

Impacts of the Reimagine Appalachia & Clean Energy Transition Programs for Pennsylvania

Job Creation, Economic Recovery, & Long-Term Sustainability

PRELIMINARY SUMMARY OF MAIN RESULTS ON:

- Employment creation through investments in clean energy, manufacturing/infrastructure, and land restoration/agriculture
- Employment contraction and just transition for workers in fossil fuel-dependent industries

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The COVID-19 pandemic has generated severe public health and economic impacts in Pennsylvania, as with most everywhere else in the United States. This study proposes a recovery program for Pennsylvania that is capable of exerting an effective counterforce against the state's economic collapse in the short run while also building a durable foundation for an economically viable and ecologically sustainable longer-term recovery. Even under current pandemic conditions, we cannot forget that we have truly limited time to take decisive action around climate change. As we show, a robust climate stabilization project for Pennsylvania will also serve as a major engine of economic recovery and expanding opportunities throughout the state.

The full forthcoming study is divided into five parts:

1. Pandemic, Economic Collapse, and Conditions for Reopening Pennsylvania
2. Clean Energy Investments, Job Creation, and Just Transition
3. Investment Programs for Manufacturing, Infrastructure, Land Restoration, and Agriculture
4. Total Job Creation in Pennsylvania through Combined Investments
5. Financing a Fair and Sustainable Recovery Program

We present here some of the main findings from Parts 2 and 3 of the forthcoming study.¹

Emissions Reduction and Clean Energy Investments

We develop in this study a clean energy investment project through which Pennsylvania can achieve climate stabilization goals which are in alignment with those set out by the Intergovernmental Panel on Climate Change (IPCC) in 2018—that is, to reduce CO₂ emissions by 45 percent as of 2030 and to achieve net zero emissions by 2050. We show how these two goals can be accomplished in Pennsylvania through large-scale investments to dramatically raise energy efficiency standards in the state and to equally dramatically expand the supply of clean renewable energy supplies, including primarily solar, but also wind, low-emissions bioenergy, geothermal and small-scale hydro power. We also show how this climate stabilization program for Pennsylvania can serve as a major new engine of job creation and economic well-being throughout the state, both in the short- and longer run.

Reducing Fossil Fuel Energy to Cut CO₂ Emissions

The first overarching goal of the program is to achieve, by 2030, a 50 percent reduction in CO₂ emissions in Pennsylvania relative to the 2018 emissions level. Emissions in Pennsylvania in 2018 were at about 233 million metric tons after including emissions produced by bioenergy sources as well as oil, coal, and natural gas. The emissions level as of 2030 will therefore need to be no more than 117 million tons.² About 85 percent of all energy

1 This project was commissioned by The Heinz Endowments, the Community Foundation of the Alleghenies, Policy Matters Ohio, the Keystone Research Center and the West Virginia Center on Budget and Policy. We greatly appreciate their financial support as well as the fact that they respected our terms of engagement. Those terms included full autonomy in drafting the study and reaching the conclusions presented here. The results presented here are near-final but remain preliminary.

2 Our basic measures of CO₂ emissions throughout this study are units of metric tons. However, to simplify, for the most part we refer hereafter to this unit as “tons” of CO₂ emissions.

consumption in Pennsylvania presently comes from burning natural gas, oil, coal, and high-emissions bioenergy. Consumption of oil, gas, and biomass will all need to fall by 40 percent and coal by 70 for the state to reduce CO₂ emissions by 50 as of 2030.

Clean Energy Investments to Replace Fossil Fuels

The clean energy investment program that we have developed for Pennsylvania includes the following main components:

- **Energy Efficiency.** Dramatically improving energy efficiency standards in Pennsylvania's stock of buildings, automobiles and public transportation systems, and industrial production processes.
- **Clean Renewable Energy.** Dramatically expanding the supply of clean renewable energy sources—including solar, wind, low-emissions bioenergy, geothermal, and small-scale hydro power—available at competitive prices to all sectors of Pennsylvania's economy.
- **Total Investment Expenditures.** The level of investment needed to achieve Pennsylvania's energy goals will average roughly \$26.1 billion per year between 2021 – 2030.
 - This estimate assumes that Pennsylvania's economic growth proceeds at an average rate of 1.5 percent per year.
 - Clean energy investments will need to equal about 2.8 percent of Pennsylvania's annual GDP.

We have generated results as to the employment impacts of these clean energy investments. We estimate that, as an average over 2021 – 2030, a clean energy investment program scaled at about \$26 billion per year will generate roughly 174,000 jobs per year in Pennsylvania. This figure is equal to about 2.8 percent of Pennsylvania's overall work force as of 2019. We show these preliminary estimates in Table 1.

Investments in Manufacturing/Infrastructure and Land Restoration/Agriculture

In Part 3 of the study, we present investment programs for Pennsylvania in the areas of public infrastructure, manufacturing, land restoration, and agriculture. Specific investment areas include manufacturing R&D, broadband development, regenerative agriculture, and plugging orphaned oil and gas wells. We have scaled this overall set of investments at \$8.2 billion per year over 2021 – 2030, equal to about 1 percent of Pennsylvania's 2019 GDP. We estimate that the full program would generate about 78,000 jobs per year in the state. We present these estimates in Table 2.

Overall Job Creation through Combined Investment Programs

Overall, the combination of investments in clean energy, manufacturing/infrastructure, and land restoration/agriculture will create about 252,000 jobs in Pennsylvania, equal to about 4.1 percent of the state's 2019 work force. These investments will also provide the foundation for a long-term sustainable growth path for the state. Table 3 shows these summary employment figures.

TABLE 1
Annual Job Creation in Pennsylvania through Combined Clean Energy Investment Program
Average annual figures for 2021 – 2030

Industry	Budget allocations	Number of direct and indirect jobs created	Number of direct, indirect and induced jobs created
Energy efficiency	\$6.5 billion		
1) Building retrofits	\$2.6 billion (40%)	17,680	26,230
2) Industrial efficiency, including combined heat and power	\$1.3 billion (20%)	4,160	6,630
3) Electrical grid upgrades	\$960 million (15%)	3,552	5,500
4) Public transportation expansion/ upgrades, including rail	\$960 million (15%)	14,880	19,370
5) Expanding high efficiency automobile fleet	\$640 million (10%)	0*	0*
6) Total energy efficiency job creation	\$6.5 billion (100%)	40,272	57,730
Clean renewables	\$19.6 billion		
6) Solar	\$9.8 billion (50%)	27,900	44,440
7) Onshore wind	\$3.9 billion (20%)	8,880	13,750
8) Low-emissions bioenergy	\$2.9 billion (15%)	11,480	16,950
9) Geothermal	\$1.5 billion (7.5%)	12,730	19,780
10) Small-scale hydro	\$1.5 billion (7.5%)	14,250	21,590
11) Total job creation from clean renewables	\$19.6 billion (100%)	75,240	116,510
12) TOTALS (= rows 6+12)	\$26.1 billion	115,512	174,240
13) TOTAL AS SHARE OF 2019 PENNSYLVANIA LABOR FORCE <i>(Labor force at 6.2 million)</i>	---	1.9%	2.8%

Note: We assume no net job creation through expanding the high-efficiency automobile fleet. This is because we assume that job creation through the production and consumption of high-efficiency autos will be offset by job losses through the contraction of the conventional gasoline-powered auto industry.

TABLE 2
Annual Job Creation in Pennsylvania through Manufacturing/Infrastructure and Land Restoration/Agriculture Investment Programs
Average annual figures for 2021 – 2030

Industry	Budget allocations	Number of direct and indirect jobs created	Number of direct, indirect and induced jobs created
Manufacturing development and public infrastructure	\$4.1 billion		
1) Broadband	\$1.2 billion (29%)	3,120	4,800
2) Water/wastewater/inland waterways	\$1.2 billion (29%)	8,400	11,880
3) Manufacturing R&D	\$580 million (14%)	3,306	5,220
4) Bioplastics R&D	\$580 million (14%)	3,306	5,220
5) Dams/levees	\$350 million (8.5%)	3,290	4,655
6) Gas distribution pipelines—repairing leaks	\$230 million (5.5%)	483	1,357
7) Total job creation from manufacturing development and public infrastructure (=rows 1-6)	\$4.1 billion (100%)	21,905	33,132
Land restoration and agriculture	\$4.1 billion		
8) Regenerative agriculture	\$1.7 (41%)	17,680	19,890
9) Farmland conservation	\$1.2 billion (29%)	10,680	14,400
10) Plugging orphaned oil and gas wells	\$600 million (15%)	1,200	3,420
11) Land restoration	\$600 million (15%)	4,920	6,900
12) Total job creation from land restoration/ agriculture (=rows 8-11)	\$4.1 billion (100%)	34,480	44,610
13) TOTALS (= rows 7+12)	\$8.2 billion	56,385	77,742
14) TOTAL AS SHARE OF 2019 PENNSYLVANIA LABOR FORCE (Labor force at 6.2 million)	---	0.9%	1.3%

TABLE 3
Annual Job Creation in Pennsylvania through Combined Investment Programs

- Clean Energy
- Manufacturing/Infrastructure
- Land Restoration/Agriculture

Estimates are annual averages for 2021 – 2030

Overall Investments at \$34.3 billion/year; 3.8% of Pennsylvania GDP

	Number of direct and indirect jobs created	Number of direct, indirect and induced jobs created
1) \$19.6 billion/year in clean renewable energy	75,240	116,510
2) \$6.5 billion/year in energy efficiency	40,272	57,730
3) \$4.1 billion/year in manufacturing/public infrastructure	21,905	33,130
4) \$4.1 billion/year in land restoration/agriculture	34,480	44,610
5) Total for all investment areas (= rows 1 - 4)	171,897	251,980
13) TOTAL AS SHARE OF 2019 PENNSYLVANIA LABOR FORCE (labor force at 6.2 million)	2.8%	4.1%

Sources: See Tables 1 and 2.

Just Transition for Displaced Workers in Fossil Fuel-Based Industries

Nearly 64,000 people are employed in Pennsylvania in fossil fuel-based industries, including oil and gas extraction, support activities for oil and gas, coal mining, and other ancillary sectors, such as fossil fuel-based power generation. This amounts to about 1 percent of Pennsylvania’s overall workforce as of 2019. We show these figures in Table 4.

Workers in Pennsylvania’s fossil fuel-based industries will experience job losses as the state dramatically reduces consumption of these CO₂-generating energy sources in order to reach the emission reduction goals, starting with a 50 percent emissions reduction in the state as of 2030. Our estimates of the employment contraction in Pennsylvania’s fossil fuel-based industries follow from our framework in which oil and natural gas consumption fall by 40 percent as of 2030 while coal falls by 70 percent.³

Based on this rate of contraction, we estimate that, on average, 2,870 fossil fuel-based jobs will be lost per year between 2021 – 2030. But based on the demographic profile of workers in these fossil fuel-based sectors, we also estimate that 1,056 workers in the industry will voluntarily retire at age 65 or sooner. This means that 1,814 workers per year will experience displacement—i.e. their jobs in the fossil fuel industry will be phased out, and they will need to find employment elsewhere. We show how we derive these estimates in Table 5. Figure 1 also summarizes these results

³ We assume that the state’s much smaller bioenergy sector will also contract by 40 percent over this period.

TABLE 4
Number of Workers in Pennsylvania Employed in Fossil Fuel-Based Industries, 2018

Industry	2018 Employment levels
Oil and gas extraction	15,563
Support activities for oil/gas	13,665
Coal mining	6,276
Natural gas distribution	5,923
Fossil fuel electric power generation	3,985
Wholesale -petroleum and petroleum products	3,517
Drilling oil and gas wells	3,301
Pipeline transport	2,595
Pipeline construction	2,398
Petroleum refining	2,133
All other petroleum and coal products manufacturing	2,106
Support activities for coal	1,155
Mining machinery and equipment manufacturing	721
Oil and gas field machinery and equipment manufacturing	180
Total	63,518
TOTAL FOSSIL FUEL-BASED EMPLOYMENT AS SHARE OF PENNSYLVANIA EMPLOYMENT <i>(Pennsylvania 2018 employment = 6,150,782)</i>	1.0%

Sources: IMPLAN, 3.0, U.S. Department of Labor.

This average annual figure of about 1,800 fossil fuel-based industry workers experiencing job displacement in Pennsylvania represents a tiny fraction—three one-hundredths of one percent (0.03 percent)—of the state’s overall 2019 labor force of about 6.5 million people. Nevertheless, it is critical that all of these roughly 1,800 workers per year are provided with a package of generous just transition policies, as they move out of the fossil fuel industry into other areas of employment or into voluntary retirement. The just transition program should include five components:

- Pension guarantees for retired workers who are covered by employer-financed pensions;
- Retraining to assist displaced workers to obtain the skills needed for a new job;
- Re-employment for displaced workers through an employment guarantee, with 100 percent wage insurance.
- Relocation support for all workers who require this support; and
- Full just transition support for older workers who choose to continue past the traditional retirement age of 65.

TABLE 5
Attrition by Retirement and Job Displacement for Fossil Fuel-Based Workers in Pennsylvania

	Fossil fuel workers
1) Total workforce as of 2018	63,518
2) Job losses over 10-year transition, 2021-2030	28,702
3) Average annual job loss over 10-year production decline (= row 2/10)	2,870
4) Number of workers reaching 65 over 2021-2030 (=row 1 x % of workers 54 and over in 2019)	13,200 (20.9% of all workers)
5) Number of workers per year reaching 65 during 10-year transition period (=row 4/10)	1,320
6) Number of workers per year retiring voluntarily (80% of 65+ workers)	1,056
7) Number of workers requiring re-employment (= row 3 – row 6)	1,814

Source: Source: The 80 percent retirement rate for workers over 65 derived from U.S. Bureau of Labor Statistics: <https://www.bls.gov/cps/cpsaat03.htm>. According to these BLS data, 20 percent of 65+ year-olds remain in the workforce..

FIGURE 1: Estimated Annual Job Losses, Voluntary Retirements, and Workers Displaced in Pennsylvania’s Fossil Fuel Related Industries, 2021–2030



Source: See Table 5.

In Table 6, we present what would be a viable just transition package for this average of about 1,800 displaced workers in the state every year from 2021 – 2030.

As we will present in detail in the full study, the overall costs of providing these displaced workers with generous just transition support will be trivial relative to the size of Pennsylvania’s economy. The just transition program should be financed jointly by federal and state government funding sources.

TABLE 6
Policy Package for Displaced Workers in Pennsylvania’s Fossil Fuel-Based Sectors

Pension guarantees for workers (65+) voluntarily retiring	– Legal pension guarantees
Employment guarantee	– Jobs provided through clean energy and public infrastructure investment expansions
Wage insurance	– Displaced workers guaranteed 3 years of total compensation at levels in fossil fuel-based industry jobs
Retraining support	– 2 years of retraining, as needed
Relocation support	– \$75,000 for one-half of displaced workers

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