



# FRACKALACHIA UPDATE:

PEAK NATURAL GAS AND  
THE ECONOMIC IMPLICATIONS FOR APPALACHIA

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 Ohio River  
Valley Institute



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The Ohio River Valley Institute is an independent, nonprofit research and communications center founded in 2020. We equip the region’s residents and decision-makers with the policy research and practical tools they need to advance long-term solutions to some of Appalachia’s most significant challenges. Our work includes in-depth research, commentary, and analysis, delivered online, by email, and in-person to policy champions, emerging leaders, and a range of community partners.

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## EXECUTIVE SUMMARY

By the first quarter of 2020, EQT Corporation,<sup>1</sup> the nation's largest domestic producer of natural gas, was supplying more than 4 billion cubic feet of natural gas per day.<sup>2</sup> Just a decade earlier, EQT's output wasn't even one-tenth as much and the company ranked an undistinguished 25th for output among US producers. But EQT had the good fortune and foresight to base all of its operations in Appalachia, which made it the greatest beneficiary of what turned out to be the world's richest natural gas field.

In those early days of 2010, when EQT was the scuffling little guy trying to find a place among giants, such as ExxonMobil, the company employed just 1,815 people.<sup>3</sup> But, by 2020, when EQT's production had surpassed that of ExxonMobil and all others, its employee count mushroomed to . . . 624.

Yes, EQT's head count actually declined by nearly two-thirds between 2010 and 2020. In fairness, some of EQT's job reduction was attributable to its spin-off of Equitrans Midstream (EQM)<sup>4</sup> in 2018. But, even if you add EQM's 2020 head count to EQT's, combined employment at the two companies was only 1,395 in 2020, still a quarter smaller than EQT's workforce in 2010.

EQT's tale of skyrocketing output accompanied by a shrinking workforce helps us understand important things about the shale gas industry. It helps explain why, as the Ohio River Valley Institute documented in 2021, the Appalachian natural gas boom failed to deliver what had been expected to be hundreds of thousands of new jobs for the region.<sup>5</sup> And it demonstrates that as the natural gas industry matures, it becomes less jobs-intensive and its already meager contributions to economic development and prosperity become even fewer. The dynamic is simple. As a larger share of output comes from existing wells and fewer new ones are dug and work is completed on the construction of processing plants and pipelines, fewer workers are needed.

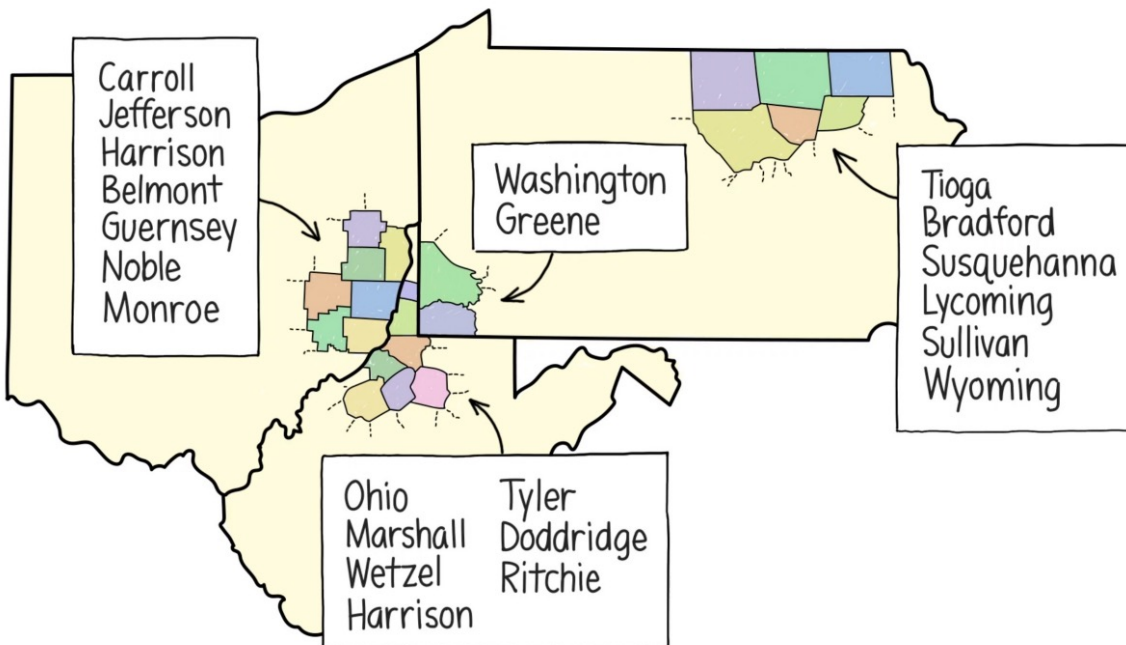
Consequently, if production stagnates and the only need for new wells is to replace those that retire, the economic value of the gas industry to Appalachia may diminish even further. And if the Energy Information Administration is correct in its most recent forecast for domestic natural gas production between now and 2050, that is exactly the scenario Appalachia and its natural gas industry are facing.

According to the EIA's "Annual Energy Outlook 2023", Appalachian natural gas production likely peaked in 2022.<sup>6</sup> Although this year's events may prove that forecast to be incorrect in the short term, the long-term trend is clear. Production is leveling off. Indeed, data show that Appalachian production began to plateau as early as 2019. And, as this report will show, economic outcomes in the 22 counties in Ohio, Pennsylvania, and West Virginia that are responsible for 90% of Appalachian gas production deteriorated even further since 2019, which was the last year examined in ORVI's original study of the Appalachian natural gas boom's economic impacts in the counties where it is concentrated – an area christened "Frackalachia".<sup>7</sup>

In summary:

- Job growth in Frackalachia went from a meager 1.6% gain in jobs since 2008 to a decline of 2.1% and an overall net loss of more than 10,000 jobs.
- Income growth fell further behind both the nation and also the combined states of Ohio, Pennsylvania and West Virginia.
- Population loss worsened, from a decline of 3.8% in 2019 to 4.8% in 2021, nearly 47,000 people in all.

**Figure 1: Map of Frackalachian Counties**



Source: Ohio River Valley Institute

These findings present a unique and troubling challenge to policymakers in the northern Appalachian region and to all of us who care about the economic wellbeing of a place that has suffered mightily since the collapse of the steel industry in the 1980s. Development or redevelopment strategies were first focused on trying to cling to the industries that for a century had been the drivers of jobs and commerce in the region. But, when that approach failed and all others as well, the natural gas boom and downstream industries, including petrochemicals and plastics manufacturing to which it was expected to give rise, became saviors in the eyes of the region's policymakers - a belief that was greatly encouraged by the gas industry, which provided relentlessly sunny economic impact studies predicting the creation of hundreds of thousands of jobs.

This report, its predecessors, and struggling downtowns in communities throughout Frackalachia provide overwhelming evidence that the predictions weren't only wrong, they were the products of deeply flawed and biased analyses and, more importantly, the reasons why the natural gas boom and its offspring - a second US petrochemical hub and a third natural gas liquids storage hub - failed to deliver on promises of economic prosperity are structural in nature, meaning they are not going to change.

Sadly, the same is likely to be true of the most recent shiny object being dangled in front of the region's policymakers - the promised creation of an Appalachian hydrogen hub, which would be heavily subsidized by the federal government. The proposed hydrogen hub suffers from the same shortcomings as its predecessors.<sup>8</sup> First, like the once imagined but unrealized Appalachian petrochemical hub, it is unlikely to come to fruition in anything but a highly abbreviated form. Second, the expanded hydrogen economy of which it would be a part, while growing to perhaps two or three times its current size, will still not be large enough to induce fundamental economic change in the region. Third, the hydrogen hub, like the petrochemical hub, may not come to fruition at all because private markets may not support it, despite generous federal subsidies. Finally, even if a hydrogen hub is realized, the plants and facilities that would comprise it are, in many respects, like the natural gas industry - highly capital-intensive, not very jobs-intensive, highly polluting, and destructive of quality of life.

That isn't to say that the region doesn't need new industry, including some that might be part of a hydrogen hub. It's to say that policymakers should be realistic about what these industries do and do not offer in the way of economic development as well as the costs they may inflict and the quality of life trade-offs they may require. If policymakers are realistic about these things, they will recognize the need for a more effective and sustainable approach to economic development regardless of whether or not the natural gas industry stagnates or continues to grow, regardless of whether the hydrogen hub is realized, and regardless of whether some small amount of petrochemical development manages to find a foothold.

In an earlier report, the Ohio River Valley Institute suggested such an approach, called the Centralia Model.<sup>9</sup> The Centralia Model is named for an old coal community and the surrounding micropolitan area in rural, western Washington. Since at least the mid-1990's Centralia's economy has looked much like the economies of counties throughout the greater Ohio Valley region. It was heavily reliant on coal mining and a coal-fired power plant, the former of which closed and the latter is in the process of retiring. And whereas the Ohio Valley suffered from the collapse of the steel industry, Centralia suffered from the collapse of the lumber industry. The result was more than 20 years of zero job growth. Then in 2016 something changed in Centralia.

With \$55 million in economic transition funding from the mine's and power plant's owner, the Centralia Coal Transition Grants Board began investing in energy transition - energy efficiency and renewable resources - and education. The result was four years of job growth at twice the national average, wage growth 50% greater than that of the nation, a restored downtown, and a growing population. And, best of all for communities in northern Appalachia, the Centralia model appears to be replicable.

That's critical for a region which has seemingly tried everything else. And pursuing the Centralia Model doesn't conflict with the hydrogen hub, or a petrochemical hub, or even natural gas. It just means that we should stop mistaking the natural gas industry and its assorted hubs for economic development strategies because they are not.

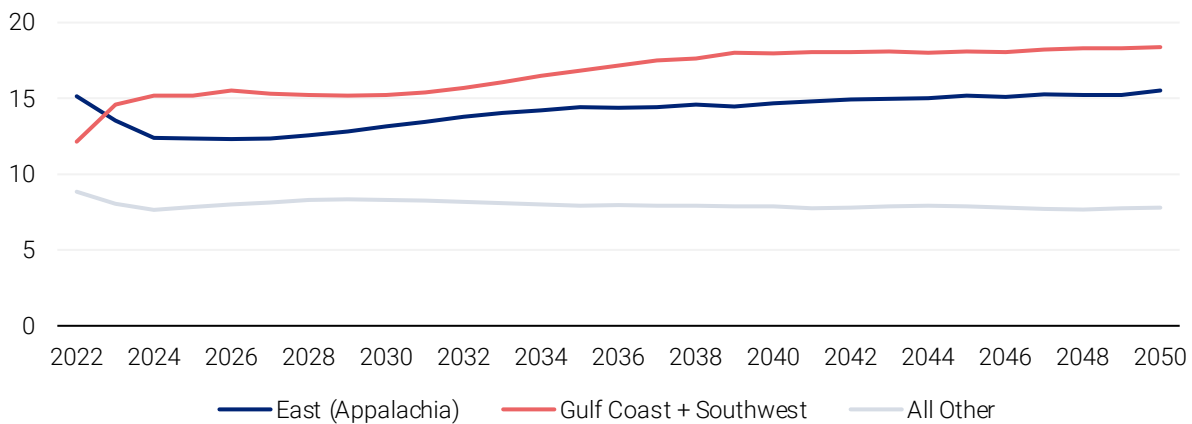
This report will examine, in the following order:

1. Peak Appalachian Natural Gas
2. Coal, Steel, Natural Gas and the Northern Appalachian Economy
3. The Original Frackalochia Report: Jobs, Incomes, and Population, 2008-2019
4. Frackalochia Update: Jobs, Incomes, and Population Through 2021
5. Could It All Be A Mistake? Did Natural Gas Deliver and Everything Else Fail?
6. Hübris: The Appalachian Storage Hub, Petrochemical Hub, and Hydrogen Hub
7. The Centralia Model & Other Economic Development Measures
8. Taking Action

## I. PEAK APPALACHIAN NATURAL GAS

If the recently-released US Energy Information Administration’s “Annual Energy Outlook 2023” is correct, the year 2022 marked a seminal moment in the economic history of the greater Ohio River Valley and the states of Ohio, Pennsylvania, and West Virginia.<sup>10</sup> According to the EIA, 2022 will turn out to be the year in which Appalachia’s Marcellus and Utica natural gas fields reach peak production, a peak that EIA researchers believe will not be equalled again until 2045.<sup>11</sup> Meanwhile, they anticipate that natural gas production in the combined Haynesville and Permian basins will soon surpass that of Appalachia and grow by more than one-third by the year 2050. Half of that growth is expected to take place in the next five years.

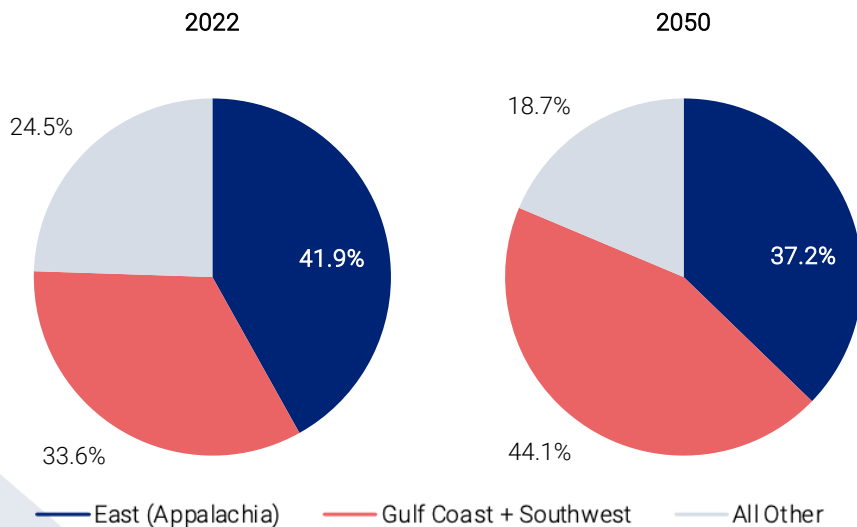
**Figure 2: Natural Gas Production Forecast (Tcf), 2022-2050**



Source: EIA

As a result, by 2050, Appalachia’s share of US natural gas production is expected to decline from 41.9% in 2022 to 37.2%.

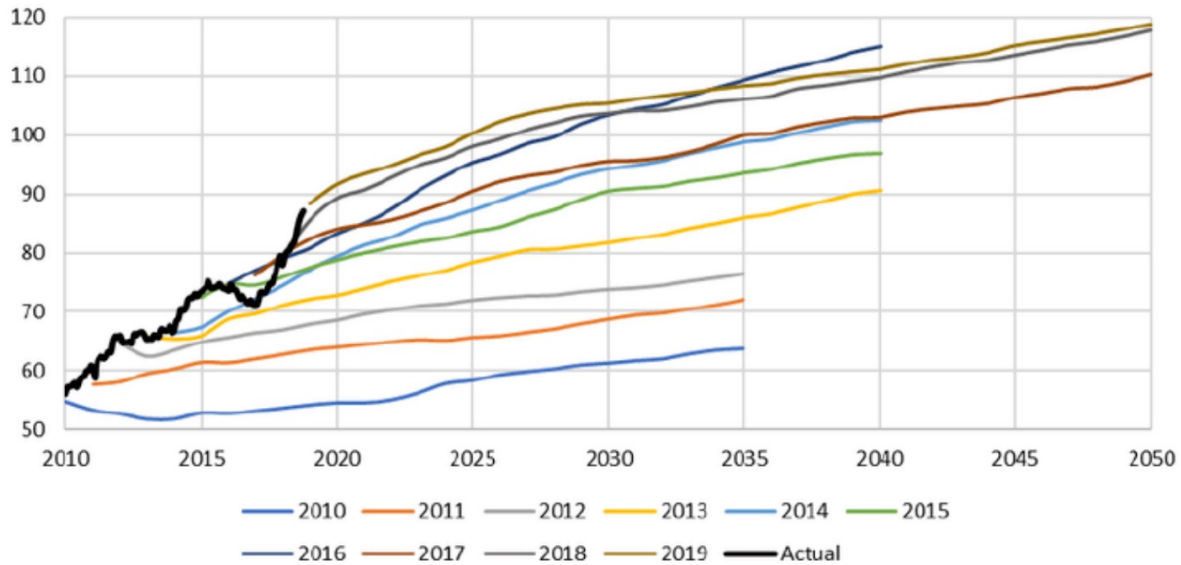
**Figure 3: Share of Natural Gas Production Forecast (Tcf), 2022-2050**



Source: EIA

Of course, the EIA forecast might prove to be incorrect - it is a forecast after all. In fact, this year's production is outstripping estimates and may turn out to be larger than 2022. And the EIA's previous natural gas production forecasts have not been terribly accurate, usually underestimating growth.

**Figure 4:** Comparison of Prior Years' AEO Gas Production Forecasts to Actual (Bcf/d)



Source: EIA, Oil & Gas 360

But, for a variety of reasons, it appears that over the long term, EIA is likely to be correct.

One can argue that Appalachian gas production, which comes from the Marcellus and Utica basins, began plateauing as early as the end of 2019. In December of that year, average monthly production exceeded 31 billion barrels per month, a figure that, at the time, was 50% greater than the combined output of the Permian and Haynesville basins in the Southwest and along the Gulf Coast. Since then, Appalachian output has experienced a series of small increases offset by small decreases, which have resulted in April 2023 output being almost equal to the December 2019 figure.

**Figure 5:** US Shale Plays

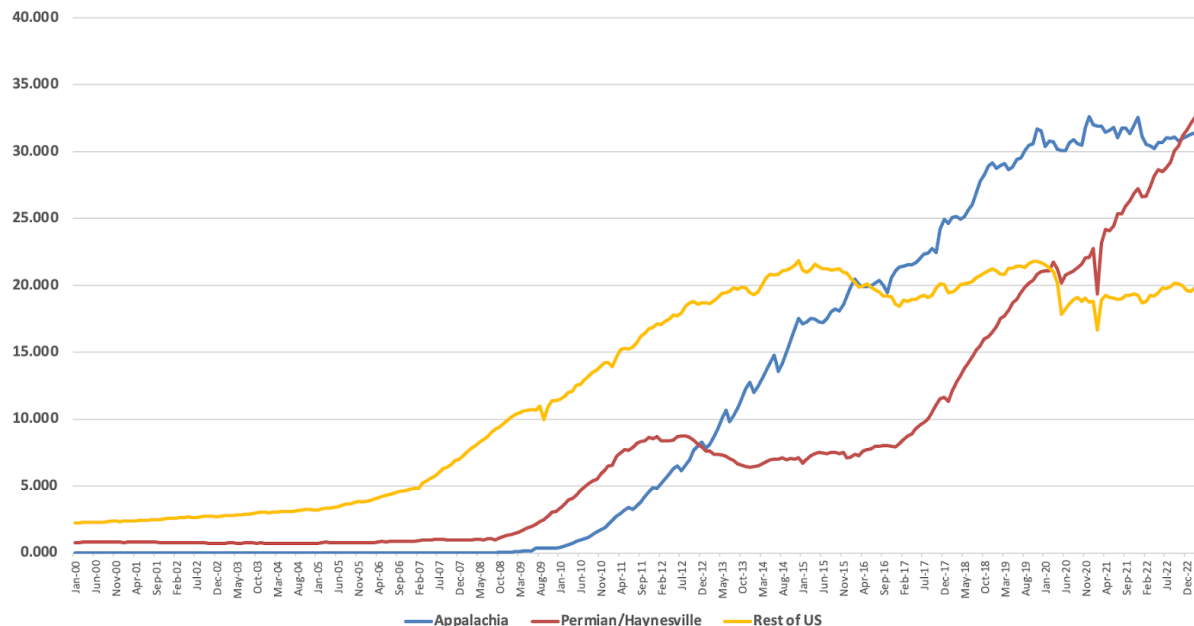


Source: EIA



During that same period, Permian/Haynesville output continued to grow. As a result, in October 2022, output from the combined Permian and Haynesville plays caught and then surpassed Appalachian output.

**Figure 6: US Shale Dry Natural Gas Production by Region (Mcf), 2000-2023**



Source: EIA,

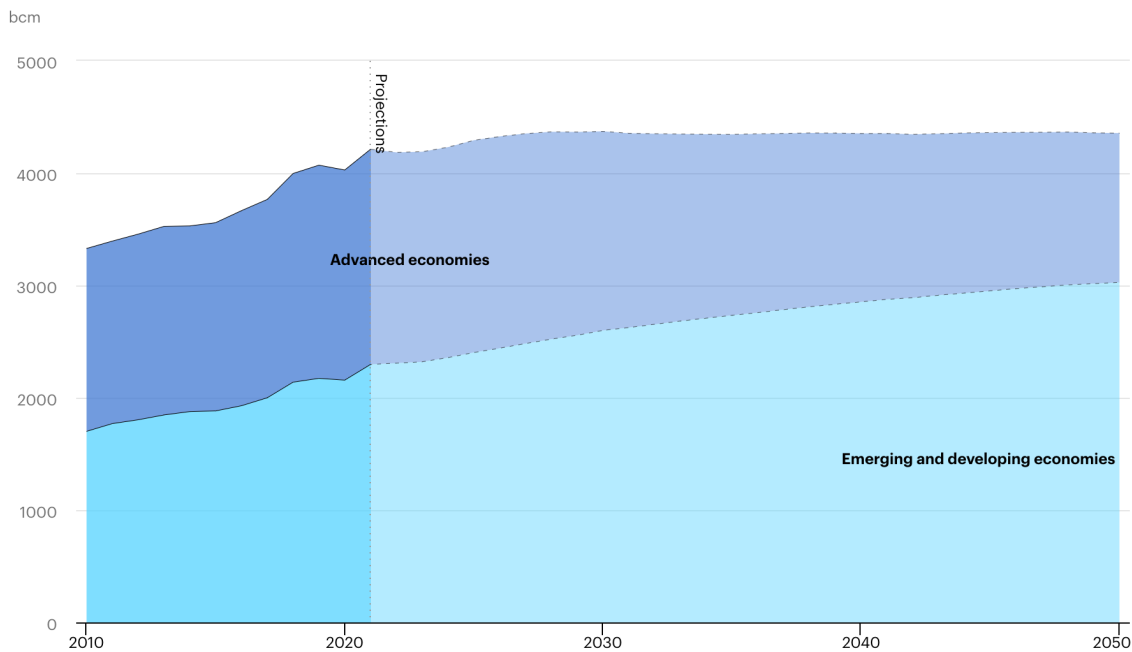
A number of factors are driving the diverging arcs of Appalachia and Permian/Haynesville production. Foremost among them is the domestic natural gas industry’s growing reliance on export markets. Currently, nearly a quarter of US production is exported and the share is growing. Because the Permian/Haynesville plays have ready access to export terminals along the Gulf Coast, they are the primary beneficiaries of demand from markets in Europe and especially in Asia.

Appalachian production on the other hand is constrained by limited take-away capacity due to challenges in constructing pipelines that would either connect the region to export terminals on the east coast or reach other regions in the US thereby allowing more Southwest and Gulf Coast natural gas to be diverted to export markets. This situation will be somewhat ameliorated by the Mountain Valley Pipeline, which will presumably be completed and come online relatively soon thanks to recently adopted Fiscal Responsibility Act. However, the MVP’s capacity of 2.2 billion cubic feet of gas per day is equivalent to only about 7% of current Appalachian production. And, because not all of the natural gas that flows through the MVP will be incremental, the effective impact will be somewhat less than 7%.

But other factors also weigh in favor of EIA’s prediction. Increases in global demand for natural gas are slowing. The war in Ukraine, which triggered an immediate burst in demand for US natural gas to replace lost supplies from Russia, also triggered previously unmatched efforts by European countries to reduce their reliance on gas by electrifying heating, accelerating the development of wind and solar resources, and adopting other energy efficiency measures. The resulting destruction of demand is structural and ongoing and will long outlast the war in Ukraine. Meanwhile, China’s economy has slowed and faces challenges, which threatens the pace at which demand for natural gas has been growing there.

These factors play a major role in the International Energy Agency’s “World Energy Outlook 2022” forecast that global natural gas demand will plateau by sometime around the end of this decade.<sup>12</sup>

**Figure 7: Global Natural Gas Demand, 2010-2050**



Source: IEA

Of course, as the war in Ukraine demonstrated, global events are unpredictable. For instance, western efforts to cripple the Russian natural gas industry may continue for years after the war ends and allow domestic US producers to hang on to some of the increased share of global markets they've come to enjoy. Still, that is unlikely to be enough to turn a tide, driven more by markets than by policy, which is flowing in the direction of increased electrification and reduced reliance on fossil fuels, particularly natural gas.

But even if the EIA's finding that natural gas has plateaued is only approximately accurate, Appalachia and its natural gas industry have reached a turning point making it essential that residents and political leaders take stock of the Appalachian natural gas boom's economic, environmental, and social effects in the decade and a half during which the region went from being a minor industry player to become the richest and most productive natural gas play in the world – one so large that it fundamentally changed global energy markets and the ways in which nations decide how to power their societies.

That this immense fossil fuel resource was brought to bear at the same time the world was beginning to understand and figure out how to deal with global warming proved to be an immensely complicating factor. Although natural gas is a fossil fuel and, therefore, a contributor to climate warming, its greenhouse gas emissions are only about half of the amount released when coal is combusted to generate electricity. Natural gas is also less polluting than gasoline and crude oil, facts which caused some people to conclude that, far from being a problem in the struggle to reverse global warming, natural gas should be seen as a solution, or at least a bridge to a solution.

The debate over whether natural gas is more of a solution for climate change or more of a problem is still one that rages. The United States' signature tool in its fight against climate change, the Inflation Reduction Act, includes among its provisions many designed to encourage and perpetuate reliance on natural gas. And recently, the debate over raising the nation's debt limit was accompanied by highly controversial permitting reform provisions to facilitate construction of a new natural pipeline that will move Appalachian natural gas to regional and global markets. Both sides in the debate argued that their preferred outcome would result in reduced greenhouse gas emissions.

## II. COAL, STEEL, NATURAL GAS, AND THE NORTHERN APPALACHIAN ECONOMY

As important as these global and national issues may be, they don't speak to the economic, environmental, and social impacts of the natural gas boom on the northern Appalachian region in which it is concentrated and for the states of Ohio, Pennsylvania, and West Virginia, whose finances and economies it has unalterably changed. Usually, when we hear of the discovery of major new deposits of natural gas and crude oil, they are located in sparsely populated or remote places, often literally "off-shore". The Marcellus and Utica natural gas deposits that make up the Appalachian play are different.

They sit beneath a region that, starting in the mid-nineteenth century, was settled and developed in response to the industrial revolution's demand for coal and steel. By 1940, Pennsylvania was the second most populous state in the nation and Ohio was fourth, both with more people than California. Even the comparatively sparsely populated West Virginia had more residents than Florida. And large portions of these populations were concentrated in the upper Ohio River Valley.

These conditions meant that development of Appalachian natural gas would have to take place in a highly complicated environment. Not only would the industry, state legislatures, and communities have to figure out how to allocate space and decide upon the conditions under which fracking pads and pipelines would coexist with people and communities, the entire enterprise would have to deal with the aspirations of people whose families and communities had struggled economically for decades and were still struggling as a result of deindustrialization, which took hold in the 1980s when the nation's and region's steel industry collapsed. Meanwhile, the coal industry was also shedding workers, initially due to automation, and eventually because coal, like steel, began to go into decline.

In one respect, these struggles were a godsend for the natural gas industry because the region's economic desperation could be exploited in order to win very favorable terms and subsidies for the production of gas. Promises of immense numbers of new jobs started to fly. 200,000 in Ohio, and 200,000 more in Pennsylvania, and 50,000 in West Virginia, a state with only 750,000 to begin with. In 2010, one West Virginia state legislator, noting that the state counted only 45,000 people as unemployed at the time, gleefully declared, "We'll have more jobs than people!"

The effects of these promises and the industry's ultimate inability to fulfill them, which is the subject of this report, go beyond disappointment and crushed hopes. The expectations of jobs and prosperity the natural gas industry created through intense lobbying and public relations that showcased conveniently optimistic economic impact studies, caused policymakers in Ohio, Pennsylvania, and West Virginia to change their economic development thinking and plans.

To be fair, that thinking, such as it was, had reached a bit of a dead end by the late 2000s when talk of an imminent natural gas boom first began percolating. Since the 1970s, when the steel industry, which employed tens of thousands of people in the greater Ohio River Valley, started faltering, and the 1980s when it collapsed altogether and threw most of those tens of thousands out of work, the region had suffered from job stagnation and often severe depopulation, especially among young adults who found few career options.

State and local policymakers' principal response to the decline was to cling desperately to the businesses and industries that were imploding but hadn't yet expired. There were occasional efforts to attract or stand up new industries or build upon the few that were relatively unaffected by the collapse of steel. But there weren't many, and the efforts often felt half-hearted partly because they were more the products of hope than of planning. As a result, people didn't have much confidence in them and nearly all were badly underfunded. The seminal documentary movie of the era was Michael Moore's "Roger and Me" about the causes and effects of the automobile industry's collapse in his hometown of Flint, Michigan. The film could just have easily been made about the steel industry in the greater Ohio Valley.

So the natural gas industry's promise of jobs and prosperity quickly came to represent salvation. Expectations of a gas boom largely short-circuited whatever other economic development thinking or planning might have been underway in the late 2000s as much of the region prepared to receive the blessings that tens and ultimately hundreds of billions of dollars of natural gas investment would bestow. It may be too strong to call that pause an abdication of responsibility for planning and developing new opportunities, but whether it was a sin of commission or omission, the outcome was devastating.

Far from conferring jobs and prosperity, between 2008, at the start of the Appalachian natural gas boom, and 2021, the last year for which data are available, in the twenty-two Ohio, Pennsylvania, and West Virginia counties that produce 90% of all Appalachian natural gas:

- The number of full-time jobs dropped by 10,439 or 2.1%, which was worse than the combined states of Ohio, Pennsylvania, and West Virginia, in which jobs grew by 3.8%, and far worse than the US as a whole, which experienced a jobs increase of 6.5%.
- Income growth trailed that of the combined states of Ohio, Pennsylvania, and West Virginia by 4 percentage points and the US by 16 percentage points.
- And the population in the 22 counties fell by 46,652 or 4.8%, while the populations of Ohio, Pennsylvania, and West Virginia climbed by 2.1% and the US population grew by more than 9%.

By every measure of economic well-being, the Appalachian natural gas counties, which were christened "Frackalachia" in an earlier Ohio River Valley Institute report,<sup>13</sup> performed markedly worse than the regional and national economies, extending what was already decades-long economic decline.

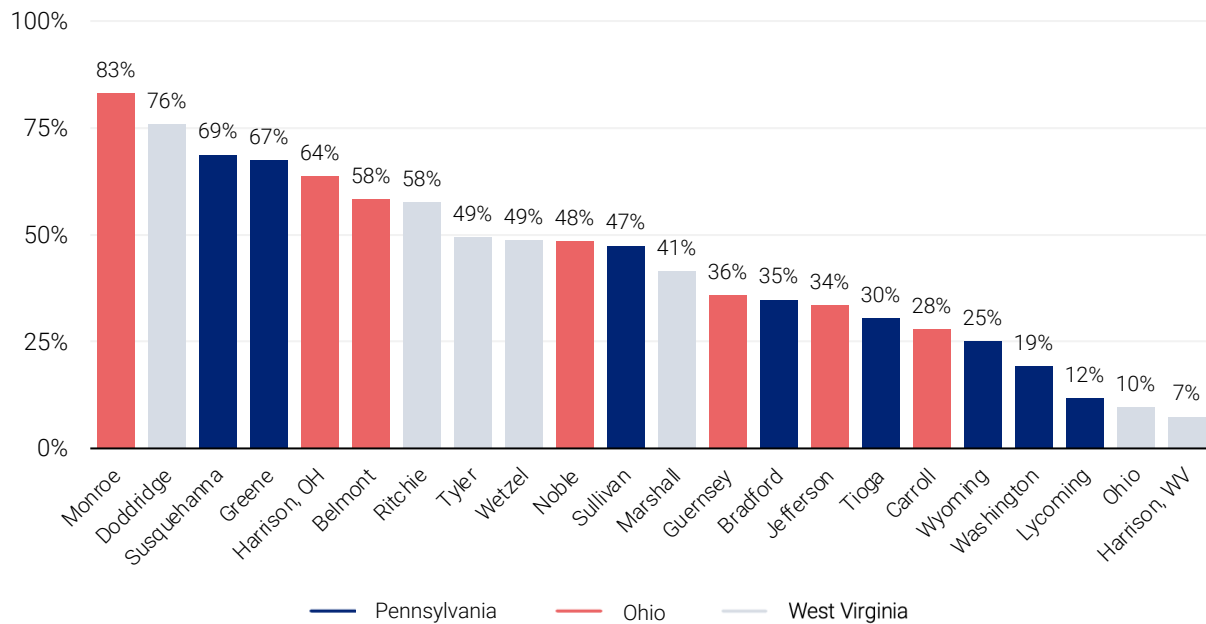
The reasons the Appalachian natural gas boom failed to deliver on its promises are discussed below. But they add only context to a finding that should, at this point, be blindingly obvious to policymakers in the region. Natural gas development and, as we shall see, hoped-for development of downstream industries dependent on natural gas, are not sound foundations upon which to premise economic development and recovery. Indeed, because the reasons for the failure are structural and endemic to these industries,<sup>14</sup> no amount of future development is likely to make any appreciable difference in economic conditions in the region and, in some ways, may worsen them.

To imagine otherwise and to do so in light of the Energy Information Administration's finding that Appalachian natural gas production has plateaued is deluded thinking. It rests on the unfounded assumption that an industry that could not deliver on promises of job creation and prosperity when it was expanding and in its most vibrant phase will somehow be able to do so as it lapses into the stagnation of middle-age. Doing so requires a willful disregard of facts that are not only apparent in the statistics but also in the lived realities of the region's communities and families, many of which continue to struggle with the loss of sons and daughters and of grandchildren to places that offer more opportunity.

### III. THE ORIGINAL FRACKALACHIA REPORT: JOBS, INCOME, AND POPULATION, 2008-2019

In 2021, the Ohio River Valley Institute issued its first report on the local economic impacts of the Appalachian natural gas boom in the 22 counties of Ohio, Pennsylvania, and West Virginia that are responsible for 90% of the region’s dry gas production.<sup>15</sup> In these counties, the mining sector, which includes oil and gas extraction, was responsible for 35% of gross domestic product in the year 2019.

**Figure 8: Mining, Quarrying, and Oil & Gas Extraction Share of County GDP, 2019**

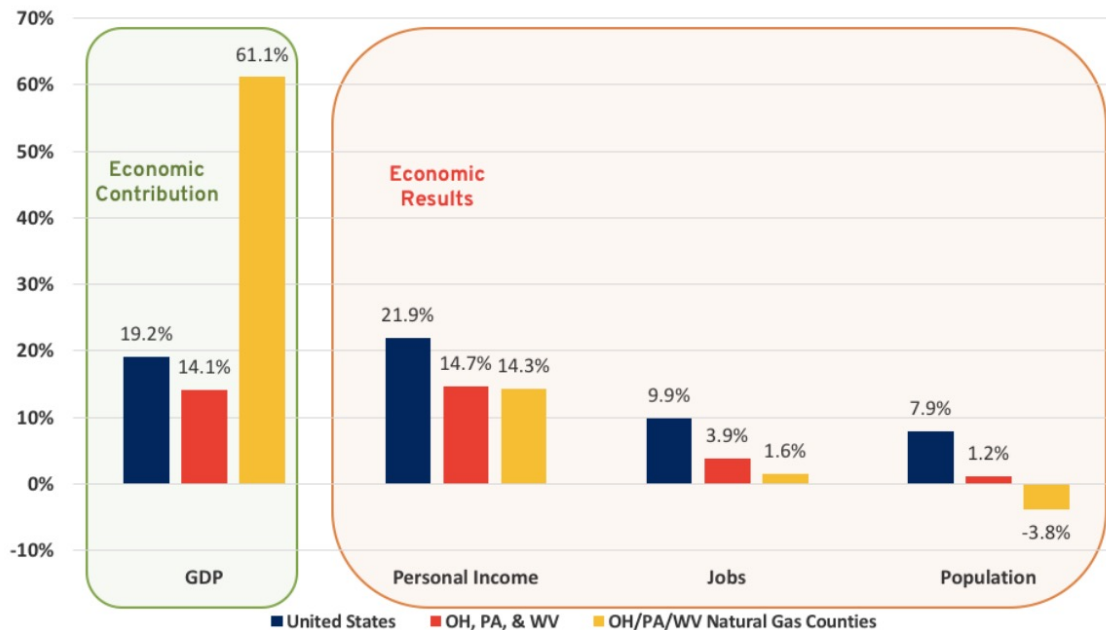


Source: US Bureau of Economic Analysis

Nationally, the mining sector made up just 2.2% of GDP. The Frackalachian counties had also experienced a sort of economic surge during 11 years of the natural gas boom as GDP grew at more than three times the rate of US growth and more than four times the rate at which the economies of the combined states of Ohio, Pennsylvania, and West Virginia grew.

However, Frackalachia’s astonishing growth in GDP, which is often cited as a principal barometer of economic health, failed to produce commensurate gains in local measures of prosperity and well-being, including job, income, and population growth. In fact, not only were the gains not commensurate, they were, for income growth, feeble, for job growth, almost non-existent, and for population growth, negative.

**Figure 9: Change in GDP, Personal Income, Jobs, and Population, 2008-2019 (2019 dollars)**



Source: US Bureau of Economic Analysis, US Bureau of Labor Statistics

As revealed in a follow-up report, titled “Destined to Fail: Why the Natural Gas Boom Failed to Deliver Jobs and Prosperity and What it Teaches Us”, the reasons for the disconnect between growth in GDP and local measures of prosperity are structural in nature.<sup>16</sup> They include:

- Natural gas extraction is, by some measures, the least labor-intensive sector of the US economy with less than 10 cents of every dollar earned allocated to labor.
- Of the jobs and business opportunities that were created by the Appalachian natural gas boom, many went to workers and suppliers from regions of the US such as the Gulf Coast, Texas, and Oklahoma where well established suppliers, service providers, and talent pools were readily available.
- Of the large pool of income allocated to capital from the sale of natural gas, the portion that enters local economies is diluted by a combination of occasional out-of-state ownership of properties being developed, lower than expected natural gas prices, and, perhaps most importantly, a tendency by recipients of royalties and lease payments to save or invest the funds, use them to pay down debts, or to make purchases of goods and services outside the region.

When the Ohio River Valley Institute first reported on changes in jobs, income, and population between 2008 and 2019, many people were quite surprised at the findings primarily because the Appalachian natural gas boom had been sold to the public and to local and state policymakers on the grounds that it would be an “economic game-changer”.

That was the term used by West Virginia’s then-Governor Joe Manchin and numerous politicians and industry representatives since. It was based on a series of industry-sponsored economic impact reports which concluded that natural gas development in the Marcellus and Utica fields of Ohio, Pennsylvania, and West Virginia would result in the creation of over 650,000 jobs,<sup>17</sup> which, had it happened, would have represented an overall 6% increase in the three states. The actual and nearly non-existent jobs increase associated with the boom and first reported in 2021 was surprising because growth in natural gas production was every bit as big, and in some cases, bigger than the modelers anticipated.<sup>18</sup>

Appalachian natural gas production rose in a matter of 10 years from being little more than a footnote in the industry to become the world leader, responsible for more than 40% of US output. And the statistics were matched by the level of activity on the ground as drilling pads, processing plants, and pipelines popped up around the region, accompanied by fleets of heavy equipment, tanker trucks, white pick-up trucks, and out-of-state workers who were responsible for a hotel construction mini-boom. At the same time, rental prices for houses and apartments in many parts of the region skyrocketed.

So, despite the fact that downtowns in places at the center of Marcellus and Utica fields like Bellaire, Ohio, Wheeling, West Virginia, and Waynesburg, Pennsylvania continued to deteriorate as they had been doing for decades, highly visible natural gas activity persuaded many observers that the predictions of job creation and economic revival and prosperity were coming true and would eventually be felt. And, if your only measures of prosperity were levels of natural gas investment and gross domestic product (GDP), you could make that case.

Between 2008 and 2019, more than \$90 billion was invested to produce natural gas in Ohio alone. And Ohio is the least prolific of Appalachia's major gas-producing states. As a result, GDP in the 22 Frackalachian counties grew at three times the rate of the US economy. In 2019, were Frackalachia a state, it would have had the 9th highest level of per capita GDP in the United States. However, the problem was that very little . . . astonishingly little . . . of the incremental investment or proceeds from the sale of natural gas ever landed in local economies. While Frackalachia would have ranked ninth among states for per capita GDP, it would have ranked only 41st for per capita income.

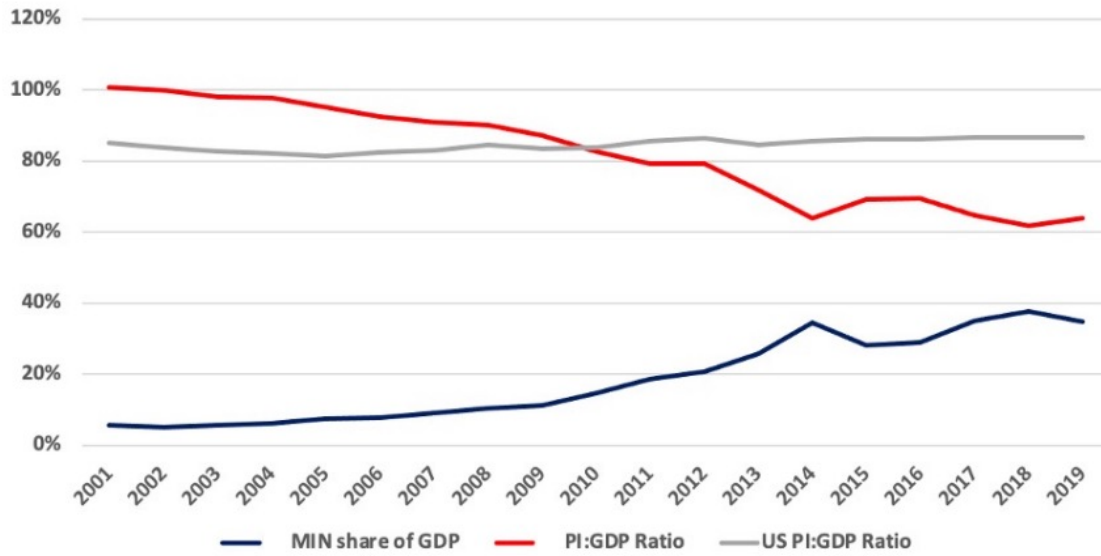
That's because, as later analysis revealed, natural gas extraction is one of the least labor-intensive activities in the US economy. Over 90% of the investment and revenue associated with natural gas production is allocated to capital. Less than 10% goes to labor. And even the tiny fraction that went to labor was further diluted by the industry's employment of workers and contractors from the southwest and Gulf Coast, regions that have established oil and gas supplier and service provider ecosystems and a large pool of trained workers.

Meanwhile, very little of the income allocated to capital landed locally because the investors were largely from outside the region, some of the land on which drilling took place was owned by out-of-state entities, and even the proceeds that did go to local property owners in the form of royalties and lease payments were often saved, reinvested, used to pay down debts, or used to make property purchases outside the region, none of which inject money into local economies.

Funds used in these ways have none of the multiplier effects that improve local measures of prosperity. Finally, these challenges are compounded by the environmental and public health toll natural gas development imposes and consequent diminution of quality of life and increased public expenses for activities such as road maintenance.

The combined effects of these factors can be seen most clearly in the fact that, as the mining share of overall GDP rose in the Frackalachian counties, the rise was almost entirely offset by a corresponding decline in the share of GDP realized as income within those counties.

**Figure 10:** Frackalachia Mining Share of GDP and PI:GDP, 2001-2019



Source: Author's calculation using Bureau of Economic Analysis data

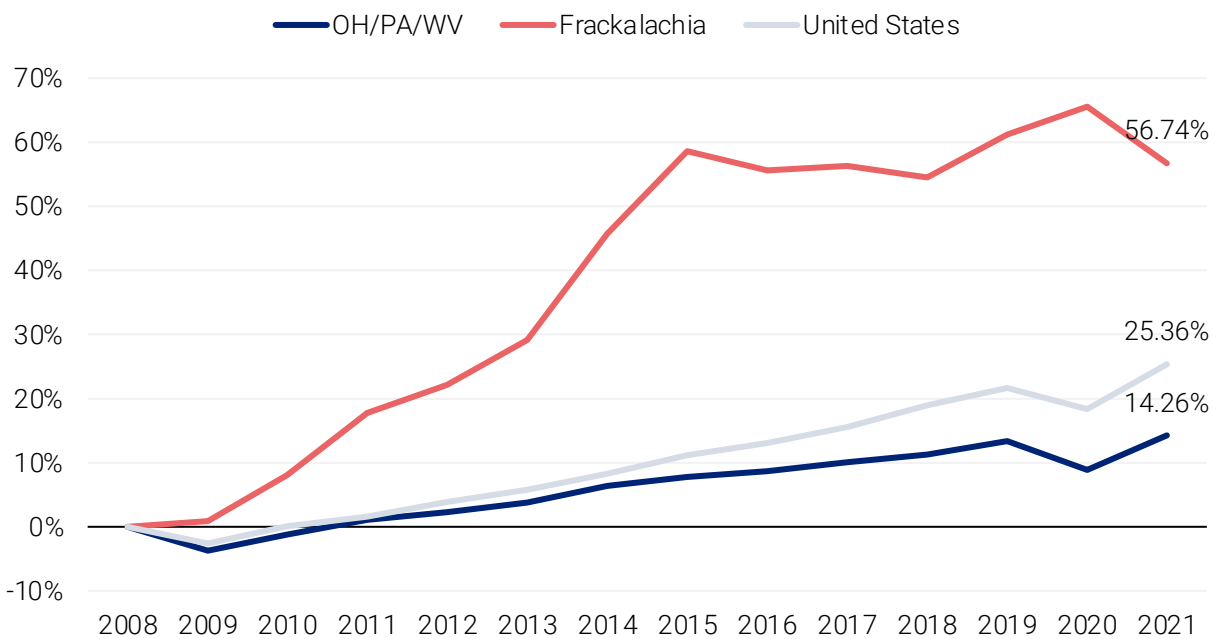


#### IV. FRACKALACHIA UPDATE: JOBS, INCOME, AND POPULATION THROUGH 2021

The US economy absorbed a blow from the COVID-19 epidemic. Many service-related industries and workers suffered immensely, children had their educations disrupted, and the few “winning” industries, mainly in durable and non-durable goods, often found their success truncated by supply chain issues that prevented them from meeting demand. Still, the blow wasn’t as severe as many feared it might be. Today, despite an ongoing bout with inflation, the recovery from COVID has been steady and marked by a stubbornly resilient job market . . . that is unless you live in Frackalachia.

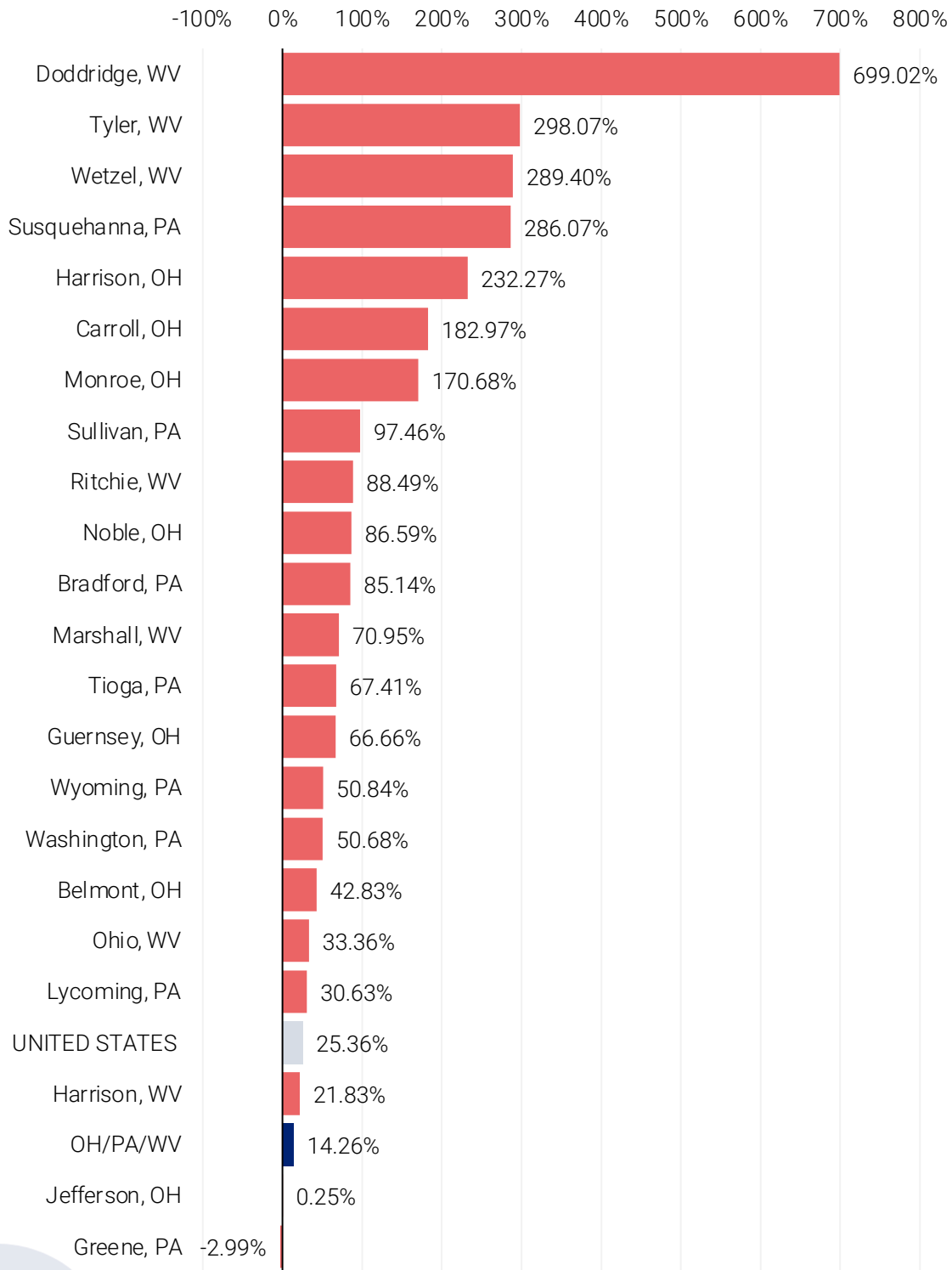
By 2021, nineteen of the twenty-two Frackalachian counties were continuing to outpace the US and the combined states of Ohio, Pennsylvania, and West Virginia for GDP growth. However, their advantage had started to erode as Appalachian natural gas production approached its 2022 peak. Indeed, the tide of natural gas-driven, double-digit GDP growth had turned after 2015, the year in which the growth gap between Frackalachia and the nation reached its zenith.

**Figure 11: Cumulative Change in Real GDP, 2008-2021 (2012 dollars)**



Source: Bureau of Economic Analysis, CAGDP9 Real GDP by county and metropolitan area

**Figure 12: Cumulative Change in Real GDP by County, 2008-2021**

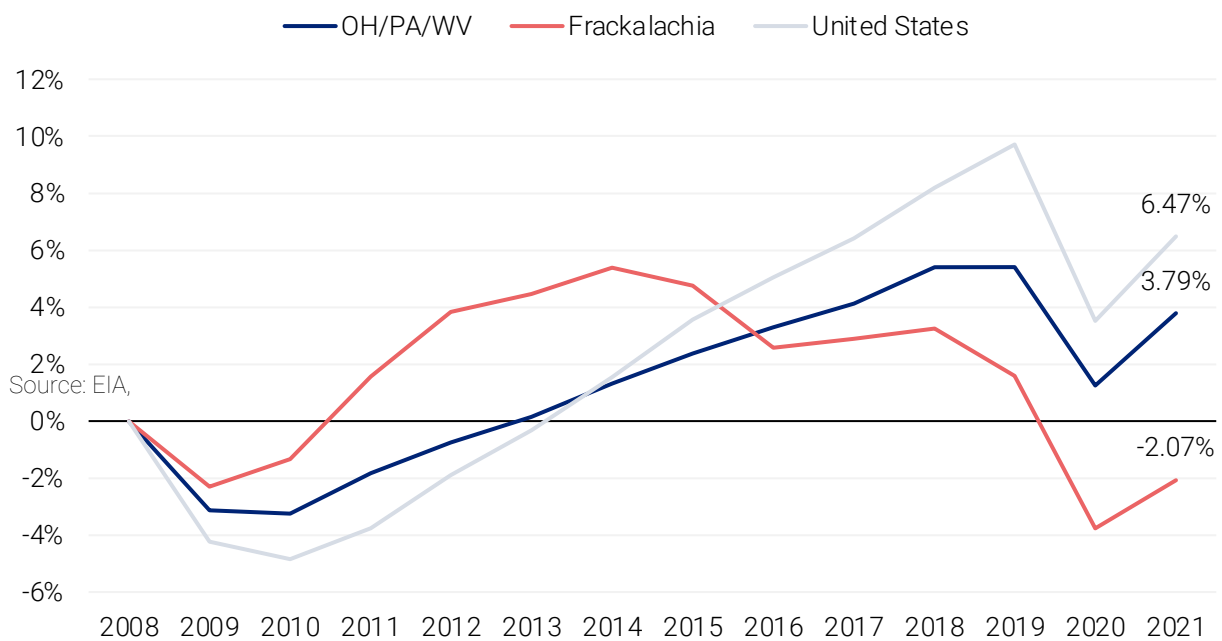


Source: Bureau of Economic Analysis, CAGDP9 Real GDP by county and metropolitan area

From 2008 to 2015, a period of time when the development of new natural gas wells was at its peak and the nation was falling into and gradually starting to emerge from the Great Recession, job growth in the Frackalanchian counties actually outpaced growth in the nation and in the combined three states. Then the industry started to mature, shedding unneeded workers even as production continued to climb. 2016 stood out as the first year since the start of the natural gas boom that the twenty-two counties fell behind the nation and the combined states of Ohio, Pennsylvania, and West Virginia in job growth.

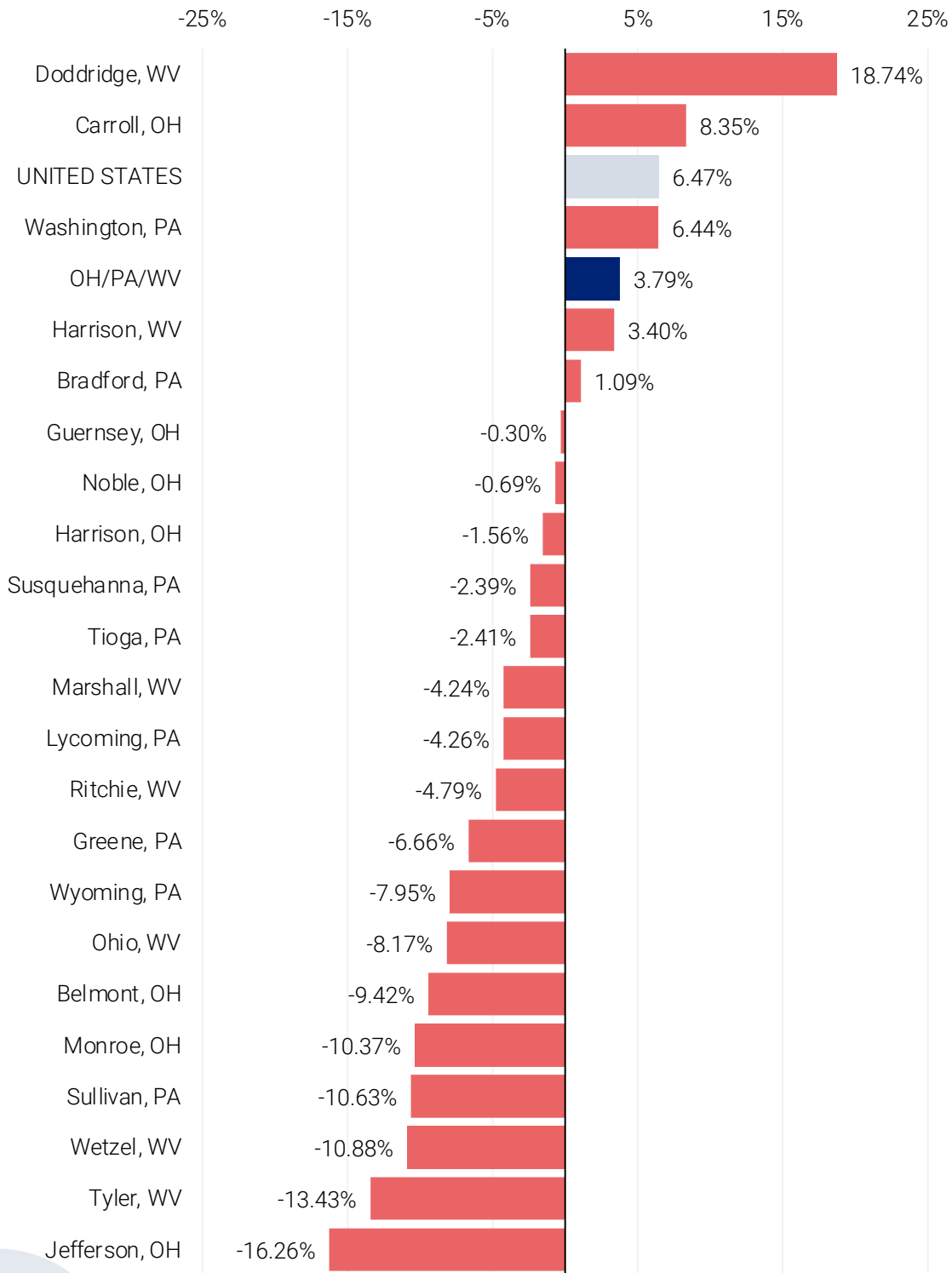
It can be argued that the Appalachian natural gas boom did to a degree help protect job growth in the Frackalanchian counties from the worst ravages of the Great Recession. But it can be equally persuasively argued that the gas industry helped drive job loss in the years prior to and during the COVID recession.

**Figure 13: Cumulative Change in Total Employment, 2008-2021**



Source: Bureau of Economic Analysis, CAEMP25N Total full-time and part-time employment by NAICS industry

**Figure 14: Cumulative Change in Total Employment by County, 2008-2021**



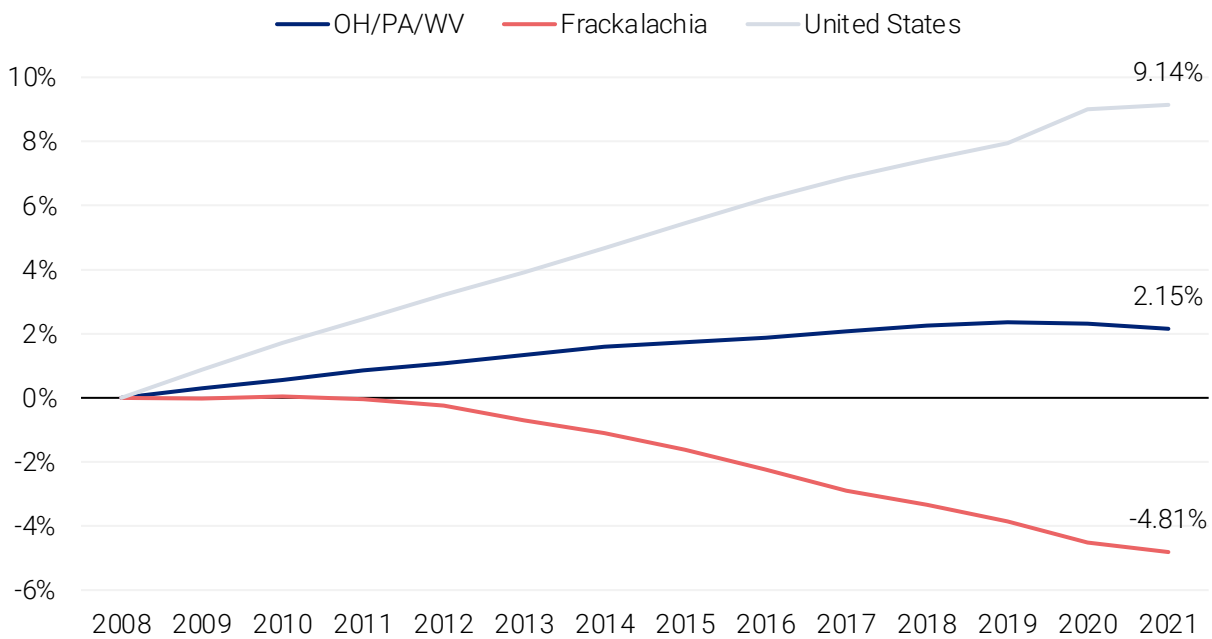
Source: Bureau of Economic Analysis, CAEMP25N Total full-time and part-time employment by NAICS industry

The story of population change in the Frackalachian counties is less nuanced and more devastating.

Between 2008 and 2021, just one Frackalachian county—Washington County in Pennsylvania—experienced population growth. And that county is in many ways the least “Frackalachian” of the twenty-two. In addition to having by far the largest population among Frackalachian counties, Washington County borders on Allegheny County and is part of the Pittsburgh metropolitan area. It hosts upscale suburbs and has a diversified economy in which the mining sector, which includes oil and gas extraction, makes up just 19% of GDP.

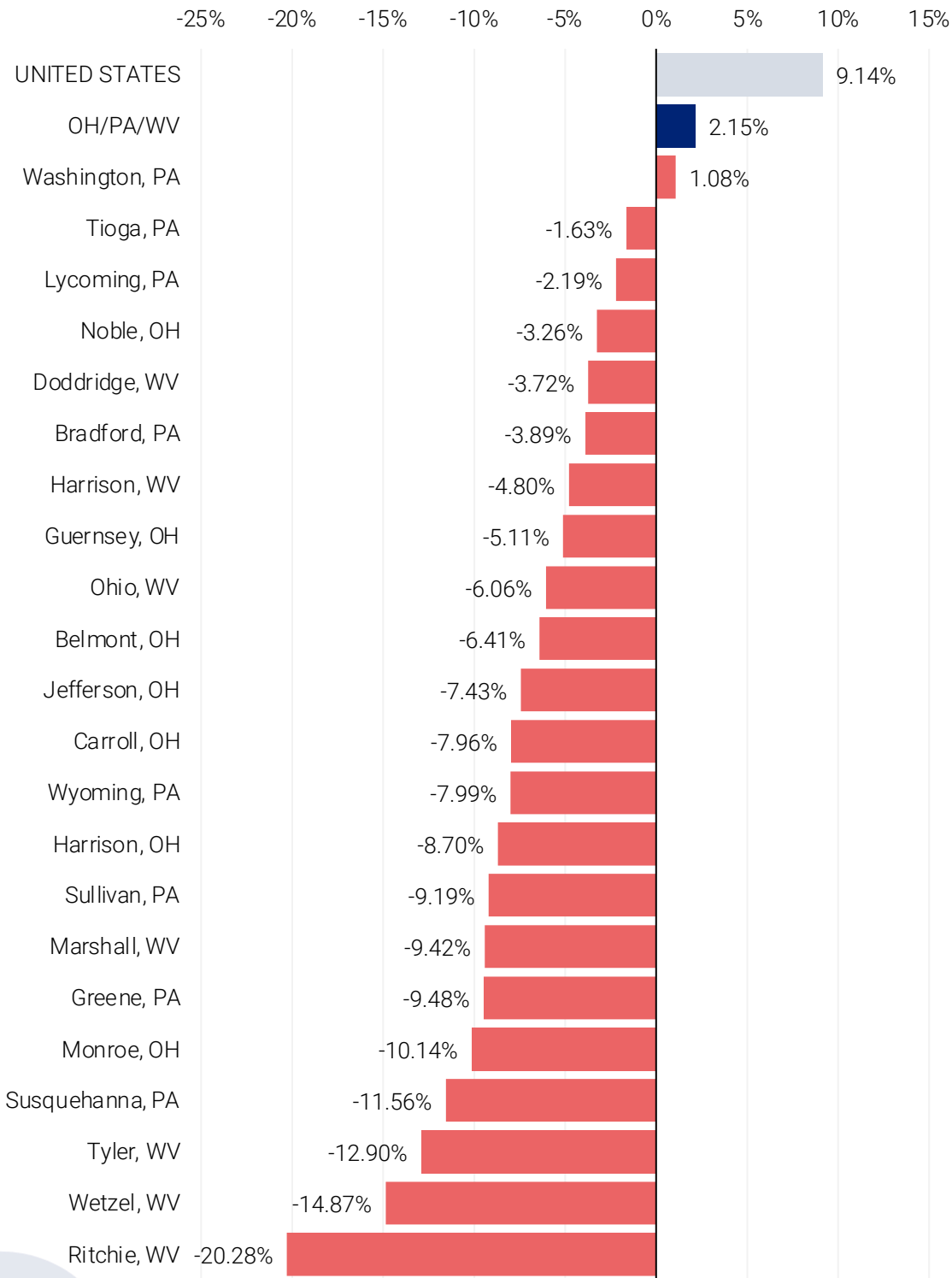
That’s a small share compared to the mining sector’s 35% of GDP in the combined Frackalachian counties. But it is also nine times greater than the mining sector’s share of the US economy. But the characteristic that marks Washington County as Frackalachian is that despite immense GDP growth—twice that of the United States between 2008 and 2021—its population grew by just 1%. All other Frackalachian counties experienced net losses, the majority of them more severe than a 5% decline.

**Figure 15: Cumulative Population Change, 2008-2021**



Source: Bureau of Economic Analysis, CAINC1 County and MSA personal income summary: personal income, population, and per capita personal income

**Figure 16: Cumulative Population Change by County, 2008-2021**

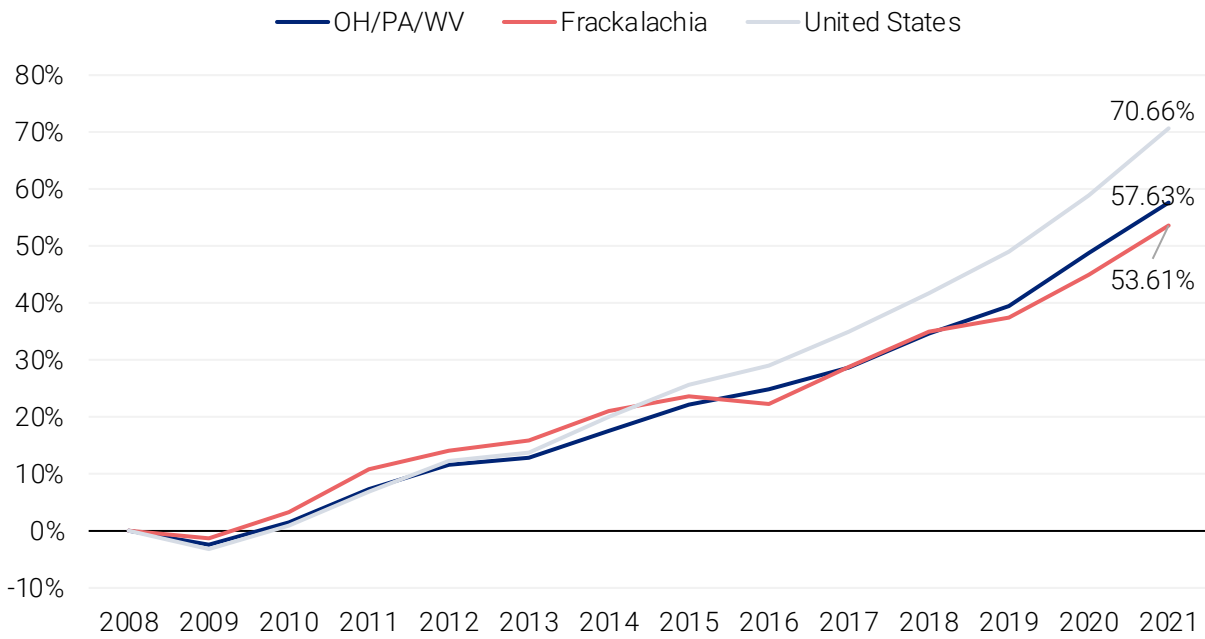


Source: Bureau of Economic Analysis, CAINC1 County and MSA personal income summary: personal income, population, and per capita personal income

Income is another category in which the year 2016 stands out in Frackalochia as the year the region fell behind both the US and the combined three states for income growth.

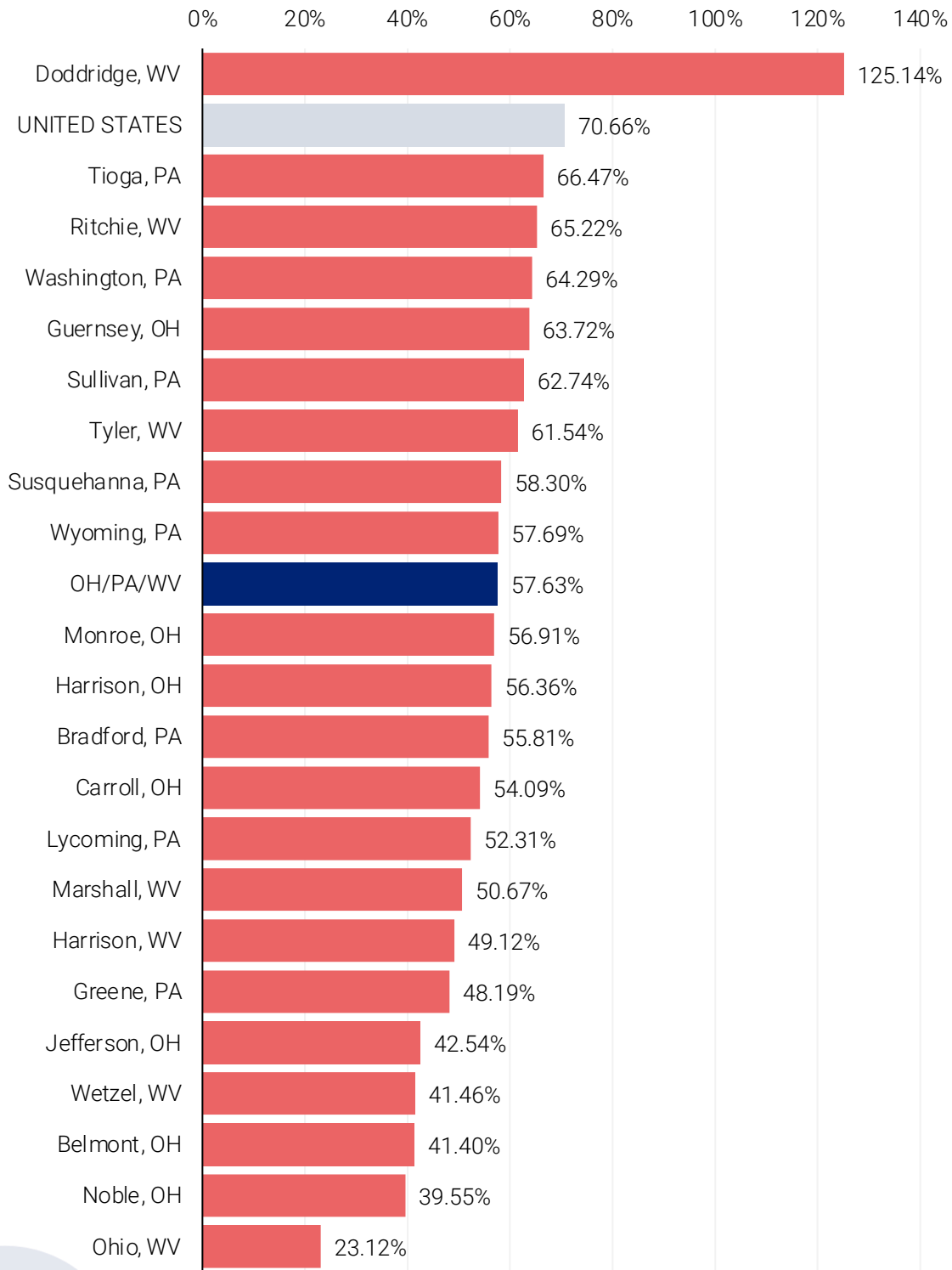
Since the Ohio River Valley Institute's first analysis of Frackalochia, income is the variable for which the region has come closest to keeping pace with the three states and the nation.

**Figure 17: Cumulative Change in Aggregate Income, 2008-2021**



Source: Bureau of Economic Analysis, CAINC1 County and MSA personal income summary: personal income, population, and per capita personal income

**Figure 18: Cumulative Change in Nominal Income by County, 2008-2021**



Source: Bureau of Economic Analysis, CAINC1 County and MSA personal income summary: personal income, population, and per capita personal income

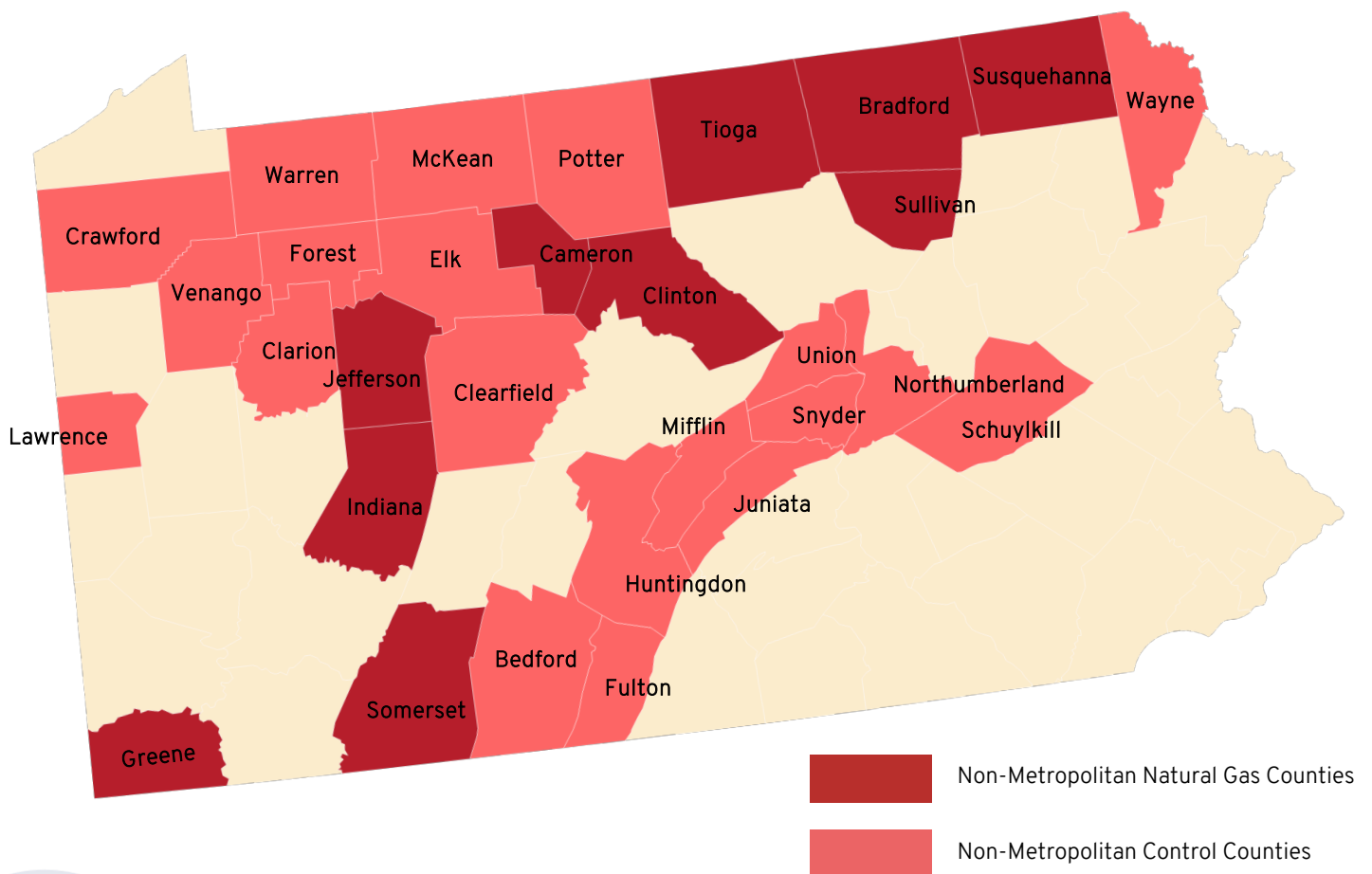


## V. IS IT ALL A MISTAKE? DID NATURAL GAS DELIVER AND EVERYTHING ELSE FAIL?

After ORVI reported on the failure of the natural gas boom to deliver growth in jobs, income, and population, it was suggested that perhaps the ongoing weakness in Frackalachian economies was attributable, not to a failure of the natural gas industry, but rather to poor performance in other sectors of the Frackalachian economies that were offsetting the benefits being conferred by natural gas development.

To assess this possibility, the Ohio River Valley Institute took advantage of a “natural experiment” offered by the Commonwealth of Pennsylvania in which there are thirty rural non-metropolitan counties.<sup>19</sup> These thirty counties, which are spread across the Commonwealth and which had very similar economic trajectories in the decade prior to the natural gas boom, are split between ten that went on to participate heavily in the boom and twenty that had little or no participation.

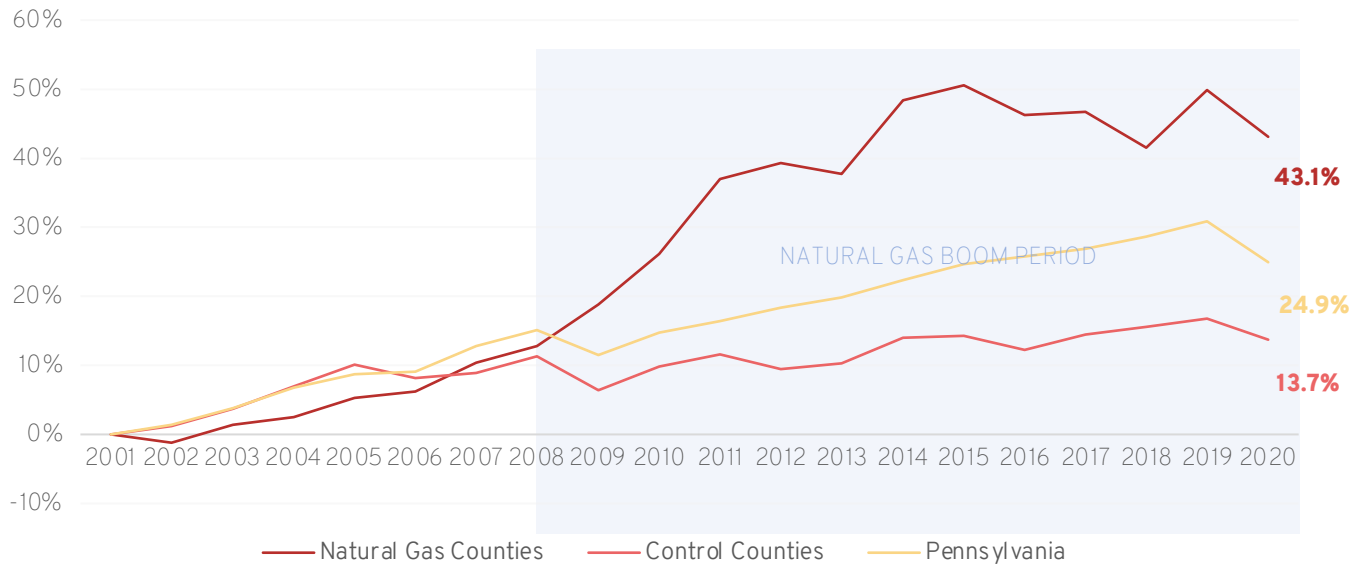
**Figure 19:** Map of Pennsylvania’s Non-Metropolitan Counties



Source: Pew Charitable Foundation

In the years prior to the onset of the natural gas boom, the economies of the natural gas counties and non-gas (Control) counties were growing at about the same rate as each other and Pennsylvania as a whole. Then, after 2008, the gas and Control county paths began to diverge, with the gas counties experiencing a huge surge in GDP, far in excess of the growth in the Control counties and in the state.

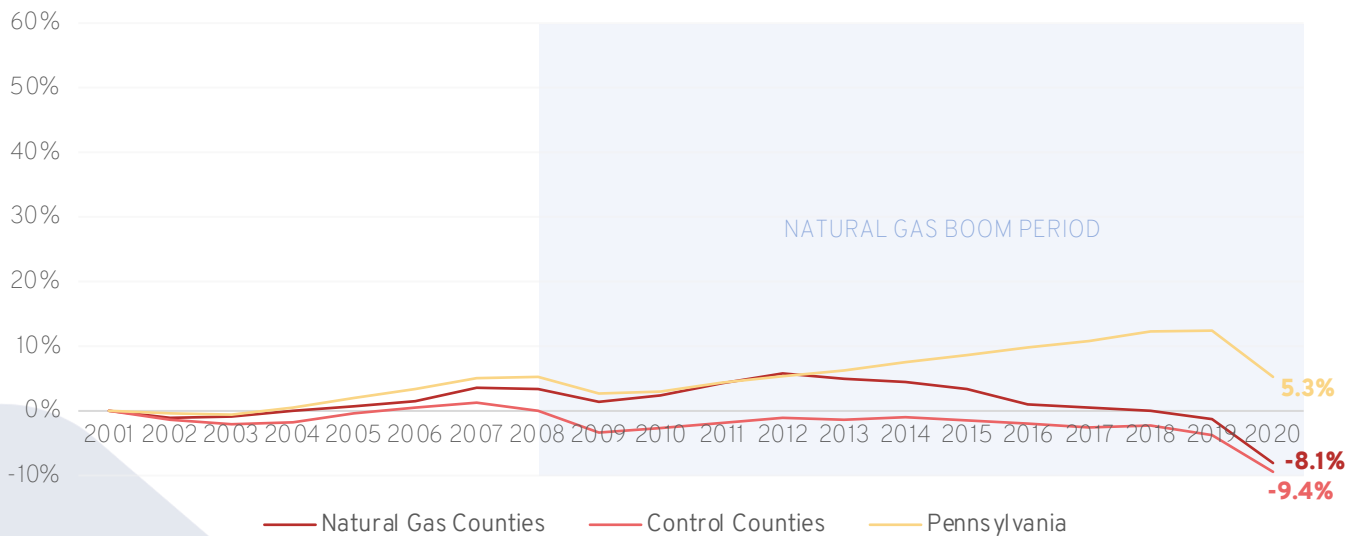
**Figure 20: Change in Real GDP, 2001-2020**



Source: Author's calculations using Bureau of Economic Analysis data

However, changes in job growth between the gas and Control counties were quite similar and, by the year 2020, both groups had lapsed from what had been tepid job growth to absolute job losses.

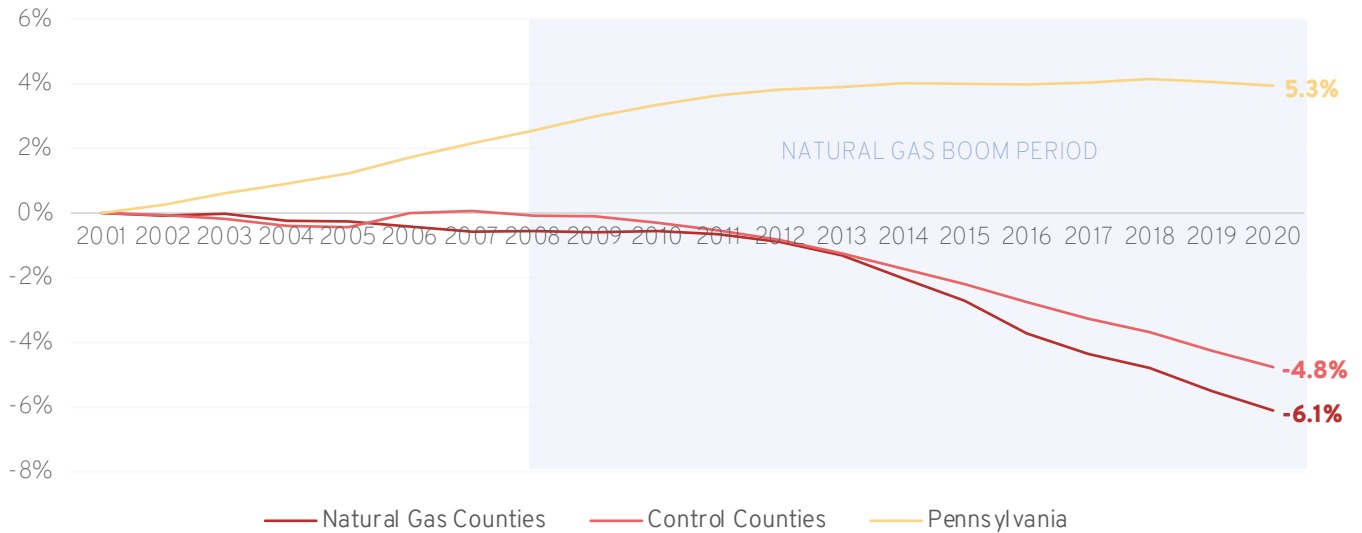
**Figure 21: Change in Total Employment, 2001-2020**



Source: Author's calculations using Bureau of Economic Analysis data

And population loss in the natural gas counties was even greater than the loss in Control counties.

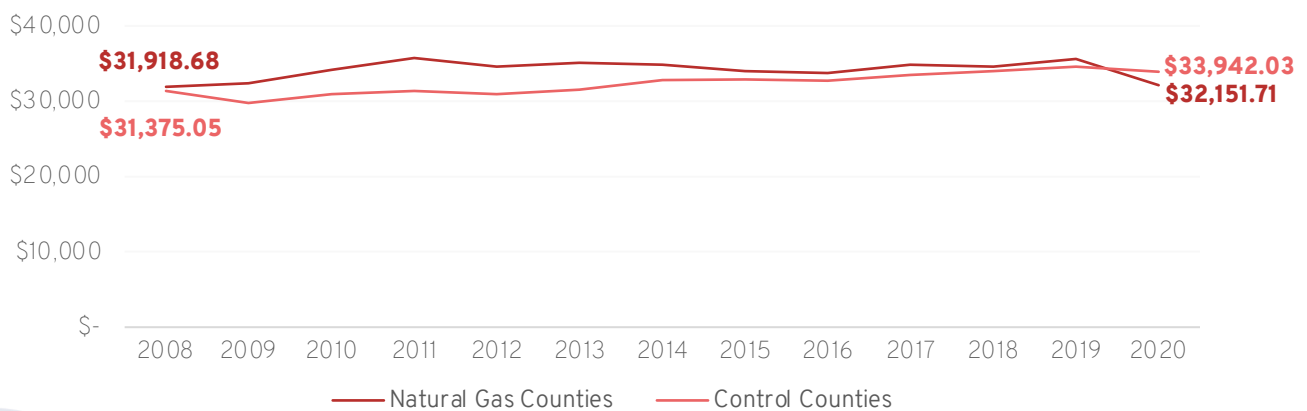
**Figure 22: Change in Population, 2001-2020**



Source: Author's calculations using Bureau of Economic Analysis data

But, perhaps the final spike in the heart of the theory that the natural gas boom might have had the benefits it was conferring offset by failures in other economic sectors, was a comparison of the natural gas and Control county economies after the mining sector, which includes oil and gas extraction, is excluded. That analysis of per capita GDP found that, throughout the natural gas boom period, the non-mining sectors of the natural gas and Control counties performed almost identically.

**Figure 23: Per Capita GDP Excluding the Mining Sector, 2008-2020**



Source: Author's calculations using Bureau of Economic Analysis data

The Appalachian natural gas boom took place, as it were, within an economic bubble, although not an environmental one. The boom did and continues to change lives and communities, rarely for the better.

## VI. HUBRIS: THE APPALACHIAN STORAGE, PETROCHEMICAL, AND HYDROGEN HUBS

The natural gas boom's failure to instigate growth in jobs and prosperity didn't sneak up on everyone. By the middle of the 2010s, some natural gas boosters recognized the failure. But there was hope that a pipeline building boom would generate incremental employment that the drilling boom had failed to. However, pipeline construction provides only temporary employment and, as it turned out, the demand for more pipelines to increase take-away capacity was stymied by a combination of weaker-than-expected demand and legal and regulatory hurdles.

Against this bleak backdrop, a new Great Giver of Jobs emerged—the planned creation of a second US petrochemical hub. It was hoped that Appalachia's abundance of feedstocks, including methane and natural gas liquids, could give rise to a petrochemical complex that one day might rival in size the one along the US Gulf Coast. In 2017, the American Chemistry Council released a report describing in some detail the petrochemical cluster that could emerge in the greater Ohio River Valley.<sup>20</sup> It would be anchored by the construction of five world-class ethane cracker plants, which produce the ethylene and polyethylene that drive plastics manufacturing.

As described in the ACC study, the crackers would drive upstream job creation by adding to demand for natural gas and by inducing the creation of an ecosystem of supplier services upon which massive petrochemical complexes depend. And downstream jobs would be created by a proliferation of plastics manufacturers that would want to locate their businesses close to their suppliers of ethylene and polyethylene.

In all, 100,000 jobs were predicted. The Trump administration Department of Energy proclaimed the project the Appalachian Natural Gas and Petrochemical Renaissance.<sup>21</sup> And, when Shell began construction of its first US ethane cracker plant in Beaver County, Pennsylvania in 2017, it looked to many like the dream might come to fruition. But that was before investors and markets had the opportunity to fully assess the benefits and risks of trying to build out a second US petrochemical complex.<sup>22</sup>

Investors looked at proposals for additional crackers in Wood County, West Virginia and Belmont County, Ohio and blanched. There was already a cracker building boom going on along the Gulf Coast that would result in a 50% increase in manufacturing capacity. And an even bigger cracker building boom was going on in China and other parts of Asia, where increased demand for ethylene and polyethylene was expected to be centered. Meanwhile, North American demand, while expected to increase, was expected to do so much more slowly. In the meantime, the North American market's needs were already being met by existing suppliers who would be loath to give up their customers to new upstarts from Appalachia at a time when production capacity was well on its way to exceeding demand for the foreseeable future. On top of all this, no one knew the degree to which growing environmental concerns about plastics pollution would constrain market growth or possibly throw it into reverse.

Consequently, investors said no to the kind of investments that a new petrochemical hub would have required. More world class crackers in Appalachia were too risky. The Wood County cracker was canceled and the Belmont County cracker has now languished in "Final Investment Decision" limbo for six years. Its sponsor, the Thai company PTT, has announced the project will not go forward unless it replaces a partner it lost more than two years ago. None is on the horizon. In the meantime, PTT has decided to proceed with half a dozen other projects of equal or greater scale and cost, suggesting a lack of confidence by PTT as well as any prospective partners in the Belmont County project's likelihood of success.

As a result, six years after the American Chemistry Council and the Trump administration DOE unveiled the Appalachian manufacturing renaissance, the Shell cracker, which by the way employs fewer people than EQT, is the only one of the nine major projects outlined in the ACC study to go forward. Former petrochemical boosters, such as the Allegheny Conference in Pennsylvania, now assume that it is unlikely that more crackers will be built in the region. Nor has the Shell cracker triggered any identifiable downstream manufacturing development.<sup>23</sup> Its projected employee count of between 400 and 600, while positive, is a drop in the bucket in the context of Beaver County's economy, which currently provides more than 50,000 jobs. And it's scarcely a rounding error in the context of the 100,000 jobs that it was claimed the Appalachian petrochemical hub would deliver.

The petrochemical hub was actually the second imagined offspring of the natural gas boom to arrive stillborn. Previously an Appalachian Storage Hub—a project heavily promoted by West Virginia's two senators, Shelley Moore Capito and Joe Manchin—which would have required construction of a massive pipeline network to transport and store natural gas liquids, and which presumably would have been used by a burgeoning manufacturing sector, collapsed due to lack of private sector interest.

Today, the newest shiny object is the possible development of a regional hydrogen and carbon capture hub that is being aggressively promoted by the Biden administration and which will likely be subsidized by the Department of Energy using funds provided by the recently enacted Inflation Reduction Act. In the case of Appalachia, the hydrogen in question will almost certainly be derived from natural gas while using carbon capture and sequestration (CCS) technology to minimize greenhouse gas emissions during its manufacture. This could potentially be a boon for the natural gas industry both by creating a larger market for methane and facilitating construction of an asset—carbon capture transportation and storage facilities—that could also theoretically be used by gas-fired power plants to mitigate their greenhouse gas emissions. And, if the cost is shouldered by taxpayers and ratepayers, carbon capture technology could extend the functional lives of some coal and gas-fired power plants even though they already struggle to compete with renewable energy resources.

But, as with the imagined petrochemical hub and the even more imaginary Appalachian Storage Hub, there is a serious question about whether the private sector will jump on board. Despite IRA subsidies that would reimburse more than 100% of the anticipated cost of installing and operating carbon capture technology in the power generating sector, a recent report by the Energy Futures Initiative finds that these subsidies are still inadequate to attract private sector investment at the level necessary to achieve economies of scale.<sup>24</sup> And there is a good reason for that.

Carbon capture in the power generating sector is absurdly costly.<sup>25</sup> Using the 5-year average wholesale price of electricity in the region's PJM market, prior to the war in Ukraine, a 1,000 megawatt gas power plant that generates 7 million megawatt hours of electricity annually could expect to be paid about \$223 million dollars for its output. But, if the plant were retrofitted with CCS, under the Inflation Reduction Act, it would also be paid \$85 per metric ton for capturing and sequestering the carbon emissions it creates. That would come to about \$262 million.

So ratepayers and taxpayers would have to pay the plant's owner more for creating and sequestering the carbon emissions it creates than for producing electricity. And electricity that otherwise would cost \$223 million would instead cost \$485 million. Meanwhile the plant would have to compete against renewable resources that already generate electricity at or below the \$223 million figure and do so without emitting carbon and other pollutants.

The economics of CCS in coal plants are even worse. Because coal is more carbon-intensive than gas the carbon capture subsidy for \$223 million worth of electricity would be nearly \$565 million. So taxpayers and consumers would end up paying \$788 million.

Finally, even after taking new federal subsidies, which are time-limited, into account, the risk of cost-inefficient assets such as CCS-retrofitted coal and gas plants to eventually become stranded is obvious and could result in the same kind of investor avoidance that sank both the petrochemical hub and the Appalachian Storage Hub.

So, while hydrogen hub promoters have been more circumspect than promoters of the gas boom and the petrochemical hub were about suggesting specific job creation potential, that circumspection is of little interest to prospective investors whose only concern is ROI.

Consequently, local planners and policymakers be cognizant of two risks associated with the proposed hydrogen hub: first, that it may not take root just as the petrochemical and Appalachian Storage Hubs did not and, second, even if the hydrogen hub does take root, it, like the natural gas boom, may have very short or non-existent economic coattails.

## VII. THE CENTRALIA MODEL AND OTHER ECONOMIC DEVELOPMENT MEASURES

Now that the natural gas boom has plateaued, the region’s leaders face a moment of truth. Even the most fervent believers in natural gas-driven prosperity should recognize that an industry, which could not deliver jobs and prosperity when it was growing and vibrant, is even less likely to do so as it enters what the EIA forecasts to be a period of middle-aged stasis. But the track record of recognizing and addressing these facts isn’t encouraging.

In 2022, the Bel-O-Mar Regional Council, an intergovernmental planning organization for Belmont County, Ohio and Ohio, Marshall, and Wetzel counties in West Virginia, issued an updated Comprehensive Economic Development Strategy (CEDS) for the four counties, all of which are part of Frackalachia.<sup>26</sup> The CEDS contained a “Strengths, Weaknesses, Opportunities, and Threats” analysis, which could identify just one opportunity for economic development, the construction of an ethane cracker plant in Belmont County and the downstream manufacturing development it was expected to spawn.

**Figure 24: Bel-O-Mar SWOT Analysis, 2022**

Based on the data and profile information presented in earlier sections, this section summarizes the major trends and forces impacting the regional economy, that is, the economic strengths, weaknesses, opportunities, and threats in the Belomar region.

**Table 19. Strengths, Weaknesses, Opportunities, and Threats in the Belomar Region**

<p style="text-align: center;"><b>Strengths</b></p> <ul style="list-style-type: none"> <li>• Career development and training programs</li> <li>• Innovation</li> <li>• Cultural resources</li> <li>• Leveraging resources</li> </ul>	<p style="text-align: center;"><b>Opportunities</b></p> <ul style="list-style-type: none"> <li>• A new ethane cracker</li> <li>• Downstream manufacturing potential</li> </ul>
<p style="text-align: center;"><b>Weaknesses</b></p> <ul style="list-style-type: none"> <li>• Population loss</li> <li>• Low labor force participation</li> <li>• Few suitable industrial and commercial sites</li> <li>• Low educational achievement and attainment</li> </ul>	<p style="text-align: center;"><b>Threats</b></p> <ul style="list-style-type: none"> <li>• Ongoing population loss</li> <li>• Lack of job growth diversification</li> <li>• Drug use</li> <li>• Fiscal issues for small communities</li> </ul>

Source: Bel-O-Mar Regional Council Comprehensive Economic Development Strategy, 2022

Three years later, the hoped for cracker project is moribund and unlikely to be revived. The void this leaves shouldn’t just call out a need for alternative economic development strategies. It should stalk Frackalachian leaders and policymakers in every waking hour and then continue to stalk them in their dreams when they go to sleep. Because, as bad as economic conditions in Frackalachia have been in the last forty years, they can get worse.

If leaders and policymakers recognize and respond to this continuing and worsening deterioration and begin searching for solutions, they are likely to go in one of three directions.

First, and regrettably the most likely, they may glom on to the economic happy talk surrounding the development of an Appalachian hydrogen hub and hope that it represents an economic development strategy that will succeed where the natural gas boom, the Appalachian Storage Hub, and the Appalachian petrochemical hub all failed.

Second, they can embrace an approach that has become a sort of last resort for chronically declining regions—slashing taxes and offering subsidies in an effort to become more “business friendly” in the hope that, by aggressively minimizing the cost of doing business, they can overcome their frequent inability to provide positive benefits that heavily influence business’ decisions to locate and expand. These include a high quality talent pool, a healthy ecosystem of suppliers and service providers, and a thriving and growing market for the products and services they provide.

This approach has been derisively referred to as “smokestack chasing” and trying to “discount their way to prosperity”. And its ineffectiveness has been solidly documented by University of Akron economist, Dr. Amanda Weinstein in multiple studies.<sup>27</sup>

The third approach, which holds genuine promise for the region, has also been suggested by Dr. Weinstein – building economic growth from within by leveraging local resources and assiduously trying to improve the quality of life for residents and the employees of companies that choose to come and expand.<sup>28</sup>

This approach is best exemplified by the experience of the region around the old rural coal community of Centralia, Washington and surrounding Lewis County, which is recognized by the federal Bureau of Labor Statistics as the Centralia Micropolitan Area.

Going back to the 1990s, Centralia’s economy looked a lot like the economies of communities in the upper Ohio River valley. For twenty years job growth had been non-existent as foundational industries, including coal mining and, in Centralia’s case, timber, declined. By the year 2011, Centralia’s decline was expected to continue after it was announced that one of the community’s largest employers, a coal-fired power plant that employed 350 workers, would be retired by 2025.

2011 was also the year that expectations of massive job growth in Marcellus and Utica regions of Ohio, Pennsylvania, and West Virginia reached their zenith as industry organizations and many political leaders trumpeted the findings of industry-sponsored economic impact studies, which forecasted the creation of 50,000 new jobs in West Virginia, 200,000 new jobs in Pennsylvania, and 200,000 in Ohio as well.

Forced to place a bet, almost any reasonable person would have guessed that ten years later, the Ohio Valley would be enjoying an economic revival and that Centralia would be mired in continuing decline. In fact, exactly the reverse took place.

As the Appalachian natural gas counties known as Frackalachia, continued in their long, established patterns of job and population loss, Centralia’s economy made a turn in 2016 and, over the next four years:

- Jobs grew in number at twice the rate of the national average
- Wages grew 50% faster than in the nation as a whole
- Population grew faster than the national average as well



In all, an economy that only had 24,000 jobs in 2011 added 2,800 new ones by 2019.<sup>29</sup> It's the kind of economic growth of which county commissioners and economic development professionals in Frackalachia dream and, in many cases, expected to arrive courtesy of the natural gas boom.

So, why did Centralia, which seemed to have few if any prospects for economic revival, suddenly take off like a rocket? As a forthcoming paper from the Department of Agriculture, Environment, and Development Economics at Ohio State University shows, a major share of the credit goes to a Coal Transition Grant program, funded by TransAlta Corporation, the owner of the coal mine and power plant, and administered by a grant board made up of local TransAlta employees and community representatives.

In 2016, the year employment in Centralia first surpassed historic levels, the grants board began disseminating funds that will eventually total \$55 million by the time the transition program comes to its end in 2025. The grants are made from three funds:

- A "Weatherization Fund" that supports energy efficiency upgrades in businesses, institutions, and private homes.
- An "Economic & Community Development Fund" that supports workers, families, businesses, and organizations.
- An "Energy Technology Fund" that supports clean energy generation, energy efficiency, storage, and transportation electrification.

Although the grants are in aggregate comparatively small, amounting to an average of a little more than \$4 million per year, they have disproportionate economic impact because they help trigger a number of economic multipliers.

- The energy efficiency and education sectors in which grant funding is concentrated are highly labor-intensive.
- Work in these sectors tends to be performed by local suppliers and contractors, so most of the upstream and downstream economic activity occurs locally, as well.
- The grants program is efficient because it leverages existing businesses and programs.
- The grants trigger supplemental private investment, which compounds their impact.
- The grants are annuity-producing because they lower monthly utility bills, which becomes added disposable income for residents now and in the future.
- Growth in jobs and commerce for local merchants begins right away because energy efficiency and education are always "shovel-ready."
- Energy efficiency upgrades result in safer, more comfortable living, working, and recreation spaces that reduce absenteeism and healthcare costs and enhance residents' quality of life.

The work by the Ohio State University researchers as well as others to quantify, document, and explain what has transpired in Centralia means that we now have something more than an example of successful economic transition in a long-struggling fossil fuel community, we have a model for transition that may be replicable in Frackalachia and similarly struggling communities and region throughout the nation. In coming months, we hope to meet with regional policymakers to discuss the Centralia Model and explore how it might be applicable in our region. In the meantime, we will examine the prevailing economic condition in order to understand the challenges we have to overcome.

## VIII. TAKING ACTION

Embracing the Centralia Model isn't the only thing policymakers can do to turn around economic prospects for the region. In the United States, there are many counties in which incomes are low, sometimes scandalously low. In the vast majority of those unfortunate counties, output as measured by GDP is also significantly lower than the national median.

While regrettable, this marriage of low output and low income is understandable. We usually expect to be paid roughly in proportion to the value of the goods and services we provide through our work and property. But that's not the way it works in Frackalachia.

Nationally, 92% of the value we create in the form of GDP comes back to us in the form of income. In Frackalachia, the figure is just 74%. Another way of putting it is that one out of every three dollars of value created in Frackalachia ends up in the pockets of people who live in other places. And the majority of that one dollar gap between the value of the goods and services Frackalachia contributes and the compensation it receives is attributable to the Appalachian natural gas boom.

Prior to the boom, in 2008, Frackalachia's ratio of per capita income to per capita GDP was in the area of 90%, like the rest of the nation. By one measure, less than 10% of the incremental output created by the boom ever landed in Frackalachia. Whether that is even enough to compensate the region for the costs it incurred in the form of added expenses and diminished quality of life remains unknown.

Still, there is promise. Although incomes in Frackalachian counties are comparatively low, the funds necessary to change that condition are present. The only problem is that a third of the income Frackalachia generates lands elsewhere. That is a situation that can be addressed or corrected by government policy . . . if the region's policymakers can be motivated to enact those policies.

Unlike regions where both per capita GDP and per capita incomes are low, Frackalachia's elected representatives have the opportunity to simply capture for their constituents more of the wealth that they and their property are generating. This can be done financially through mechanisms such as severance and property taxes. And other forms of compensation can be tapped through regulation that lessens the adverse impacts that natural gas development can have on quality of life.

Developing and enacting such policies requires only that policymakers first recognize the futility of natural gas and fossil fuel-based economic development and then decide to take the actions that are necessary to ensure that their constituents and communities finally start to get, if not a good deal from natural gas development, at least a fair one.

In order to take the steps that will be necessary to enact the policies suggested above and perhaps ultimately to implement the Centralia Model, policymakers will first have to tune out the siren song of fossil fuel-based economic prosperity. Despite the facts cited in this report and despite EIA and IEA forecasts which find that Appalachian natural gas production is likely to stagnate, oil and gas industry leaders and their many champions in local, state, and federal offices are continuing to claim that what's good for oil and gas industry is good for America and the world. That's the vision being promoted by Toby Rice, President and CEO of the aforementioned EQT, the nation's largest domestic natural gas producer, which is based in Canonsburg, Pennsylvania and operates exclusively in Appalachia. In a PowerPoint presentation titled, "Unleashing U.S. LNG: The Largest Green Initiative on the Planet", Rice envisions a future in which US gas production increases by 50%.<sup>30</sup> And, far from being a laggard, Rice proposes that Appalachian gas will represent 70% of the growth, a doubling of current production levels. And, as the presentation's title suggests, Rice argues this expansion should be undertaken in the interest of decarbonizing in order to fight climate change.

Rice's climate change claim is based on a presumption that the added natural gas will mostly be used to replace coal and, as a result, slash carbon dioxide emissions by 60%. That would, he argues, get the world half way to achieving its climate goals. And quantitatively speaking, Rice is roughly correct. However, as anyone who understands the difference between distance "as the crow flies" and actual driving distance, it's possible to travel to a location, which is geographically closer to your destination but which leaves you farther away in terms of actually getting there.

Such is the case with Rice's scenario, which would take the world down a road only to leave it at a dead end when the greenhouse gas emissions from all the added natural gas, while being less than those from coal, would nonetheless still be too great to overcome by changes in the rest of the economy.

**Figure 25: EQT Decarbonization Scenario Summary**

**Step I: Develop the Resource**  
Deploying Just 50 Rigs Above Today's Levels



**Remaining Inventory @ \$3.75/mcf<sup>1</sup>**

Basin	Region	Remaining Wells	BCF/Well	Total Resource (TCF)
Appalachia	Northeast	90,000	14.4	1,275
Haynesville	Gulf Coast	25,000	12.8	300
Eagle Ford (dry gas)	Gulf Coast	20,000	8.3	168
Woodford (dry gas)	Gulf Coast	8,000	10.9	82
<b>Total Gas Shales</b>		<b>140,000</b>	<b>13.0</b>	<b>1,800+</b>
Permian Associated Gas	Gulf Coast	50,000+	4.0	200+

**Resource Summary**

- 1,800 TCF from 4 basins to be developed from 140,000 wells
- All wells are economic at \$3.75/mcf or below, in line with historical/current prices
  - Including LNG costs, U.S. natural gas is a cheap alternative to carbon intensive coal

**Development Needed**

- All basins have been developed for 15 years with 40,000 wells already drilled
  - 120 active rigs as of March '22
  - 50+ Rig Additions Needed for LNG Ramp

**Production Ramp<sup>2</sup>**

- Current rates of 4 gas plays: 45 Bcfd
- 2030 Rate: 90 Bcfd
  - Y/Y Growth rates of +5.5 Bcfd are in line with historical norms
  - 2022-2030 growth of +45 Bcfd is split roughly 60/40 Appalachia vs Gulf Coast
- 2040 Rate: 100 Bcfd
  - Appalachia constitutes 70% of total production, growing from 33 Bcfd to 70 Bcfd
- Able to hold these rates flat for 30 years to incentivize long term LNG buildout
- Permian associated gas would be additive (+8 Bcfd by 2030)

1. BCF/well is calculated from historical performance from existing wells in each basin, and remaining wells counts is estimated by well spacing and available acres in each basin 2. Internal study assumes rig activity will ramp up to ~170 / year and stay relatively flat until 2030. Source: Enverus, EQT analysis.

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Source: "Unleashing U.S. LNG: The Largest Green Initiative on the Planet," EQT

Still, the point of Mr. Rice's presentation isn't to bring about the implausible scenario he imagines. The point is to provide a narrative that industry representatives and compliant policymakers can use in order to present themselves as being responsible environmental stewards of climate and the planet while enacting policies that will enrich, perpetuate, and maybe even expand the oil and gas industry. They will interweave elements of Rice's narrative with visions of the natural gas-based Appalachian hydrogen hub and possibly, again, an Appalachian petrochemical hub, selling it to the people of the region as the thing that will finally turn our economy around and bestow jobs and prosperity thereby obviating the need for any alternative economic development strategies.

That is the risk the greater Ohio River Valley of Appalachia faces. It is a test of whether fact can ultimately triumph over wishful thinking and the not inconsiderable inducements self-interested industries are willing to offer in order to insure that delusion carries the day.

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