

Climate Change and The Inflation Reduction Act: Recommendations for Job Seekers in US Energy

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ABSTRACT

The onset of the global climate crisis has caused many to consider potential impacts on the United States economy, particularly those on the energy sector. Currently dominated by traditional means of production such as coal and fracking, the sector is set to shift towards more sustainable forms such as solar, wind, hydroelectric, and nuclear as stakeholders seek to keep warming below 1.5°C. Accelerating this shift is the recently passed Inflation Reduction Act (IRA), which promises new green incentives, but also leaves questions unanswered regarding the true scale of US divestment from fossil fuels. This paper seeks to combine data regarding projected employment in carbon-intensive/neutral industries with examination of provisions in the IRA, in order to make recommendations for those considering jobs in the US energy sector.

Jobs in Carbon-Intensive Energy

Currently, 61% of American power is produced through carbon-intensive means (Musykens and Eilperin). As the United States attempts to mitigate excess CO₂ emissions and the resultant greenhouse gas effect, public sentiment has shifted away from these forms, though their lobbies have seemingly enshrined their use for years to come. For those entering the workforce, it is vital to not only understand these competing forces, but also whether newfound opportunities can be found by bridging their intersection.

Coal Mining

Coal mining was once a booming industry, employing a peak of 883,000 Americans in 1923 (“Coal mining”). That said, as demand has shifted and temperatures have risen, the industry has taken a major hit. As of October 2022, only 38,000 jobs remained in mining, a 52% decline from the 79,400 a decade prior. Further, the US Bureau of Labor Statistics estimates job growth from 2020-30 to be 5.70% (see Figure 1), falling behind many green jobs and perhaps a function of speculation that “hazards such as heavy precipitation, drought, and heat...will get more frequent and intense, increasing the physical challenges to mining operations” (Delevingne et al.).

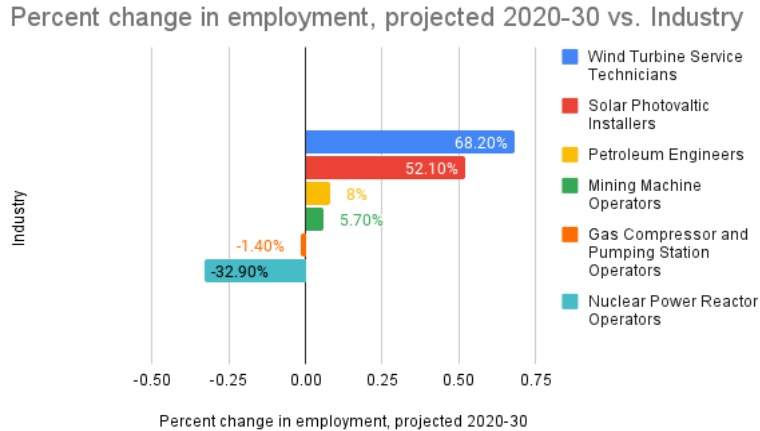


Figure 1. Percent change in employment, projected 2020-2030 by Industry. Source: US Bureau of Labor Statistics

Despite this rapid decline in industry, coal communities have maintained a strong hold on today's lawmakers. Lobbying officials such as Senator Joe Manchin of West Virginia, they have successfully stymied multiple pieces of climate legislation. In the case of the Inflation Reduction Act, the coal lobby's efforts took the form of securing multiple self-benefitting clauses. Including increased value of the 45Q carbon capture tax credit, \$5 billion in funding to help existing coal power plants perform upgrades, and \$4 billion of the 48C clean energy manufacturing tax credit being reserved for use in coal communities, these clauses indicate that coal is here to stay ("Manchin Sets"). These clauses aren't alone. McKinsey reports, "mines theoretically can fully decarbonize through operational efficiency, electrification, and renewable-energy use" (Delevingne et al.). New electric machinery would bolster the image of coal, produce 87% less heat, be quieter, and be cheaper than diesel alternatives as it doesn't require cooling/ventilation mechanisms ("How Electrification").

Recommendation

The IRA's clauses regarding coal signify that current miners have job security for the foreseeable future. That said, with declining projections of future employment, job seekers interested in mining will likely find greater success in selling the electrification of mines. Evidence shows that there's a market for it as well; only .5% of mining equipment is electric globally today, and Figure 2 shows that search interest for "electric mining" has exhibited a positive, increasing trend over the past 5 years.

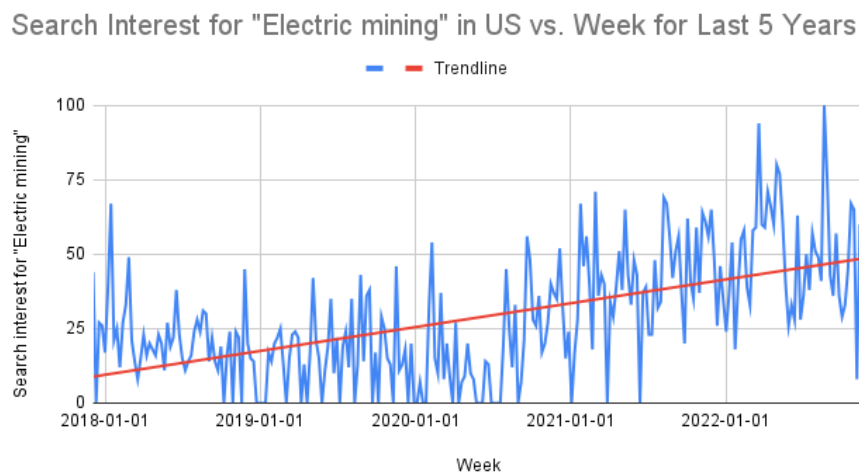


Figure 2. Search Interest for "Electric mining" in US vs. Week for Last 5 Years. Source: Google Trends

Note: Numbers represent search interest relative to the highest point on the chart for the given region and time. A value of 100 is the peak popularity for the term. A value of 50 means that the term is half as popular. A score of 0 means there was not enough data for this term.

Fracking

As compared to the 36,000 Americans employed in coal mining, fracking supports 9.8 million jobs, accounting for 5.6% of total US employment (“How Many”). However, environmental consequences and unsound economics should serve as deterrents to joining this seemingly thriving industry.

Fracking involves drilling into the earth and releasing a high-pressure water, sand, and chemical mixture to loosen fissures and release natural gasses. Such natural gasses are 80% methane, a pollutant which when leaked, poses a substantially greater risk of contributing to global warming than does carbon dioxide.

Problems with fracking don't stop there. Cleanup of gas leaks and methane from well water costs hundreds of thousands of dollars, and companies often avoid such initiatives due to high capital and labor costs. Residents living near fracking sites suffer a variety of health issues. The fracking industry replaces rural and forested areas with roads and systems, which have an effect on local ecological activity. Additionally, the maintenance of these systems cost millions, with Texas and Pennsylvania approving \$40 million and \$265 million respectively, to repair roads and infrastructure in fracking-intense regions (“The Costs”).

The negative externalities associated with fracking didn't go unnoticed by the IRA. The act placed a \$900 tax per ton of methane emitted starting in 2026, and raised the tax to \$1,500 per ton starting in 2028 (“The Sticks”). With an increasing focus on consumer protection in Washington it's unclear where this cost might be compensated for, but it very well could be taken out of an entry-level employee's paycheck.

Along with various environmental consequences, fracking finds fault in its economics. Evidence of this can be seen most clearly in observations gathered from the so-called “fracking boom” that took place in Appalachia from 2008 to 2019. Data from 22 counties across Ohio, Pennsylvania and Virginia, showed that local GDP rose three times faster than that of the nation, but jobs only grew by 1.6% (“Appalachia's Natural 3”). This incongruence between growth in GDP and employment was later understood to be a function of low labor demand; fracking has monumental equipment requisites, but only a few technicians and operators needed to work on-site. The problems with fracking's economics don't stop there. By the end of 2019, the majority of the 22 counties experienced “economic stagnation or outright decline and depopulation” (“Appalachia's Natural 16”). In this way, fracking failed to meet any growth expectations that these rural communities might have had.

Recommendation

The data available indicates that fracking is not a viable industry to enter moving forward, but the task of well-plugging offers an opportunity to divert jobs. There are at least 3.3 million abandoned oil and gas wells nationwide, of which 60% are unplugged (“Bertrand”). These unplugged wells leak methane, and companies are more motivated than ever (by the recent IRA provision) to plug these. While it may require the support of state governments, Resources for the Future estimates that “plugging 500,000 wells could create as many as 120,000 job-years” (Raimi et al. 5).

In contrast to well-plugging, the occupation of a petroleum engineer offers another alternative for those interested in fracking. With 8% job growth expected between 2020-30 (see Figure 1), it stands as the most viable carbon-intensive career over the next 10 years.

Jobs in Carbon-Neutral Energy

Current State of the Industry

In the United States, carbon-neutral power accounts for 38% of the total U.S. energy market (“U.S. Energy Information Administration”). The production of solar, wind, and hydroelectric power supported 517,000 jobs in 2021 and other renewable forms, such as biomass and ethanol, employed 103,000 (“U.S. Energy & Employment Report”). Current wages for carbon-neutral energy industries are also comparable with carbon-intensive competitors. A fossil fuel worker makes a mean hourly wage of \$41, while a solar installer makes \$43, and a wind technician \$39 (Glasser). President Biden has set a goal of the US becoming a zero-carbon electricity grid by 2035. While solar photovoltaic installers and wind turbine service technicians are two of the five fastest growing jobs in the US, Figure 3 shows the immense speed at which the US would have to increase energy production with carbon-neutral forms to reach this goal.

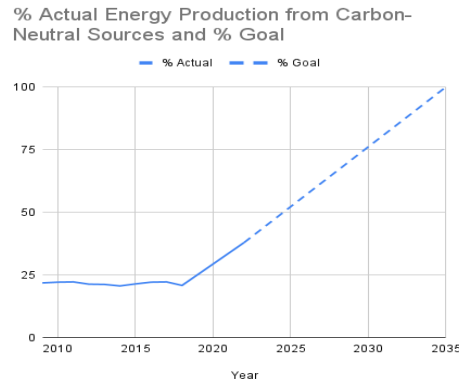


Figure 3. % Actual Energy Production from Carbon-Neutral Sources and % Goal. Source: Renewable Energy Data Book

Regardless of whether this goal is met, US ambition and provisions in the IRA make carbon-neutral industries an exciting prospect for job-seekers in search of the next great American frontier.

Solar

The solar industry is one of the fastest growing in the United States, with market size expected to grow 27.3% in 2022 ("Solar Power"). Solar panels absorb photons, transferring them into usable power (Solar Technologies Office). This process was invented in France in 1839, and brought to the U.S. in 1888. High energy prices of the 1970s led to Congress passing a law dedicated to the research of this field, and a tax credit in 2006 led to the industry’s extraordinary growth (Chu and Tarazano). From 2008-2018, the solar industry experienced an average annual growth rate of 50%. Cheaper production of the technology in foreign nations has led to the movement of some jobs overseas, but the domestic job market has continued to grow with imported panels requiring installation.

Solar photovoltaic panel installers are projected to be the fifth fastest growing job in the next decade, expanding 52.1% (See Figure 1) to 400,000 jobs. However, in order to meet President Biden’s goal of net-zero by 2035, the industry will need to employ a total of 900,000 people by that time. While a lofty goal, the Inflation Reduction Act makes this much more feasible through aggressive incentives. The Act raises the Investment Tax Credit to 30% through 2032. This credit can be further increased to a total of 60% through purchase of domestic hardware (+10%), installing panels in previous fossil fuel communities (+10%), and through selling electricity via community solar to low income individuals (+10%). It’s not just consumers who are set to benefit though. The Act provides tax credits for the manufacture of the solar panel, inverter, and racking components. Further, it incentivizes the paying of fair wages to apprentices, and provides a production tax credit equal to 2.5 cents/kWh for the first 10 years of a project’s life ("What’s in the Inflation").

Recommendation

The immense growth of solar is already evident to American consumers, politicians, and labor statisticians. Through sweeping economic incentives, the Inflation Reduction Act will enable homeowners, business owners, municipalities, and states alike to become far more aggressive in their goal-setting when it comes to installation of this carbon-neutral source. Outlooks appear promising in any part of solar one might wish to enter - whether that be selling, installing, or manufacturing it.

Wind

Enabled by decreases in fixed costs, the use of wind turbines has increased significantly over the past 20 years. Rising from 6 billion kWh of production in 2000 to 338 billion kWh in 2020, wind turbines are now the source of 8.4% of US utility-scale electricity generation (“Wind Explained”).

This increased demand and reliance on wind turbines has created a robust employment market for technicians. Accounting for 6,900 jobs in 2020 (“Wind Turbine”), the occupation of wind-turbine technicians is the fastest growing in the United States, with a 68.2% increase expected between 2020 and 2030 (See Figure 2). This rapid growth is accelerated by two factors. First, the typical entry-level education for a wind turbine technician is a postsecondary nondegree award (See Figure 4), meaning high school graduates who complete vocational training are eligible. Second, the median annual wage for wind turbine technicians in May of 2020 was \$56,230 (“Wind Turbine”), comparable to that of mining machine operators at \$56,920 (“Occupational Employment”).

Occupation	Typical Entry Level Education
Wind Turbine Service Technicians	Postsecondary nondegree award
Solar Photovoltaic Installers	High school diploma or equivalent
Petroleum Engineers	Bachelor's degree
Mining Machine Operators	No formal educational credential
Gas Compressor and Pumping Station Operators	High school diploma or equivalent
Nuclear Power Reactor Operators	High school diploma or equivalent

Figure 4. Typical Entry Level Education by Occupation. Source: US Bureau of Labor Statistics

As with solar, the Inflation Reduction Act contains a number of clauses that will promote the growth of wind. The primary of these clauses is a 30% tax credit for offshore wind projects that begin construction before January 1, 2026. Additional clauses include appropriating \$100 million to convene stakeholders for the purpose of analyzing transmission for offshore wind, as well as a tax credit equal to 10% of the sale price of domestically produced wind turbine components. Unlike solar though, wind is unique in that one of its clauses has incited controversy. According to the IRA, "during the 10-year period following...enactment, DOI's Bureau of Ocean Energy Management (BOEM) may not issue a lease for offshore wind development unless the agency has offered at least 60 million acres for oil and gas leasing on the outer continental shelf (OCS) in the previous year ("Offshore Wind")."

Recommendation

While employment figures regarding wind-turbine technicians are encouraging, further analysis is required due to the aforesaid IRA clause which some have equated to 'one step forward, yet two steps back'. Such analysis can be

done through examination of search trends in the two areas that the clause concerns: offshore wind and offshore drilling. In looking at Figure 4, one can observe that prior to President Biden's signing of the IRA, the search popularity of these terms greatly fluctuated, and intertwined with one another. After Biden's signing though, the terms only briefly met before splitting again, with "offshore wind" being consistently more popular than "offshore drilling". While it is impossible to know exactly who is searching these terms, the trend is encouraging, and indicates that the US has a greater interest in understanding and/or investing in offshore wind. As such, the occupation of turbine technician appears to still be a safe employment bet.

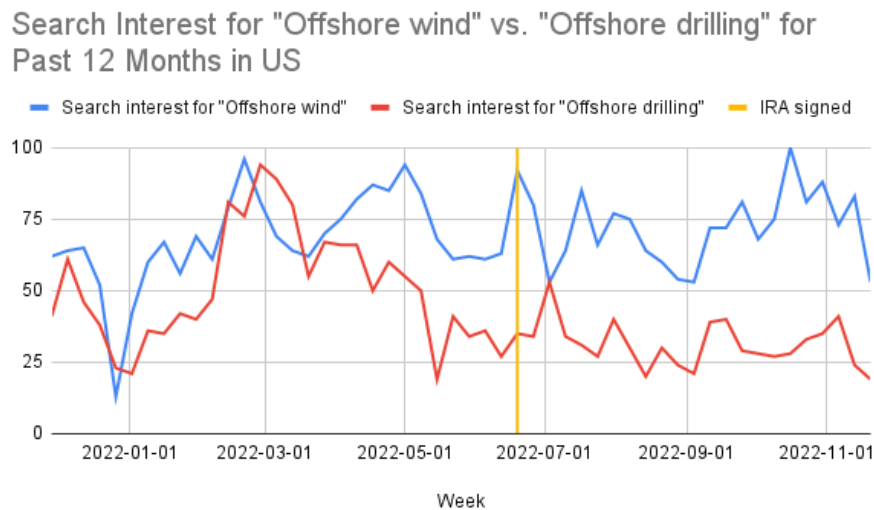


Figure 5. Search Interest for "Offshore wind" vs. "Offshore drilling" for Past 12 Months in US. Source: Google Trends

While the IRA did incentivize domestic manufacturing of wind turbine parts, it is important to note that as compared to the production of solar panels (in which the US has fallen behind the global market), the production of wind turbines is a thriving domestic industry (See Figure 6). As such, entering this part of the wind industry promises stable wages and benefits, but fewer opportunities for expansion in the short term.

Wind Turbine Part	% Produced Domestically
Nacelle	>85%
Towers	75%-90%
Blades and Hubs	50%-70%

Figure 6. % Produced Domestically by Wind Turbine Part. Source: US Geological Survey

Hydropower

Hydropower describes the use of fast-moving water, frequently through a dam, to produce electricity or power a machine. While a highly intuitive form of carbon-neutral energy, its expansion is limited by three factors. First, hydropower already accounts for 37% of all renewable energy generation in 2020 ("Electricity Explained"). With such a large share of the renewables market, stakeholders are looking to ramp up other forms before continuing to grow hydro. Second, hydropower jobs in craft and engineering (accounting for 61% of those currently employed)

requires a high level technical education, which is scarcely available in 4-year universities. Figure 5 also demonstrates that those entering carbon-neutral industries scarcely attend 4-year universities in the first place, with the typical entry level education of solar and nuclear being a high school diploma. Finally, the large majority of eligible US rivers already have hydroelectric dams, meaning there is finite room for expansion.

Even with simulations of aggressive government intervention, hydropower has only been projected to generate 83,000-120,000 new jobs by 2030 (Keyser and Tegen 17).

Provisions in the Inflation Reduction Act reflect hydro's role as an important player in the carbon-neutral market, but one unlikely to see large expansion. The Act creates a new 30% investment tax credit for new pumped hydro power and a production tax credit on par with wind ("What They're").

Recommendation

While the hydro industry is largely stagnant, there is speculation that the new production tax credit will spur development of existing, non-powered dams. Entering the industry at this time might give one a chance to participate in this development, and the occupation itself promises stable benefits like solar, due its developed and well-utilized infrastructure.

Nuclear Energy

Nuclear energy is most frequently produced through the fission of uranium and plutonium. The most dangerous of the discussed carbon-neutral forms, it is set to take a hit. Jobs in power plant operation are expected to decline 32.9% in the next decade (See Figure 1). Despite being a reliable source of baseline power (to supplement wind and solar in a sustainable environment), the nuclear energy sector is plagued by a lack of profitability, a lack of storage systems, and reliance on subsidies. As such, some states have banned new developments, and many investors are hesitant to build new plants. In addition, a large number of facilities are set to shut down by 2050, leaving a gap in American energy production (Scheuh).

It is precisely for these reasons that the Inflation Reduction Act is seeking to buoy the nuclear energy industry, in two primary ways. Firstly, the US is giving taxpayers the option of deciding between a \$25/kWh production tax credit, or a 30% investment tax credit on new zero-carbon plants placed into operation in 2025 or after. Secondly, the IRA is investing \$700 million to support the development of high-assay low-enriched uranium, boosting the profit margins of plants, and hopefully ensuring their reliability for years to come ("Inflation Reduction").

Recommendation

Nuclear energy is not an industry one should seek to enter. With projected declines in employment, fundamental problems in the economics of running a plant, as well as acts of retaliation by states, the industry is set to face a number of problems moving forward. While the IRA does have provisions in regards to nuclear, these are largely designed to keep the industry afloat, as opposed to promoting the expansion seen in solar, wind, and hydro industries.

Conclusion

As the global climate crisis and federal legislation such as the Inflation Reduction Act collide, it is imperative for job seekers to understand these forces, and their implications. To that, to understand these implications not only means examining industries individually (as done above), but also taking a look at a sector as a whole. Figure 7

shows the average search interest of 6 terms over the past 12 months in the US. All 6 terms included the name of an energy industry followed by the word "employees". This was meant to capture both the searches of employers seeking these types of workers, as well as job seekers interested in reading up on their prospective profession. The term "solar employees" was by far the most popular, achieving an average of 31.00, nearly 70% greater than the next closest term, "nuclear employees" (average of 18.27). This data aligns with positive projected employment statistics, as well as a multitude of provisions in the IRA promoting growth over the next 10 years. Looking at the performance of other terms, "nuclear employees" likely did as well as it did due to the volatility of the position as well as people's general interest in the topic. Wind employees were the next highest with an average of 13.15, which makes sense given new offshore wind developments. "Coal employees" and "drilling employees" were relatively close with averages of 11.54 and 11.17 respectively. These scores likely reflect their continued influence as well as short-term job security provided for by the IRA. The least popular term was "hydro employees" with an average of 3.50. This reflects the limited expansion opportunities (and thus low incentive to enter the industry) discussed above.

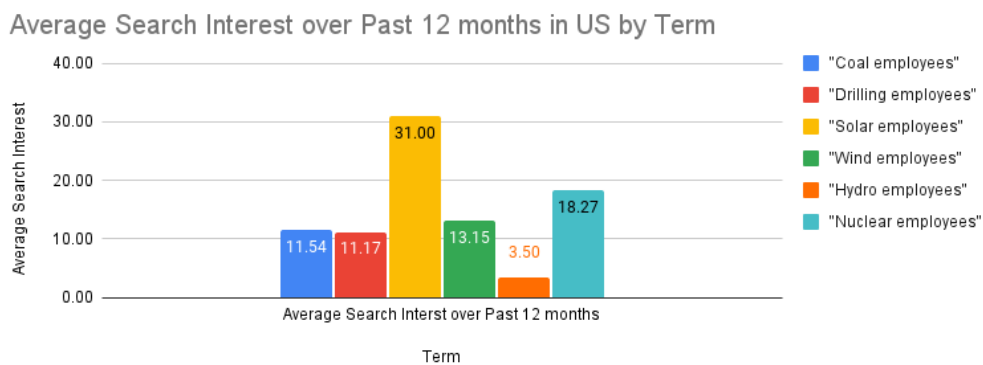


Figure 7. Average Search Interest over Past 12 Months in US by Term

While some statistical and historical data can be used to predict why "coal employees" and "drilling employees" were as popular as they were, answers can also be found by looking at the interconnectedness of carbon-intensive and carbon-neutral energy industries. Figure 8 shows the percent of wind turbine mass by material. Pretty strikingly, every single material that makes up a wind-turbine, is extracted or produced in a way that emits CO₂. Steel, the material making up at least two-thirds of a wind turbine's mass, has been characterized as perhaps one of the most carbon-intensive industries" with "coal as the reducing agent but also as the source of energy ("Can Steel")." Plastic is made from petroleum, extracted by previously mentioned petroleum engineers. Iron, copper, and aluminum are all metals that require mining and refinement, two processes that emit carbon.

Material	% of Wind Turbine Mass
Steel	66%-79%
Fiberglass, resin, or plastic	11%-16%
Iron or cast iron	5%-17%
Copper	1%
Aluminum	0%-2%

Figure 8. % of Wind Turbine Mass by Material. Source: US Geological Survey

By understanding the ways that carbon-intensive and carbon-neutral industries are interconnected one can start to see a new picture. A picture in which the industries this paper discussed are not mutually exclusive, but instead deeply intertwined and reliant on the success of one another. It is perhaps for this reason that the decline of fossil fuels and subsequent increase in sustainable energy has moved at a slower pace than once previously predicted. It is perhaps for this reason that the Inflation Reduction Act was designed simply to lower the cost of energy for Americans, not to promote the exorbitant growth of one industry over another. Finally, it is perhaps for this reason that job seekers in US energy should fully weigh the breadth of their options and the state of current industry, choosing a career path that promises long term growth and the chance at the next American Dream.

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