

## CHAPTER 6: CLIMATE CRISIS

### OVERVIEW

The *Economic Report of the President* fails to address sufficiently one of the most critical threats facing the American and global economies: the climate crisis. Without sweeping and immediate action, global temperatures will continue to rise and cause growing economic harm that will dwarf the most serious economic crises in our history. It is estimated that the future cost to the U.S. economy will reach hundreds of billions of dollars each year.

Nevertheless, President Trump has called climate change a “hoax,” and his Administration has taken steps to undo progress. He plans to withdraw the United States from the Paris Agreement, ceding U.S. leadership on the issue. Moreover, he has pulled back from the Clean Power Plan, removing standards requiring power plants to reduce emissions.

Earlier this year, four former Federal Reserve chairs joined 27 Nobel laureates and 12 former chairs of the CEA to issue a statement saying, “Global climate change is a serious problem calling for immediate national action.” This list includes every living former Republican CEA chair, with the exception of CEA Chair Kevin Hassett, who was charged with writing this year’s *Report* and has left the CEA since its publication. It is disappointing that the President’s CEA, under Hassett’s leadership, did not express similar concerns.

This chapter presents an overview of the macroeconomic impact of the climate crisis, including the rapidly growing costs of more frequent severe weather events. It looks at the rising costs to individuals and businesses, including the disproportionate impacts of the climate crisis on disadvantaged communities. On the other

hand, this chapter also highlights improvements in renewable energy and the economic opportunities of that sector. It is unfortunate that these issues are missing from the *Report*.

### **MACROECONOMIC ESTIMATES OF CLIMATE CRISIS COSTS**

Major new studies highlight the grave threat of the climate crisis. The United Nations' Intergovernmental Panel on Climate Change recently released a comprehensive 700-page report written by scientists and researchers from dozens of countries based on 6,000 peer-reviewed studies.<sup>395</sup> The report estimates that global economic damages will total \$54 trillion at 1.5 degrees Celsius of warming, and \$69 trillion at 2.0 degrees of warming. Without policy interventions, the researchers project that global temperatures are on track to rise 3.7 degrees by the end of the century.<sup>396</sup>

In May 2019, the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) announced the findings from its forthcoming report on biodiversity, which is the most comprehensive assessment of the planet's biodiversity to date. The 455 authors from 50 countries who contributed to the 1,500-page report warn that up to 1 million of the planet's eight million species are at risk of extinction, many within decades. They call for transformative change—"a fundamental, system-wide reorganization across technological, economic and social factors"—to protect and restore nature.<sup>397</sup> The report also highlights the impact of the unprecedented loss in biodiversity on human health, water, energy, agriculture and property. Notably, it concludes that land degradation has already reduced the agricultural productivity of 23 percent of the global land surface; up to \$577 billion global crops are now at risk from pollinator loss

each year and up to 300 million people now face increased risk of floods and hurricanes due to coastal habitat destruction.<sup>398</sup>

The most recent U.S. National Climate Assessment, compiled by a team of more than 300 experts, concluded that if emissions continue to grow at current rates, the annual losses to the U.S. economy could surpass half a trillion dollars by the end of the century.<sup>399</sup> The assessment warns of impacts to the agriculture, tourism and fisheries sectors, higher spending on electricity and disruptions to global supply chains and trade.<sup>400</sup>

A 2017 study estimates that the level of U.S. gross domestic product (GDP) will decline by about 1.2 percent for every degree of additional warming—for context, 1.2 percent of GDP in 2017 was \$233 billion.<sup>401</sup> These costs include higher human mortality, lower agricultural output, higher crime rates, more coastal storms, lower labor productivity and higher energy costs. The study also estimates that the economic costs could be even more severe at high levels of warming, with costs of up to 5.6 percent of GDP at four degrees of warming.<sup>402</sup>

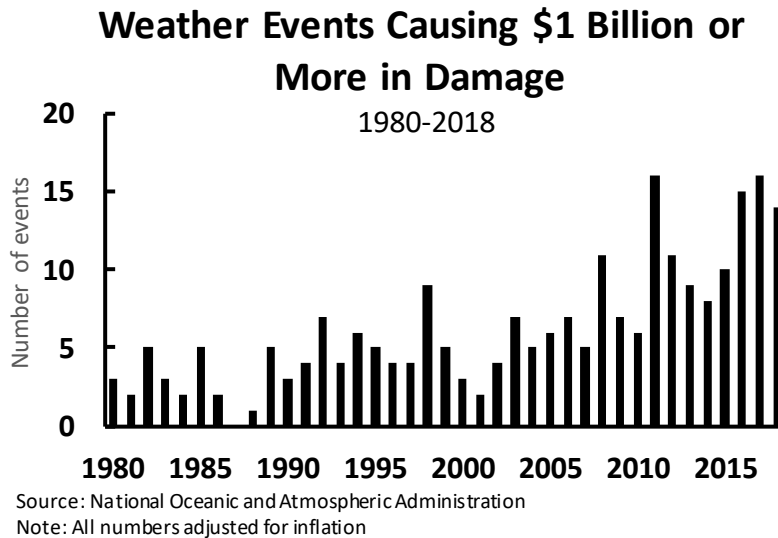
Research published by the Federal Reserve Bank of Richmond projects that climate change could reduce annual economic growth in the United States by one-third over the next century.<sup>403</sup> For context, that magnitude of impact would have reduced U.S. economic growth from three percent to two percent last year.<sup>404</sup> The researchers use seasonal and geographical variations to show that the effects of global warming will spread beyond strictly outdoor industries, such as agriculture and construction, and have substantial negative effects on industries such as real estate and the services sector. These negative effects are driven by lower labor productivity during the summer as temperatures rise.<sup>405</sup>

### **THE INCREASING FREQUENCY AND COST OF EXTREME WEATHER DISASTERS**

It will not take decades to see the economic consequences of the climate crisis—many areas of the country are already feeling its effects. One already visible consequence of climate change is the increase in frequency, intensity and cost of severe weather events, which climate experts have unambiguously linked to warming temperatures.<sup>406</sup>

The National Oceanic and Atmospheric Administration (NOAA) tracks weather events that cause more than \$1 billion in economic damage (adjusting past events for inflation). These events include hurricanes, droughts, floods, wildfires and other storms. In the 1980s, there were 28 such events, causing over \$170 billion in total damages. The pace of these extreme events has dramatically accelerated, and since 2010, there have been more than 100 high-cost weather disasters, causing more than \$750 billion in total losses. The economic cost also has soared—so far this decade the economy has suffered \$580 billion more damage from extreme weather events than during the 1980s. The years 2016, 2017, and 2018 saw the most such events in the history of the NOAA aside from 2011, and 2019 has already seen six billion-plus dollar disasters (the *yearly* average since 1980).<sup>407</sup>

Extreme weather leads to high costs to the federal government, in addition to the costs to the economy. The Office of Management and Budget (OMB) estimated in 2017 that the climate crisis cost the federal government more than \$350 billion in the prior decade. Much of this spending goes to emergency aid and rebuilding infrastructure.<sup>408</sup> These costs will likely rise even further in the near future. An analysis by the OMB projects that climate change could increase the average annual expenditures on hurricane relief by \$50 billion by 2075.<sup>409</sup>

*Figure 6-1**Threats to Household Wealth and Property*

Rising sea levels and increased frequency of disasters will have enormous consequences for homeowners and businesses in affected regions. Rising sea levels will cause increased chronic tidal flooding in coastal neighborhoods.<sup>410</sup> This flooding will cause damage and hurt property values.

The Union of Concerned Scientists identified 311,000 homes and 14,000 commercial properties that will be at increased risk of chronic tidal flooding over the next 30 years. By the end of the century, more than \$1 trillion in homes and commercial properties will be at increased risk of chronic tidal flooding because of the climate crisis, including around one million homes in Florida alone. Some U.S. communities will be hit particularly hard—almost 175 will see at least 10 percent of homes put at risk by 2045.<sup>411</sup>

Property values in coastal communities likely are already being affected. While many of these regions are still seeing property values increase, recent research shows that exposure to potential sea-level rises is leading to lower property value appreciation. Exposed homes sell for seven percent less than comparable homes that are not exposed to rising sea levels, even after accounting for the distance to beaches.<sup>412</sup> For homeowners whose wealth is mostly in home equity, a seven percent hit to a home's value can be a substantial financial setback.

With extreme weather disasters, homes and businesses are damaged and destroyed, local and regional economies are disrupted and, most importantly, lives are lost. In 2018, California wildfires that raged for weeks because of exceptionally dry conditions killed 106 people and caused a record \$24 billion in damage.<sup>413</sup> Hurricane Maria, which hit Puerto Rico in 2017, is estimated to have taken 2,975 lives.<sup>414</sup>

Few parts of the country have been spared from the rise in extreme weather. In March 2019, for instance, a “bomb cyclone” hit the Midwest United States, dropping record amounts of snow and rain and creating massive floods across a large swath of the country. Nebraska Governor Pete Ricketts called the flooding “the most widespread disaster we have had in our state’s history.”<sup>415</sup> Early estimates placed the total damage at \$12.5 billion across 11 states, including home and property damage, lost business and farm revenue from destroyed crops.<sup>416</sup>

Businesses have also suffered catastrophic losses, which affects not only shareholders but also employees. For example, after the 2018 Camp Fire in California was linked to power lines from Pacific Gas and Energy (PG&E), the anticipated liability claims led the company to declare bankruptcy.<sup>417</sup> The company is California’s largest utility and it employed 24,000 people.<sup>418</sup>

*Extreme Weather Creates Increased Risk*

Private sector actors increasingly are showing strong concern about the likely economic impacts of the climate crisis. This should send a strong message to policymakers.

The insurance industry, which is in the business of calculating the possible economic impact of future catastrophic weather events, is sounding the alarm. Extreme weather brings costly damages to homeowners and business proprietors. Afterward, these individuals are reliant on insurance policies to make them whole—or if they are uninsured, the government often steps in to partially mitigate the loss. However, where and how the climate crisis will strike is uncertain, and it is not clear that risk models can keep up. As the environment becomes less predictable, it is more likely that insurers will find that they mispriced risk and the associated premiums.<sup>419</sup> Where insurers do correctly price in climate change, premiums are likely to rise for consumers and some may choose to go without it if possible.<sup>420</sup>

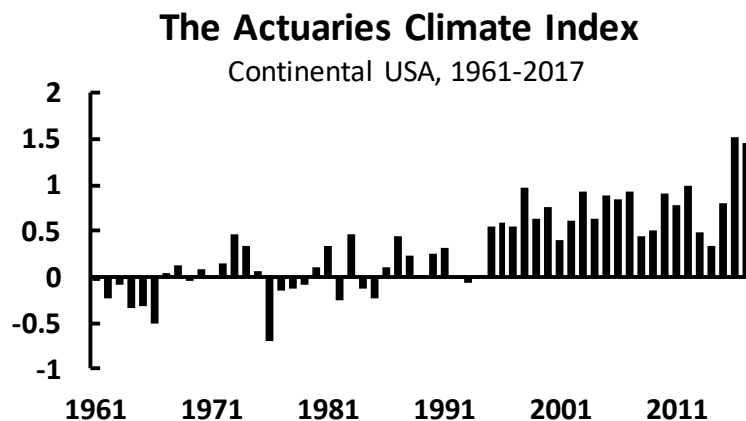
For instance, the models and maps that use past floods to determine the designation of flood zones, setting of premiums by insurance companies, and decisions of where to build or rebuild are proving increasingly inadequate for providing a realistic roadmap of risks. For example, in Houston, floods that were expected by insurers only once every 500 years hit three times in the three years from 2015 to 2017, driving home the lesson that measures of flood risk have become outdated.<sup>421</sup>

Catastrophic weather events are hitting uninsured properties more often than in the past. The amount of annual catastrophic weather-related damages not covered by insurance has increased by 50 percent globally since 2004.<sup>422</sup> This increase makes it more difficult for families and businesses to rebuild after disasters. For

example, only 50 percent of homes in Puerto Rico were covered against wind damage before Hurricane Maria.<sup>423</sup> Further, less than four percent of households had flood insurance. This left homeowners without the money needed to rebuild and instead waiting to be approved for Federal Emergency Management Agency (FEMA) aid.<sup>424</sup>

Insurers are starting to recognize the risks that climate change poses. Several industry actuary groups worked together to create the Actuaries Climate Index, which monitors the rise in extreme weather and sea levels in the United States and Canada.<sup>425</sup> The five-year moving average of the index reached a new high with its latest release.<sup>426</sup> An association of insurance executives, the Geneva Association, has also reported on the challenges that the climate crisis brings to the insurance industry, highlighting the inherent complexity and volatility of disasters and limited takeup of disaster insurance, among other challenges.<sup>427</sup>

*Figure 6-2*



Source: Actuaries Climate Index

Note: Data is average of 4-quarters; measures frequency of extreme weather and sea level rise



Past and current insurance executives are also calling for action. In a recent op-ed, former State Farm chief executive Edward B. Rust said, “We need to move away from the politically charged rhetoric about climate change and talk about its real, tangible consequences.”<sup>428</sup> Announcing damages from the California wildfires, Allstate’s current chief executive Tom Wilson stated, “It’s time to address the impact that more severe weather is having on Americans instead of fighting about climate change.... It is now time to come up with longer-term solutions.”<sup>429</sup>

#### **CLIMATE CHANGE WILL HAVE DISPARATE IMPACTS**

The climate crisis will not impact everyone or all parts of the country equally. Areas such as the South and Midwest, where temperatures are already warm or that rely heavily on agriculture, will suffer some of the harshest effects of rising temperatures. Crop yields will be negatively affected and humans will be forced to deal with the growing health consequences of extreme heat. Atlantic coastal areas will be hardest hit by rising sea levels, experiencing more chronic flooding and more intense storms.<sup>430</sup>

Not all industries will be impacted equally. Sectors that rely heavily on labor, like construction, will see large declines in productivity and output during hotter summers.<sup>431</sup> The agriculture sector will have to adjust to new growing seasons and weather patterns.<sup>432</sup> The real estate industry will be hit as hotter summers affect peak buying season. Wholesale and retail trade rely on laborers to load and unload goods in areas that are typically not climate-controlled, exposing those industries to the effects of rising temperatures as well.<sup>433</sup>

The climate crisis also will adversely affect the health and well-being of the elderly, poor and most vulnerable in our society. Increases in air pollution and frequency of extreme weather events

and temperatures due to climate change will hurt poor communities and some communities of color the most, many of whom already experience higher than average exposure to unhealthy environments.<sup>434</sup> Children will more often suffer from infectious diseases, air pollution, heat waves and mental health trauma resulting from extreme weather changes. Moreover, the elderly are at higher risk of heat-related deaths.<sup>435</sup>

#### *Climate Change Will Cause Mass Migration*

Rising temperatures will have disparate effects internationally, with some parts of the globe potentially seeing drastic changes that lead to mass migration. Destruction from extreme weather will force people from homes and communities, rising sea levels will make it untenable to live in some low-lying areas and declining agricultural yields will leave many farmers unable to earn a living. While people will first try to adapt to changes so they can stay in their communities, millions will likely be forced to find new homes.<sup>436</sup> One estimate suggests that up to one billion people could be environmental migrants by 2050.<sup>437</sup>

One-third of the population of the Marshall Islands, a U.S. territory, has already moved to the continental United States, partially due to the effects of climate change.<sup>438</sup> A town in Alaska received funding to start relocating because of the effects of the climate crisis last year.<sup>439</sup> More are under threat from coastal erosion and also considering or undergoing relocation.<sup>440</sup> Some island nations are already planning to relocate entire communities.<sup>441</sup>

Increased global migration will impact not only those forced to migrate but the rest of the world and the global economy as well. Migrant caravans could become more frequent and global humanitarian efforts will have to adjust accordingly. Developing

countries will look to richer nations like the United States to lead in relief efforts. Local communities and labor markets will have to adjust to dramatic and sudden changes in population flows.

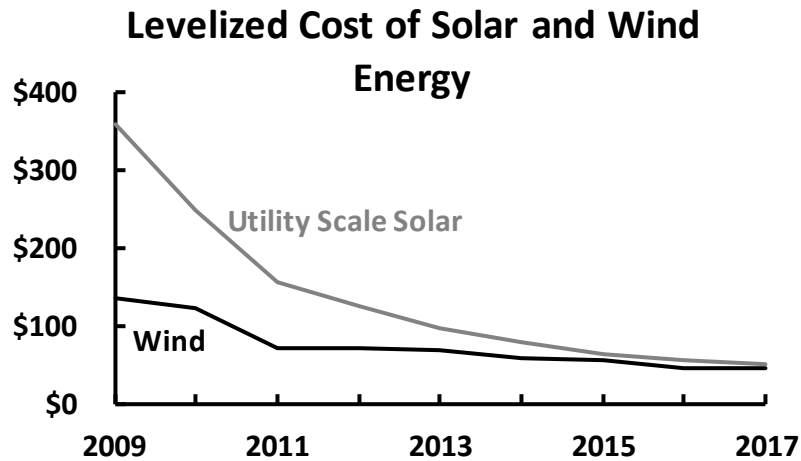
### **INNOVATION IS DRIVING RENEWABLE COSTS DOWN**

Mitigating the worst effects of climate change will require increased usage of renewable energy. Fortunately, as solar and wind are deployed on larger scales, production techniques continue to develop and grids become smarter, experts anticipate the costs of renewables will continue to decline.

Solar photovoltaic (PV) cells have dropped substantially in price and have become more efficient. System costs for PV fell by between 10 and 15 percent annually from 2010 to 2016, when measured on a per-watt basis.<sup>442</sup> These gains were driven by both improvements in production technologies and improvements in cell design leading toward more efficient cells.<sup>443</sup> Estimates from the International Renewable Energy Agency (IRENA) show that solar projects are continuing to converge on the lower end of the cost range, driving down the average cost of new solar projects.<sup>444</sup>

The cost of producing electricity from onshore wind turbines dropped by two-thirds from 2009 to 2017.<sup>445</sup> Improved efficiencies in designs, like longer turbine blade lengths and higher hub heights, and more developed supply chains have pushed down these costs. IRENA research shows that onshore wind projects are continuing to move toward the lower end of the current cost range, which will further drive down the average cost in coming years and make wind more competitive.<sup>446</sup>

Figure 6-3



Source: Lazard

Data on power purchase agreements (PPA)—contracts between energy providers and buyers—in the United States show a similar trend. In 2009, PPAs for wind averaged around \$70 per megawatt hour (MWh). By 2017 that price had dropped to around \$20 per MWh.<sup>447</sup> Similarly, prices for solar PPAs have dropped substantially since 2006. Some solar agreements are priced as low as \$20 per MWh.<sup>448</sup> At these prices, solar and wind are competitive with traditional energy sources.

#### *Renewable Prices Are Competitive with Fossil Fuels*

This rise in innovation, along with increasing economies of scale, is leading to increasing cost parity between renewables and fossil fuels. In many parts of the country, utilities are discovering that solar or wind energy comes in below the cost of conventional energy sources. As innovation continues, and prices continue to decline, the case for renewables will become even clearer.

Lazard, a financial advisory firm, analyzed new energy generation projects in the United States using a variety of conventional and alternative sources. The analysis finds that utility-scale solar and wind energy are already cheaper than coal and on par with or cheaper than natural gas, after accounting for tax preferences. This is even before factoring in the cost of externalities associated with many conventional sources of fuel, such as high levels of air pollution and climate change-induced effects of carbon emissions.<sup>449</sup>

#### *More Innovation Is on the Horizon*

Energy storage plays a key role in integrating renewables into electrical grids. Solar and wind production is variable, and storage is needed to bridge gaps in production, such as overnight when there is no sunlight. On a small scale, batteries can help homes and mini-grids powered by solar store enough energy to meet their overnight needs.<sup>450</sup> On a larger scale, hydroelectric storage facilities use surplus energy production to pump water into higher locations, which can then be released through turbines to generate electricity when demand is higher.<sup>451</sup> More advanced utility-scale technologies are also being invested in to meet this challenge—for example, a 100-Megawatt battery was brought online last year in Australia and Bloomberg NEF projects that more than \$600 billion will be invested in large-scale energy storage by 2040.<sup>452</sup>

As costs drop and new technologies emerge, energy storage will become cheaper and allow for longer durations. Costs for lithium-ion batteries already dropped by three-fourths from 2010 to 2016.<sup>453</sup> With these advances, the case for renewables will become stronger.

A development that has facilitated the incorporation of renewable technology into grids and will likely become more important in

the coming years is Distributed Energy Resources (DER) technology. These advancements incorporate a variety of physical and virtual technologies which enable a transition away from one-way centralized grids where power goes from power plants to consumers. Instead, DER creates smart microgrids where consumers and communities can feed unused power back into the grid, batteries store excess energy to cover production lulls, and other technologies are implemented to improve energy efficiency and better manage demand.<sup>454</sup> Nationwide DER capacity is expected to double from 2017 to 2023.<sup>455</sup>

*International Competition Over Renewable Jobs is Fierce and Growing*

Many jobs in clean electricity generation are protected from global competition and outsourcing because wind and sunlight cannot be imported in the same way as fossil fuel sources. However, the parts essential to making a wind turbine, the photovoltaic cells that convert sunlight into electricity, and the batteries that store energy can all be produced anywhere on the globe.

Countries around the world recognize this opportunity and are investing billions of dollars into advancing clean energy production, storage, and distribution technologies in the hopes that their countries will become the global leaders producing the technologies and jobs of the future. Clean energy investment in China totaled \$569 billion in the last five years—comparatively, clean energy investment in the United States totaled \$289 billion over the same time frame, less than half the Chinese investment.<sup>456</sup>

Before the 2016 presidential election, Ernst & Young had rated the United States as the most attractive country in the world for private sector renewable energy investment. Since the Trump Administration has taken over, China has surpassed the United

States and now is ranked as the most attractive destination for renewable investments.<sup>457</sup> Ceding leadership in this space means ceding the jobs of the future to China and other countries.

### **THE CLIMATE CRISIS REQUIRES IMMEDIATE AND BOLD ACTION**

Circumventing the worst impacts of climate change requires substantial investment in clean energy innovation and infrastructure, as well as other actions to reduce carbon and greenhouse gas emissions. The economic costs of not acting justify a very large-scale approach that some have compared to the moon landing. This Congress, more than one hundred Congressional Democrats in the House and Senate introduced a resolution calling for a Green New Deal, outlining bold principles that would help transition to a clean economy.<sup>458</sup>

#### *Supercharging Clean Energy Growth*

In 2018, renewable energy sources were used to produce nearly one-fifth (17 percent) of the electricity generated in the United States. This is almost twice the market share renewables had in 2008 (9 percent).<sup>459</sup> This surge is driven by rapid declines in the price of renewable energy, though the federal government could do more to support the sector. This is particularly important in light of the large-scale investments being made by other countries.<sup>460</sup> Millions of jobs will be created in clean energy production over the coming decades.<sup>461</sup> Ensuring that American workers are filling many of those jobs requires smart policies at the federal level.

Fully pricing in the cost of carbon through a carbon tax would level the playing field and make clean energy even more cost-competitive. Federal research support for clean sources and

complementary technology is also vital to the sector's growth. Further, the federal government could increase its own usage of clean energy wherever possible, creating more demand, and thereby greater economies of scale, for clean energy. Lastly, subsidies for high-carbon emission technologies should be ended by recognizing the high social costs that come with these fuels.

#### *Committing to International Efforts and Goals*

The climate crisis is a global problem and requires international cooperation to address. In 2015, the United States joined with 194 other countries in the Paris Agreement to commit to taking action to mitigate climate change.<sup>462</sup> Specifically, the agreement called for efforts to keep the global increase in average temperatures to below two degrees Celsius, with a long-term target of 1.5 degrees of warming.<sup>463</sup> At these levels, the negative global economic impact would still be significant, but less severe than at higher levels.<sup>464</sup>

As noted earlier, the Trump Administration has abdicated leadership on the agreement and is working to remove the United States from the pact.<sup>465</sup> Instead, the United States should be leading this effort and holding the international community accountable for reaching these targets. We also must do better—after three straight years of declines, U.S. carbon emissions increased by 3.4 percent in 2018.<sup>466</sup>

#### *Investing in Resiliency*

Beyond working to reduce emissions, policymakers need to recognize that the climate crisis is already impacting people, businesses and local economies, and work to mitigate these effects. The United States should build more resilient infrastructure and take steps to ensure that we better understand



and better minimize the risks of living in communities likely to be most affected by climate change. When it responds to major disasters, the federal government should stipulate that the relief funds are used to make regions more resilient to future extreme weather events, as was done during the previous Administration. Updating outdated FEMA flood maps to more accurately reflect flood risk and to account for the anticipated effects of climate change would provide homeowners, construction and insurance companies and urban planners better information.

#### *Equipping Workers with Training for Clean-Energy Jobs*

An issue at the center of any meaningful effort to move to a clean-energy economy is support for those workers in traditional fossil fuels jobs. Regardless of the particular approach, there must be investments in workers to help them transition from jobs in fossil fuels to new careers. The wind, solar and other clean-energy fields could offer new employment options that take advantage of many of the skills these workers already have.

There have been recent efforts in Appalachia and Wyoming, supported by companies and nonprofits, to assist workers with the transition from coal to clean-energy jobs. Some of the skills are transferrable; others require workforce training.<sup>467</sup> Of course, many of the jobs in wind and solar will be hundreds of miles from the coal mines where generations of workers earned substantial wages after graduating from high school. Successful efforts will need to combine diversification of economies in communities where mining jobs are being lost and also assistance to those workers who are able to move to build skills in demand in other regions.

The Obama Administration launched the Partnerships for Opportunity and Workforce and Economic Revitalization

(POWER) initiative in 2015 to give grants to communities seeking to transition workers from legacy fuel industries to new career paths.<sup>468</sup> Building on this model, and learning from how communities have used these grants, could be an opportunity to expand these initiatives.

### CONCLUSION

The climate crisis is one of the most pressing economic threats facing humanity in the 21<sup>st</sup> century. Without significant action, the cost to the United States alone will reach hundreds of billions of dollars annually and the cost to the global economy will be in the trillions. However, the *Economic Report of the President* largely ignores the issue and offers no proposals to address this growing threat.

Ironically, the Administration is trying to undo previous progress on climate change. This not only makes it more difficult to slow the rise in global temperatures but also cedes markets for renewable energy technologies to international competitors. Policymakers should take swift and bold action to lower carbon emissions and integrate clean energy sources. Such progress will be impossible as long as the President continues to put his head in the sand.