Don't It Make My Brown Jobs Green?

What Renewable Energy Means for Jobs and Job Quality

by Joseph Marchand

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The employment implications of the energy industry are in transition

- Counts of energy jobs—brown and green—vary widely depending upon sources.
- Natural gas overtook coal as the most produced energy good around 2010, and oil overtook coal just a few years after that.
- While energy production and consumption will remain brown until about 2040, "jobs in renewable energy and energy efficiency generate three times more additional jobs than do jobs in fossil fuels."
- One comparison of green jobs versus all other non-green jobs found a green wage premium of about 4 percent.

In the United States and other nations, a long-term transition is seemingly under way in the consumption and production of energy, moving from nonrenewable energy sources based on fossil fuels and toward renewables. This evolution is primarily driven by the intertwined environmental goals of reducing pollution (from burning fossil fuels) and reducing reliance on nonrenewables (due to their increased scarcity).

This transition has often led to classification of energy sources into two basic flavors, typically denoted by the colors brown and green. Green energy resources include the renewables of bioenergy, geothermal, hydro, solar, and wind. Brown energy resources include the nonrenewable fossil fuels of coal, natural gas, and oil, as well as nuclear power, in that it is also not renewable. In the main, the future of energy appears more "green" than "brown," as the cartoon on the facing page shows.

For those of us interested in the labor and employment aspects of this evolution—and with a nod to the Crystal Gayle song—the question is "Don't it make my brown jobs green?" The common media narrative would suggest that the answer is yes. A push for "green energy" should lead to more green jobs, which would come to replace "brown energy" and brown jobs. Examining that narrative is the main purpose of this article.

Energy jobs can be categorized, in a simple fashion, according to energy sources. Green energy jobs have come to represent employment in the growing area of renewable energy, most often in solar and wind. However, such jobs can more broadly include employment dedicated to increasing energy efficiency.

Brown energy jobs usually represent traditional employment in the consumption and production of nonrenewable fossil fuels, mostly in oil and natural gas. These jobs have as much to do with the extraction of resources as they do with their manufacturing into fuel and use in generating electricity—and can also include the work involved in vehicles using these fuels.

It is interesting before going further to track the use of this terminology. According to Google Trends, online searches for "green energy jobs" peaked in the United States in early 2009 and have steadily declined until very recently, as seen in Figure 1.

This 2009 peak coincides with President Obama's taking office and roughly $500 million being allocated for green jobs as part of the Green Jobs Act of 2007, funded through the American Recovery and Reinvestment Act of 2009. Searches for "renewable energy jobs"

followed a similar trend but surpassed "green energy jobs" in 2013.

In contrast, neither of the terms "brown energy jobs" nor "nonrenewable energy jobs" registered enough data to even form a Google trend. Figure 2 compares the search trends for "oil and gas jobs" and "coal jobs" with those for "solar jobs" and "wind jobs."

While the trends for solar and wind track those shown in Figure 2, the rise of searches for "oil and gas jobs" follows the fracking boom, which peaked in 2014. Searches for "coal jobs" remained rather constant until June 2017, a finding likely related to President Trump's taking office and media coverage of the latest jobs report from the Department of Energy.

Accounting for Brown and Green Jobs

It is possible to set up some rough accounting for brown and green jobs. Luckily, for the past two years, the Department of Energy has released the *United States Energy and Employment Report* (USEER, Department of Energy 2016, 2017), which currently provides the most in-depth comparison of brown and green energy jobs.

These reports make use of two data sources: the Quarterly Census of Employment and Wages from the Bureau of Labor Statistics (BLS), and the Energy Employment Index (EEI) from the company BW Research. This valuable resource might not have been possible without targeted funding to the BLS and the DOE.

Due to differences in survey scope and classification between the two data sources within the first report, and even within the same data source between reports, the counts of energy jobs can vary widely. The numbers that follow come from the appendix tables of the inaugural 2016 USEER report, based on 2015 data and with a comparison of BLS and EEI definitions, and from figures and tables throughout the 2017 USEER report, based on 2016 data. The latter report does not include the data comparison, and the EEI definitions changed somewhat between reporting years.

The total counts of energy jobs range from 3,866,987 for the BLS to 5,729,883 and 7,876,087 jobs for the EEI in the 2016 and 2017 reports, as seen in Table 1.

Across the four categories—generation and fuels; transmission, distribution, and storage; energy efficiency; and motor vehicles—the smallest overall job counts come from transmission, distribution, and storage. The largest differences come from the lack of energy efficiency jobs in the BLS and, because of a definitional change, from motor vehicle jobs in the 2016 EEI being half that of the BLS and then more than double that in 2017.

Under the BLS definition, which is based on the traditional North American Industry Classification System, almost all of the energy jobs would be considered brown jobs. With a very loose interpretation, fewer than 1 percent of jobs could be considered as coming from renewables. This is why the BLS separately devised a standard definition for green jobs, which involves all aspects of green goods and services, including energy efficiency.

The total count of green jobs based on this definition was 3,129,124 in 2010 (Bureau of Labor Statistics 2012) and 3,401,279 in 2011 (Bureau of Labor Statistics 2013). This trend suggests that the brown and green job counts would be roughly even, or might favor green jobs, when projected out to 2015.

The EEI definition can be more easily parsed into green and brown jobs, as seen for generation and fuels in 2016 in Table 2, although these splits are also subject to interpretation. The job mix for power generation was roughly one-third brown and two-thirds green, as seen in the first column.

The job counts by source were led by solar employment, by far, with 373,807 jobs, which grew from 299,953 in 2015. Solar employment accounted for only a paltry 2,023 jobs in the BLS report. However, employment in fuels, led by oil/petroleum, where extraction and manufacturing jobs are found, was 90 percent brown and only 10 percent green. Generation and fuels together are

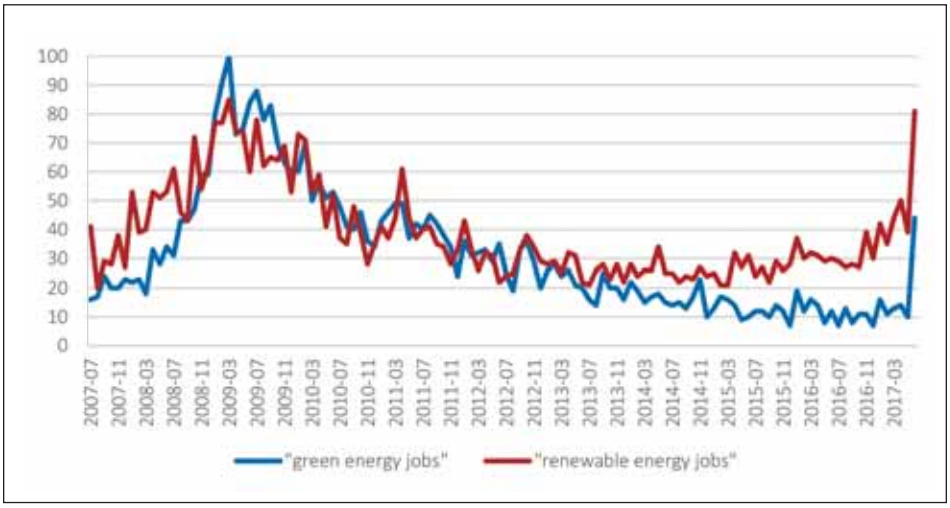
then two-thirds brown and one-third green.

Continuing with the EEI data, only a very small sliver of transmission, distribution, and storage jobs can be defined as green, mostly dealing with storage and grid modernization. Therefore, these million-plus jobs could roughly be considered overwhelmingly brown. Such jobs are mostly related to pipelines and powerlines, and that does not even include an additional one million workers employed at fuel dealers and gasoline stations.

The energy-efficiency jobs of roughly two million in count, on the other hand, are all green by definition, evening things up substantially. That said, this count includes a sizeable number of jobs in traditional HVAC goods, which are debatably green.

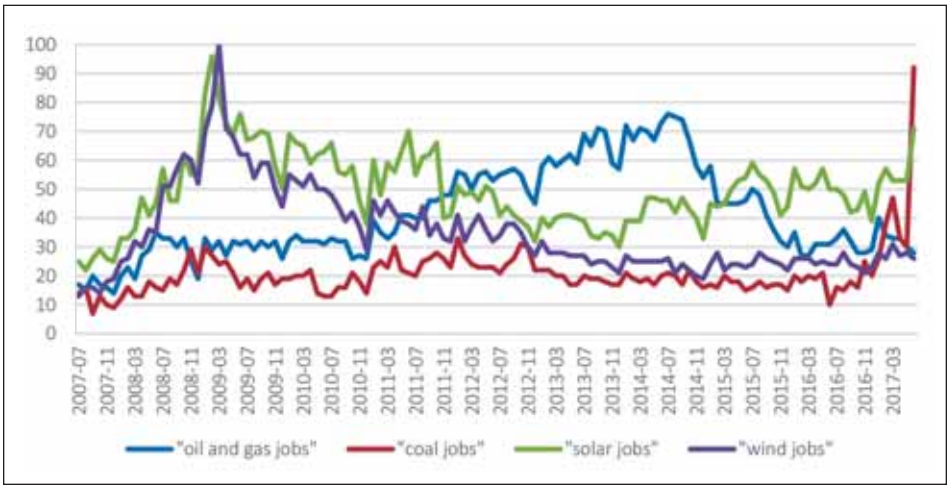
Motor vehicles represent only a very small sliver of green jobs, related to alternative vehicles, and therefore also overwhelmingly favor brown jobs. The issue here is the large discrepancy between the EEI surveys, putting the count between 1.2 to 2.5 million jobs. Depending on the size of this count and some of the other previous accounting, the brown-green job mix is again roughly even, conservatively speaking, but most likely favors brown jobs over green.

Figure 1. Google searches for "green energy jobs" and "renewable energy jobs."



Source: Google Trends (https://trends.google.com/trends/2017).

Figure 2. Google searches for "oil and gas jobs," "coal jobs," "solar jobs," and "wind jobs."



Source: Google Trends (https://trends.google.com/trends/2017).

Tracking the Energy Transition to 2040

It is worthwhile to project how domestic consumption and the production of energy products will change in the future for the United States. Overall, domestic energy consumption (in terms of BTUs) has been rather flat in the United States and is projected to grow by only 5 percent from 2016 to 2040 (Energy Information Administration 2017). Energy production, on the other hand, will increase by more than 20 percent over this time, with the upward swing having begun in the mid-2000s and the United States projected to become a net energy exporter by the mid-2020s.

Oil has historically been and will continue to be the most consumed energy resource in the United States, from now until 2040, but its use will remain constant. Natural gas use, in contrast, is projected to grow steadily over this period, virtually matching the consumption of oil by 2040, although still not overtaking it. The use of coal, which overlapped that of natural gas up to the mid-2000s, has been declining and will continue to decline.

The combination of non-hydro renewables, mostly solar and wind, will finally catch up with and overtake coal by 2040, having first overtaken nuclear by the early 2020s. The energy needs met by the nonrenewables, nuclear, and the renewables of biofuels and hydro have been small compared with the use of other resources. Their use is projected to remain comparatively low in the future.

Natural gas overtook coal as the most-produced energy good around 2010, and oil overtook coal just a few years after that. Non-hydro renewables should overtake nuclear in a few years and match the output of coal by 2040. Otherwise, the current ranking for these energy products remains stable, with natural gas at the very top by far, followed by oil and coal, with hydro at the bottom.

So although an energy shift is seemingly under way from brown to green,

Table 1. Total counts of energy jobs.

	2016 USEER BLS2015 Q2	% of total	2016 USEER EEI 2015 Q2	% of total	2017 USEER EEI 2016 Q1	% of total
Generation and fuels	935,664	0.242	1,605,066	0.280	1,943,616	0.247
Transmission, distribution and storage	767,471	0.198	1,045,916	0.183	1,317,033	0.167
Energy efficiency	—	—	1,880,149	0.328	2,181,510	0.277
Motor vehicles	2,163,852	0.560	1,198,752	0.209	2,433,928	0.309
TOTAL	3,899,987	—	5,729,883	—	7,876,087	—

Source: Department of Energy (2016, 2017).

the future of domestic consumption and production in the United States will continue to be much more brown than green, even by 2040. Sources such as solar and wind will simply replace coal, but the overall transition will be slow going, barring some technological breakthrough or political positioning of green over brown. Of course, a rapid spike or fall in the relative price of one or more resources could lead to large deviations in these projections.

Table 2. Energy job counts by source.

		Generation	%	Fuels	%	Generation and Fuels	%
Brown	Oil/Petroleum	12,840		502,678		515,518	
	Natural gas (combo)	88,242		309,993		398,235	
	Coal	86,035		74,084		160,119	
	Nuclear	68,176		8,595		76,771	
	Other	32,695		82,736		115,431	
Green	Solar	373,807		–		373,807	
	Bioenergy	26,014		104,663		130,677	
	Wind	101,738		–		101,738	
	Hydro (combo)	65,554		–		65,554	
	Geothermal	5,768		–		5,768	
BROWN		287,988	0.335	978,086	0.903	1,266,074	0.651
GREEN		572,881	0.665	104,663	0.097	677,544	0.349
	TOTAL	860,869		1,082,749		1,943,618	

Source: Department of Energy (2016, 2017).

Additional Factors Associated with Energy-Job Mix

The earlier parsing of energy jobs into nonrenewable and renewable sources somewhat favored brown jobs over green, but generous accounting led to these counts being roughly equal at mid-decade in the United States. Further, the projections that followed for U.S. energy consumption and production showed that this mix of brown and green energy jobs will remain roughly the same going into the future, barring a sizeable shock. Assuming those assertions as givens, several additional factors would be worth exploring for any further debate involving the subject of brown and green energy jobs.

Spillovers

An implied transition from green to brown jobs will inevitably result in job creation or destruction within the energy industry. Any potential creation or destruction of energy jobs might also create or destroy jobs outside of the energy industry. The existence of these spillovers could perhaps mean that a brown-green energy transition will lead to a much larger impact on overall employment. The quantification of such effects usually takes the form of job multipliers, which are calculated through local regression techniques or input-output models.

For example, the creation of one energy extraction job has been found to generate an additional one to two other jobs in the local economy (Marchand and Weber 2017). According to the 2017 USEER, about 6 percent of energy jobs were in extraction, all within generation and fuels, making up about one-quarter of jobs in that category. By definition, those are brown jobs, meaning that any spillovers would be more likely to reflect mutual job destruction in a brown-to-green transition.

These types of employment multipliers were found to be slightly larger for manufacturing jobs, at roughly one to five additional jobs created (Moretti 2010). According to the 2017 USEER, a little more than 20 percent of energy jobs are in manufacturing, with more than one-half in motor vehicles, but all other categories are also represented. Given that motor vehicle jobs are overwhelmingly brown, the effects of this manufacturing multiplier would imply that other non-energy employment would disappear in a transition.

So in the presence of large spillovers from energy to non-energy, would brown jobs or green jobs produce more total employment, once multiplier effects were factored in? One recent study provides a direct comparison, finding that jobs in renewable energy and energy efficiency generate three times more additional jobs than do jobs in fossil fuels (Garrett-Peltier 2017).

If that is the case, then the transition from brown to green would lead to more employment overall, not less, as implied by the extraction and manufacturing multipliers. Only with many good spillover estimates can it be concluded whether a brown-green transition will result in a net job gain or loss.

Windmills on the Belgian part of the North Sea are 515 feet tall and 604 feet above the sea bottom.

This Walmart Supercenter in Caguas, Puerto Rico, is one of five Walmarts on the island with solar panels. Walmart has solar panels elsewhere, too, with a goal of becoming 100 percent powered by green energy sources.

Regions

The counts and ratios of brown and green jobs will, of course, vastly differ across the United States, from state to state, and from region to region, as implied by job multipliers' being calculated locally. Thus, focusing on green and brown jobs at the national level may not be completely illuminating. Obviously, brown jobs will be more numerous where fossil fuels are located and extracted, tipping the local job ratio toward brown. The existence or lack of state subsidies for certain energy types might also play a role in these differences—for example, states with green-energy initiatives may favor the creation of green jobs.

Luckily, the 2016 USEER also includes job counts across nine U.S. regions, with collections of states based on proximity. Unsurprisingly, jobs in generation and fuels—as well as in transmission, distribution, and storage—are most heavily concentrated in regions rich in fossil fuels, including states such as Texas and Oklahoma.

The Midwestern region, including Michigan and Ohio, had the most motor vehicle jobs. In contrast, the Pacific and South Atlantic regions, including California and Florida, had the most energy-efficiency jobs. Perhaps surprisingly, a recent academic study found that green jobs are even more locally concentrated than non-green jobs (Vona et al. 2017).

Job quality

Thus far, discussion has focused on quantities of energy jobs alone and not on possible changes in their quality. Given that these jobs are mainly classified by industry rather than by occupation, statements about quality are difficult to make. However, differences in wages and union coverage among job types are two interrelated qualities worth a closer look.

Are green jobs mostly low-paying installation jobs, putting solar panels on houses and businesses, or are they installing wind turbines, requiring more skill and yielding a higher wage? One comparison of green jobs versus all other non-green jobs found a green wage premium of about 4 percent (Vona et al. 2017).

More generally, are brown jobs more likely to reflect the wages of a coal miner or petroleum engineer? If manufacturing jobs are considered good middle-wage jobs, can we say that the manufacturing of brown or green products is actually being done in the United States at all at this point?

Union coverage can also signal job quality. Based on the 2017 USEER, only 12 percent of energy jobs were unionized in 2016, with union jobs being pretty evenly split among transmission, distribution, and storage; energy efficiency; and motor vehicles, at roughly 30 percent apiece, with less than 10 percent union representation in generation and fuels.

That said, energy efficiency had the highest percentage of unionized workers, at just over 32 percent, as well as the highest count of unionized workers (over 311,000), seemingly putting green jobs ahead in terms of favorability toward unions.

Job transitions

A final consideration is whether the same types of workers are employed in brown and green jobs and what that would mean under a transition from brown to green jobs. Even if all of the currently brown jobs turned green, leaving overall energy employment the same, workers who lost their jobs might not be the same as the workers who gained

new ones. How much retraining would workers require to switch from brown to green or from green to brown?

In one example, unemployed coal miners were targeted to become wind farm technicians in Wyoming (Cardwell 2017). These workers were seen as having the skills necessary to make the transition: electrical and mechanical skills, as well as experience working under difficult conditions.

Another study identified "green skills" as being highly analytical and technical, indicating that these skills would be needed for brown workers to make the transition (Vona et al. 2015). Of course, the substitutability and complementarity between labor and capital within brown and green jobs would also matter.

Conclusion

In closing, let me repeat the question suggested by the title of this piece: will all energy jobs be turned from brown to green? The current counts and forecasts of these jobs would suggest that the answer is no, or at least not right now. How, then, should we think about energy and energy workers both now and in the future?

Beyond terminology, accounting, and forecasting, critical points to add to the conversation include brown-green differences in employment spillovers, regional concentrations, quality of jobs, and employment transitions. Any debate on this subject going forward should explore each of these areas in as much depth as possible.

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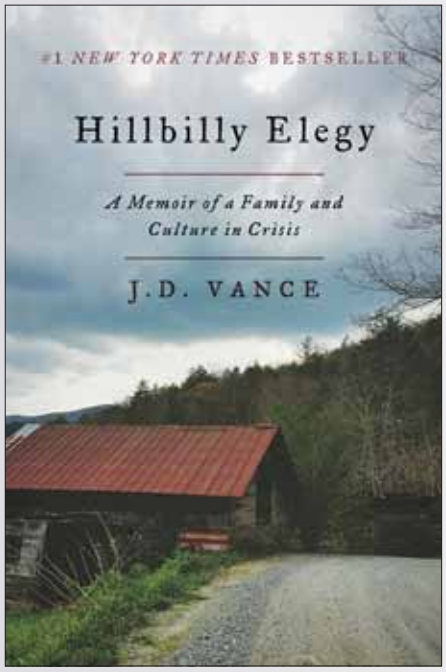

Hillbilly Elegy

A Memoir of a Family and Culture in Crisis

J.D. Vance (HarperCollins, 2016)

From the publisher's description . . .

From a former marine and Yale Law School graduate, *Hillbilly Elegy* is a passionate and personal analysis of a culture in crisis—that of white working-class Americans. The decline of this group has been reported on with growing frequency and alarm but has never before been written about as searingly from the inside. J. D. Vance tells the true story of what a social, regional, and class decline feels like when you were born with it hung around your neck.

The Vance family story begins hopefully in postwar America. J. D.'s grandparents were "dirt poor and in love," and moved north from Kentucky's Appalachia region to Ohio in the hopes of escaping the dreadful poverty around them. They raised a middle-class family, and eventually their grandchild (the author) would graduate from Yale Law School, a conventional marker of their success in achieving generational upward mobility.

But as the family saga plays out, we learn that this is only the short, superficial version. Vance's grandparents, aunt, uncle, sister, and, most of all, his mother, struggled profoundly with the demands of their new middle-class life and were never able to fully escape the legacy of abuse, alcoholism, poverty, and trauma so characteristic of their part of America. Vance piercingly shows how he himself still carries around the demons of their chaotic family history.

A deeply moving memoir with its share of humor and vividly colorful figures, *Hillbilly Elegy* is the story of how upward mobility really feels. And it is an urgent and troubling meditation on the loss of the American dream for a large segment of this country.