Could Trade Treaties Trump Green Jobs?

Upper and Lower Bounds on Clean-Energy Employment Under Varying Trade Policies

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ABSTRACT

A common argument for renewable energy is that it leads to job creation in the country or region where it is located. Yet this clean-energy boost to local employment could be at risk under WTO rulings that prohibit favoritism for local producers. Using the IMPLAN model, we explore the potential effects of trade policy on green jobs by re-analyzing two "deep decarbonization" studies for the U.S. economy under three assumptions about imports. Averaging results for the two studies, switching from business as usual to a clean energy/deep decarbonization scenario creates:

a) A loss of about 100,000 jobs per year, from now through 2050, at the lower bound, if all tradable inputs to the energy sector were imported.

b) A gain of about 1.0 million jobs per year if current import levels are continued through 2050.

c) A gain of about 1.5 million jobs per year, at the upper bound, if all tradable inputs to the energy sector were produced domestically.

Neither the lower bound nor the upper bound is a realistic option, but together they describe the outer limits of possibility, with results ranging from a moderate loss to a much larger gain in U.S. employment. The most important policy implication is that maintaining something like current import levels, as the transition to clean energy hopefully proceeds, will create about a million jobs per year, strengthening the political support for reducing carbon emissions.

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Introduction

A common argument for renewable energy is that it leads to job creation, particularly in construction and manufacturing, in the country or region where it is located. This employment effect can strengthen the political backing for clean energy, by winning support from people who are less engaged in the purely environmental reasons for emission reduction. "Buy local" policies for renewable energy help to align costs and benefits of climate policies, providing new jobs in the same jurisdictions that are losing old jobs.

Many countries have seen the local economic benefits of renewable energy as a policy goal. The stimulus package adopted in the United States after the 2008 recession promoted (among other things) local investment in renewable energy, creating tens of thousands of construction jobs, and thousands of operations and maintenance jobs in the post-construction phase (Mundaca & Luth Richter, 2015). Renewable energy auctions in Brazil, China and India have frequently included local content requirements, or other mechanisms to promote domestic manufacturing (Azuela et al., 2014). Even Russia, far from a leader in clean energy, has adopted local content requirements for renewable energy development (Smeets, 2017).

WTO vs. Clean Energy?

The local employment benefits of clean energy could be at risk under World Trade Organization (WTO) and other trade agreements, which largely prohibit favoritism for domestic producers. Strict enforcement of those rules could lead to importing many of the tradable components of renewable energy facilities, reducing local employment benefits and potentially weakening political support for climate mitigation (Meyer, 2015).

This risk is highlighted by recent WTO cases attacking renewable energy incentives that favor local producers. In the Canada-Renewable Energy/Feed-In Tariff case, the WTO upheld complaints from the EU and Japan, ruling that Ontario's incentives for renewable energy unfairly discriminated in favor of suppliers with a specified level of local content (Charnovitz & Fischer, 2014). In US – Countervailing Measures (China), the WTO made an ambiguous ruling, which leaves room for the U.S. to continue to apply countervailing duties in response to claims of unfair Chinese subsidies to domestic clean energy suppliers (Brewster, Brunel, & Madya, 2016). In early 2016, the WTO upheld a U.S. challenge to India's renewable energy program that required domestically produced solar cells and solar modules (Office of the United States Trade Representative, 2016). India responded with challenges to several US state-level renewables policies that subsidize or require domestic content, a case that is still pending (Miles, 2016).

Although the programs named in India's WTO case are relatively small, there is no reason to think that the case against them represents the last such challenge. How much could be at risk, for clean energy policies and employment in the US?

In this study, we analyze the potential impacts of trade policy on job creation from renewable energy scenarios in the United States. We project the employment that would be created under clean energy scenarios from two recent, widely discussed studies, applying varying assumptions about import levels. (This is similar in spirit to Pollin et al. 2015, who calculated changes in clean-energy employment in five other countries under moderate expansion of imports. We are not aware of other studies that have performed similar calculations for the United States).

Several other trade-related mechanisms could affect jobs from clean energy, but are beyond the scope of this paper. If other countries provide bigger subsidies or protection to renewable energy industries, then stricter enforcement of WTO rules could improve the competitive position of the United States. We make no attempt to evaluate other countries' policies, implicitly assuming they are not more protective of clean energy industries than U.S. policies. Another causal pathway, which we have not pursued, is that large enough changes in trade could affect exchange rates, partially or wholly offsetting the expected direct effects of WTO rulings.

Finally, more protective policies could raise the price of renewable energy in the United States and thereby decrease demand and employment. This is suggested by industry-sponsored commentary on the pending petition from Suniva for tariffs on imported solar cells and modules (Cory, 2017). In fact, protectionist U.S. policies on solar energy have been adopted over the opposition of a majority of the domestic solar industry (Hughes & Meckling, 2017).

To simplify calculation, we assume that demand for clean energy in each scenario is exogenous and independent of trade policy. More specifically, we calculate the number of jobs created by the switch from each study's business as usual scenario to its low-emission, clean energy scenario, under three different assumptions about imports: a lower bound on domestic production and job creation (all tradable inputs to the energy sector are imported); current import levels; and an upper bound on domestic production and jobs (all tradable inputs to the energy sector are produced in the U.S.)

We do not suggest that either of the extremes is a realistic option; rather, they are outer bounds that bracket the range of possible impacts of trade policy. At one extreme, we assume that all tradable goods used in the energy sector are produced in the U.S.; at the other extreme, we assume that all are imported. Logically, the real-world outcome of policy changes must lie somewhere between these limits.

Preview of Findings

Our principal findings (averaging results for the two studies) are:

1. Net job creation from clean energy would be slightly negative (about 0.1 million jobs lost per year) at the lower bound, if all tradable inputs were imported.
2. At current import levels, clean energy creates an annual average of almost 1 million jobs.
3. At the upper bound for domestic production (no imports of tradable inputs), net job creation from clean energy is about 1.5 million jobs per year.

These findings suggest that clean energy creates almost as many intrinsically local, non-tradable jobs (e.g., installing solar panels), as conventional energy; hence there is only a small job loss from switching to renewables at the lower bound, where all but the non-tradable energy jobs have left the country. In contrast, clean energy outdoes conventional energy in creation of jobs in tradable activities (e.g. making solar panels); hence more jobs are created by switching to clean energy when more of the manufacturing occurs in the United States.

As the proportion of domestic production increases, so does the employment gain from clean energy, rising from an (unrealistically extreme) lower bound of a modest net loss to an (equally unrealistic) upper bound of close to one percent of the U.S. labor force. On the strength of our results, the current U.S. trade position is about two-thirds of the way from the lower to the upper bound on net employment gains from clean energy.

Alternatively, these numbers can be read as measuring the available policy space for job creation. If the U.S. were to lose all policies and comparative advantages that support the current level of domestic production in renewable energy, up to about a million jobs per year could be lost. If the U.S. could somehow ensure that all production was domestic, about half a million additional jobs per year could be created.

Data and Methods

We use two widely discussed clean energy scenarios from the recent literature, both aiming for 80 percent reduction in GHG emissions below 1990 levels by 2050:

- The White House Council on Economic Quality (2016) report, "United States Mid-Century Strategy for Deep Decarbonization"(United States White House, 2016).
- The 2015 report, "Pathways to Deep Decarbonization"(Williams et al., 2015), created by Energy and Environmental Economics for the international Deep Decarbonization Pathways Project.

We refer to them hereafter as the CEQ and DDPP studies, respectively.

Both reports include multiple scenarios offering varying pathways to emission reduction. Within those reports, we focus on the scenarios that rely most heavily on wind and solar power, and energy efficiency. In both studies, clean energy scenarios are contrasted with the same study's business-as-usual or no-new-policy reference cases. Our calculations are based on each study's "scenario deltas", the differences between the study's clean energy and reference case.

CEQ

In 2016 the CEQ produced its "U.S. Mid-Century Strategy for Deep Decarbonization", based on consultation with numerous climate economists (including one of the authors of this article). It explores three main categories of actions to reduce emissions, of which the transition to a low-carbon energy system is by far the largest (the others are increased sequestration of carbon and reduction of non-CO_2 greenhouse gases). The analysis of low-carbon energy system options relies on modeling with the Global Change Assessment Model (GCAM) done by Pacific Northwest National Laboratories (PNNL).[1] The CEQ report created several scenarios that would achieve 80 percent reduction in GHG emissions by 2050, based on a wide range of existing and emerging technologies, and briefly explored scenarios for even greater reduction.

We used the low-carbon energy system portion of CEQ's "No CCUS" scenario, a scenario that achieves 80 percent reduction by 2050 without assuming the availability of carbon capture and storage (CCS) technologies. That scenario eliminates coal and sharply reduces natural gas use, through rapid expansion of energy efficiency, wind and solar power, but also of nuclear power. By 2050, total demand for electricity is 30 percent below the GCAM business as usual projection.[2] Nuclear capacity additions, from now through 2050, are assumed to occur at roughly the pace of the 1970s, a peak period in the first wave of nuclear plant construction.[3] By 2050, CEQ projects an electric system in which 38 percent of energy comes from wind, 26 percent from other renewables (mainly solar power), 26 percent from nuclear power (much more than in the reference case), and 8 percent from gas.

DDPP

The U.S. Deep Decarbonization Pathways Project (DDPP) study[4], prepared as part of an international initiative to map out routes to 80 percent decarbonization by 2050, describes three decarbonization scenarios in addition to its reference case: high use of renewables, high investment in nuclear power, and high use of CCS. It also offers a "mixed" scenario, averaging these three approaches; perhaps the most widely quoted results are from the mixed scenario. We focused on the high renewables scenario, as the one that relies most on clean energy as commonly understood, and least on CCS or unproven "advanced nuclear" plants. Results are reported only for selected years; we applied linear interpolation between reporting years.

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1 Thanks to PNNL for making available its detailed modeling results.

2 The GCAM business as usual scenario was adopted by PNNL for modeling purposes, and is not necessarily completely compatible with CEQ policy scenario assumptions (personal communication from Noah Kaufman). CEQ's "Benchmark" scenario is another route to 80 percent reduction, not a business-as-usual scenario. See also the on-line supplementary information on CEQ data and methods, at http://unfccc.int/files/focus/long-term_strategies/application/pdf/us_mcs_documentation_and_output.pdf.

3 CEQ Report, pp. 33, 48.

4 Thanks to Energy and Environmental Economics for making available the background data on costs and investments used in this study.

The DDPP high renewables scenario leads to an electric system in which, as of 2050, 62 percent of generation comes from wind, 20 percent from other renewables, almost 10 percent from nuclear power (much less than at present), and small amounts from gas and other sources. It assumes substantial use of synthetic natural gas, generated with excess electricity, to replace other fossil fuels used in industry, and to replace diesel fuel in heavy-duty transportation vehicles (primarily trucks and buses).[5] Investments in energy efficiency, renewables, fuel-switching, and related infrastructure would reach 2.5 percent of GDP by 2050.

IMPLAN

For job calculations, we used IMPLAN, the leading input-output model of employment and other economic impacts. Since IMPLAN is completely linear, its estimates of job creation per million dollars (or any other unit) of expenditure can be combined in appropriate proportions to create cumulative or average job impacts for each scenario. Note that IMPLAN calculates only jobs created in the U.S.[6]

There are two challenges in the use of IMPLAN for our purposes. First, most energy technologies (including all newer ones) do not appear explicitly in the IMPLAN database; it is necessary to create them, as combinations of IMPLAN's standard industries. We relied on prior work done at Synapse Energy Economics to represent renewable energy activities as weighted averages of standard IMPLAN categories.[7]

Second, our import scenarios depend on, but also modify, IMPLAN's assumptions about import penetration by industry. For actual import levels, we rely on IMLAN defaults (based on Commerce Department and other government data sources), with two important corrections, updating fossil fuel import rates for direct end-user purchases.[8] To create the upper and lower bound cases described above, we defined tradable commodities (following Pollin et al. 2015) as those goods and services that are currently less than 90 percent domestically produced.[9] For these tradable commodities, we set IMPLAN's regional purchase coefficient (RPC), or percent purchased from U.S. suppliers, to 100 percent, the IMPLAN defaults, and zero, respectively, to implement our three import assumptions. (If additional commodities, currently at least 90 percent domestically produced, become more widely traded in the future, then the impacts of trade scenarios could be even greater than implied by our results. We did not explore this question).

As is standard in input-output modeling, IMPLAN calculates three categories of impacts, and of job creation:

- Direct jobs are those created in the energy industry itself.
- Indirect jobs are created in industries that supply non-labor inputs to the energy industry.
- Induced jobs are created by consumer spending throughout the economy, resulting from the increases in direct and indirect employment. We have expanded the category of induced jobs to also include those created when consumers spend their additional disposable income from energy efficiency savings.

All of our results are reported as the sum of direct, indirect and induced employment impacts. Note that our varying import assumptions were applied when used directly for activities modeled as part of emission reduction scenarios. Specifically, we applied these changes to all goods purchased by electricity

5 The DDPP study provides only partial information on the separation between natural gas and synthetic natural gas. Where necessary, we inferred the distinction from the available data.

6 IMPLAN can also calculate job impacts by state or other subdivisions of the U.S.; we used only the national totals.

7 Thanks to Synapse Energy Economics for permission to use these results.

8 IMPLAN assumes an implausibly high rate (49 percent) of imports of natural gas. We used the 2016 actual rate of net imports of natural gas of 2.5 percent of domestic consumption, based on EIA data: (US Energy Information Agency, 2017b). For petroleum, IMPLAN assumes 19 percent net imports; we used the actual rate, again from EIA, of 25 percent imports in 2016: (US Energy Information Agency, 2017a).

9 We treated both natural gas and petroleum as "non-tradable" commodities, meaning that their import percentages do not change. Trade in petroleum is large enough to influence the overall results – and seemed unlikely to be affected by WTO rules changes.

producers, as well as direct fuel and equipment (electric cars, high efficiency lightbulbs, etc.) purchases by consumers. The import assumptions affect the direct and indirect employment impacts of energy scenarios (and therefore the extent of induced effects created by direct and indirect employment).

Economic assumptions

A number of additional assumptions were required to convert the CEQ and DDPP data into IMPLAN inputs. While DDPP data were generally available in dollars, most CEQ data were available only in energy terms, and required conversion into dollars for IMPLAN analysis. Wherever possible, we relied on the U.S. Energy Information Administration (EIA) data, particularly the 2017 Annual Energy Outlook (AEO). We used AEO 2017 for electricity costs by source, and for projected fuel prices (averaged from 2015 to 2050). Other sources were required for the costs of cars (Healey, 2015) and trucks (Cannon, 2016), and for the costs of energy efficiency (Ackerman, Knight, & Biewald, 2016).

We took power plant lifetime data from a National Renewable Energy Laboratory study (Tidball, Bluestein, Rodriguez, & Knoke, 2010). We then distributed plant construction costs, calculated from AEO, over that number of years. The resulting annual construction cost, added to AEO operations and maintenance costs, produced an annual version of full lifetime costs by plant type. Additional details are available on request.

The amount of energy efficiency included is explicit in DDPP, but not in CEQ's modeling. Instead, CEQ assumes an aggressive pathway for efficiency that slows the increase in electric load, without modeling the costs of efficiency measures. We added energy efficiency to the CEQ scenario, sufficient to match the projected reduction in load below the reference case. (Jobs from this inferred energy efficiency expenditure are a large fraction of the jobs created in the CEQ scenario).

Why exclude trade in petroleum?

Although it would meet our formal criterion for a tradable input into energy systems, we have excluded any potential changes in petroleum imports for direct end-user purchases from our calculations.[10] That is, current petroleum import levels are assumed in all calculations. Natural gas, with our correction to the level of imports, does not meet the criterion for a tradable good, so that current import levels for gas are also assumed in all calculations. The quantities and dollar amounts involved in fossil fuel imports are large enough to overshadow other trends – and the international trade treaties and interests involved are different from those affecting clean energy industries and other energy sector inputs.

Indeed, there is an emerging literature on the reasons why WTO cases challenge renewable energy subsidies and protectionist measures, but not the corresponding policies for fossil fuels. Meyer (2017) suggests that major fossil fuel exporters often lack significant other exports, which could be restricted to penalize them for non-compliance – and that challenges are more likely to new policies supporting renewables than to longstanding support for fossil fuels. Amelash (2015) points out that renewable policies are more likely to have domestic content requirements, which are easier to attack, and that the power of the affected interest groups is quite different in fossil fuel cases. Similarly, Lewis (2014) reviews numerous anti-dumping and countervailing duty cases against renewable energy, as well as local content requirement cases, and emphasizes the novelty of, and widespread use of, policy supports for renewable energy. For all these reasons, she concludes, there is a need to reconcile WTO policies with domestic policies supporting renewables.

For all these reasons, exclusion of potential changes in petroleum import levels seems appropriate for the focus of our analysis on the interaction of trade and clean energy systems.

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10 Due to technical modeling constraints, indirect petroleum use in other sectors is allowed to vary with trade assumptions, but direct purchase of petroleum and petroleum products, mainly gasoline, is held at current import levels. Most petroleum use in the energy sector is direct consumption for motor fuel.

Results

Job impacts by technology

As mentioned above, our scenario analyses are linear combinations of impacts by technology. Figure 1 summarizes jobs per million dollars of spending, by technology, under our three import assumptions. The data shown here are lifecycle impacts, including construction costs and operations and maintenance costs (including fuel) over the expected lifetime of a facility. Some activities (e.g. coal-fired power plants) create almost the same number of jobs under all import assumptions, implying that they involve almost no tradable inputs. Others (e.g. hydroelectric and wind power) show substantial differences across the three trade scenarios, implying that tradable inputs are an important part of costs.

Figure 2 presents jobs per TWh of electricity, in the same format. The most striking differences between the two, for energy efficiency and bioenergy, imply that the former is cheap while the latter is expensive. (The ratio of Figure 2 to Figure 1 would be expressed in dollars per units of energy – and would be small for efficiency and large for bioenergy).

The data contained in Figures 1 and 2 do not represent our final conclusions; these are the elements that are combined in different proportions to represent the impacts of the scenarios we examined. Note, however, that for all resource types, domestic job creation under current import levels (the middle, orange bar) is at least 75 percent of the upper bound (the grey, bottom bar).

Figure 1. Job years per million dollars of expenditure, by resource and trade scenario

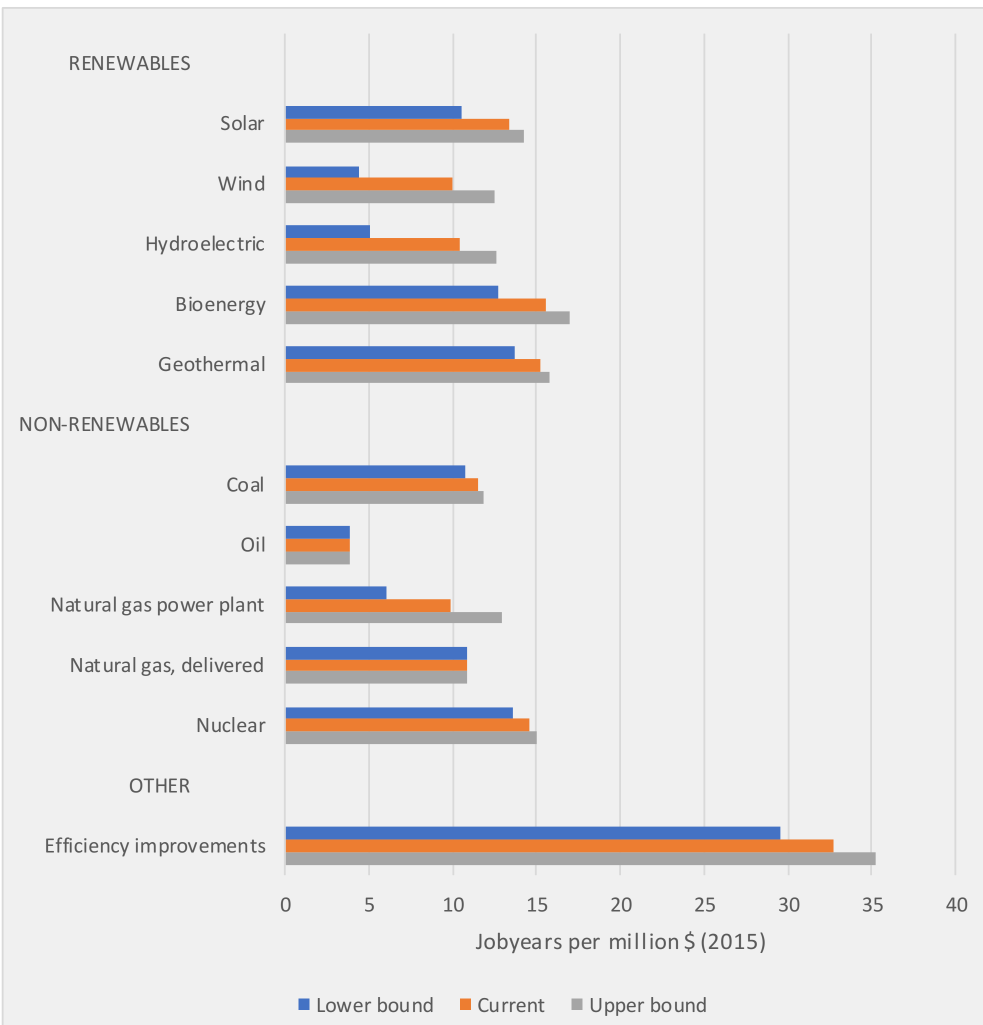
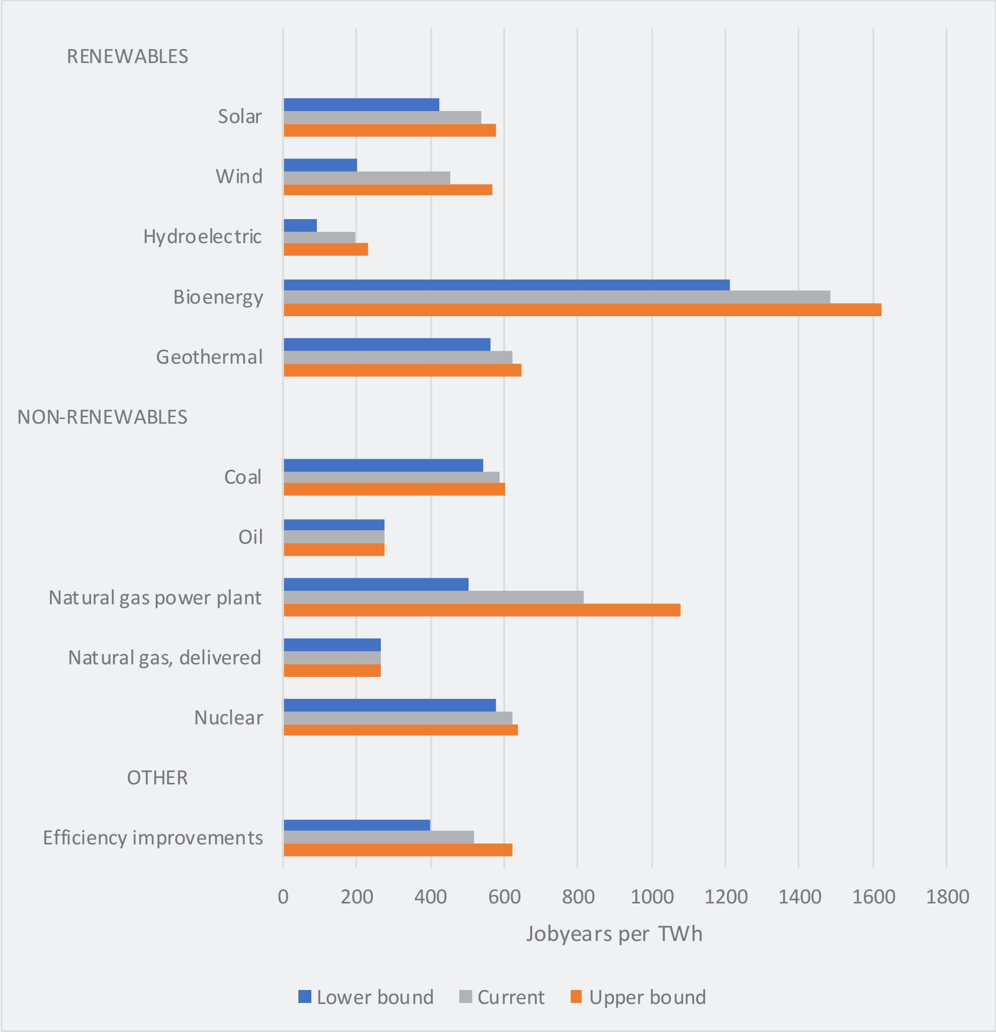


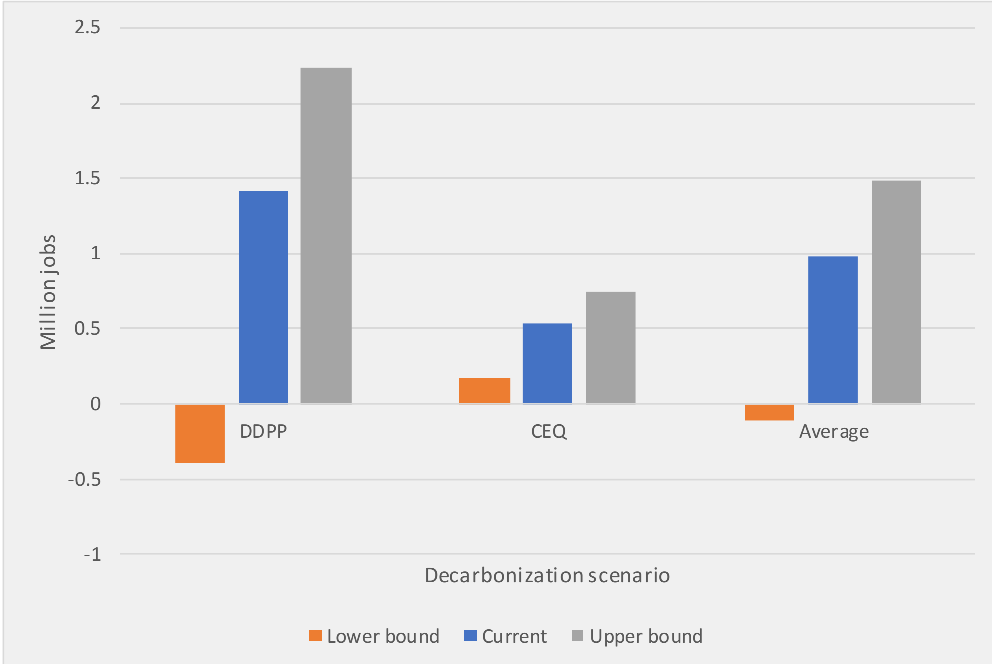
Figure 2. Job years per TWh, by resource and trade scenario



Jobs by scenario

Our analysis of net job creation under varying trade assumptions is summarized in Figure 3. As the figure demonstrates, lower bound (maximum import) net job creation is negative for the DDPP study, and slightly positive for CEQ; the average of the two is slightly negative. DDPP's scenarios are more responsive to trade assumptions than CEQ's, but the general pattern is parallel in both cases.

Figure 3. Net jobs from clean energy, by study and trade assumptions



The data displayed in Figure 3 are presented in Table 1. These are average numbers of jobs throughout the study period, from now through 2050, not job years. The greater sensitivity of the DDPP decarbonization scenario to trade assumptions may reflect its more detailed analysis of costs of energy efficiency and fuel-switching options, including electric vehicle production (where the lower bound entails no jobs in the U.S., while current conditions imply continuation of today's percentage of domestic auto production, and the upper bound involves a much-expanded domestic auto industry).

Table 1. Average annual jobs from clean energy, by study and trade assumptions

	Lower bound	Current	Upper bound
DDPP	(393,000)	1,419,000	2,231,000
CEQ	169,000	537,000	742,000
Average	(112,000)	978,000	1,486,000

For DDPP, our results can be compared to an estimate from ICF, a consulting firm, which was circulated with the DDPP report release (ICF International, 2015). ICF estimated employment with a different model, REMI, which includes some general equilibrium effects that are omitted from IMPLAN. Very little detail supporting the ICF results has been published. To approximate their overall job creation figure, we applied linear interpolation from zero in 2015 to their estimate of jobs in 2030, and again between theirs estimates in 2030 and 2050. Under this assumption, ICF's average annual net job creation from the same DDPP scenario is 1,122,000, compared to our 1,419,000. The difference could be explained by a nonlinear growth of employment, or by general equilibrium effects in ICF's REMI modeling that are absent in IMPLAN. We are not aware of any other employment estimates for the CEQ scenarios.

Where do the jobs come from?

The distribution of job gains and losses by major resource type is shown for DDPP in Figure 4, and for CEQ in Figure 5.

Figure 4. Job gains and losses, DDPP scenario

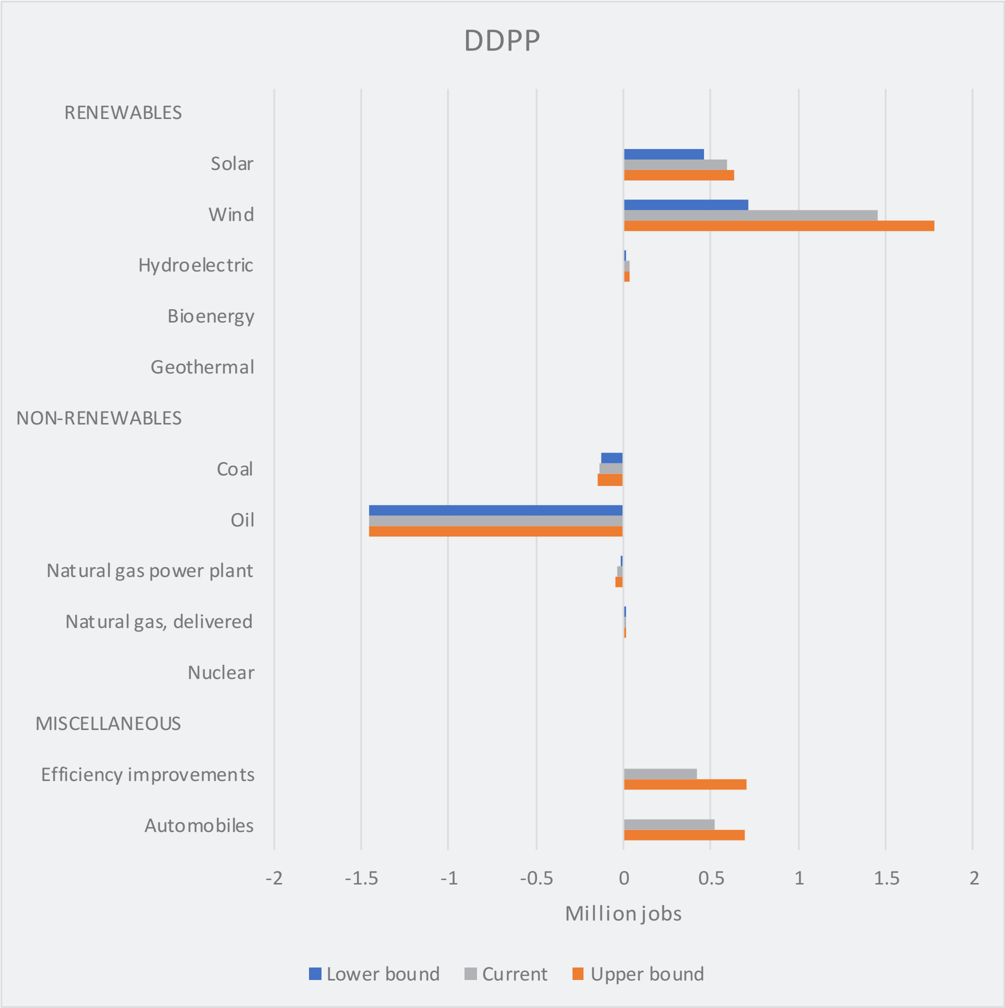
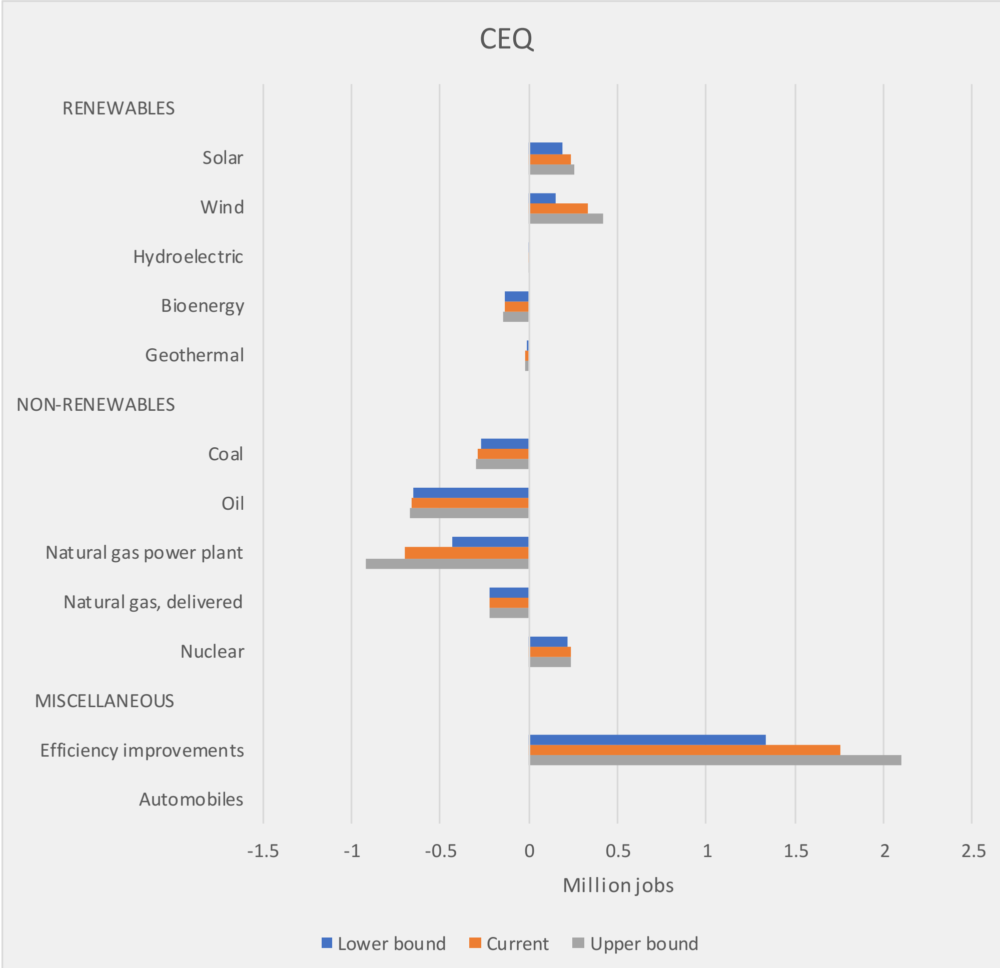


Figure 5. Job gains and losses, CEQ scenario



For DDPP, job creation results from the expansion of wind and solar power, and secondarily from the adoption of energy efficiency measures and from electrification of the automobile industry. The principal offsetting job losses are in the oil industry, due to the transformation of the auto industry.

For CEQ, job creation results above all from the (inferred) energy efficiency investments included in the scenario we modeled. There are losses throughout fossil fuel industries, and modest job gains in wind, solar, and nuclear power.

But are they "good jobs"?

Some critics of "green jobs" arguments have questioned whether the jobs created by clean energy scenarios are as good as the jobs being eliminated in conventional energy. Market trends are already causing declines in jobs related to coal mining, transport, and coal plant operation, which are outweighed by gains related to natural gas and renewable energy (Haerer & Pratson, 2015). Even if the switch to clean energy causes a net increase in employment, is it replacing well-paid jobs in coal mining, oil refining, and power plant operation, with low-paid jobs installing insulation and solar panels?

The well-paid jobs that are at risk from a transition to clean energy, epitomized by coal miners, are not distinguished by anything about the technology or the nature of the industry. Rather, they are among the surviving successes of unions from the high tide of the labor movement after World War II. As union strength has ebbed in recent decades, blue-collar jobs in new industries are unlikely to match these wages.

The average annual income in coal mining, as of 2015, was $83,611, according to the mining industry (National Mining Association, 2016). This is above the 90th percentile annual income for all construction and extraction occupations, of $80,820, let alone the 90th percentile for production (manufacturing) jobs, of $60,300, according to the Bureau of Labor Statistics (Bureau of Labor Statistics, 2016).

Even today, 22 percent of coal miners are unionized, far lower than in the past but far above the modern average for private sector employees (Energy Information Agency, 2017). The decline of unions has had a measurable effect on the wages paid to non-union workers (Rosenfeld, Denice, & Laird, 2016). A new wave of unionization would be required to achieve coal-miner wage levels for newly expanding industries.

Jobs created by clean energy scenarios are concentrated in construction and manufacturing, and within manufacturing, in electrical equipment, machinery, and metals. These are among the sectors in which the labor movement has historically found it easiest to organize (although unionization is currently low in renewable energy industries). Clean energy-driven job growth will not automatically bring old-fashioned union wages back to these sectors, but it gives the labor movement a chance to fight again on its preferred terrain from last time.

Discussion and Conclusions

We began with a question about how WTO trade rulings might affect the "green jobs" arguments that are often advanced in favor of clean energy scenarios. To answer that question, we have examined job creation from two widely discussed clean energy scenarios, developed by different organizations with differing methodologies. The results are parallel in pattern, though different in detail.

Based on the average of the two studies, under current import levels, 80 percent reduction in emissions by 2050 could create an average of 1.0 million jobs per year, from now through 2050. (These are average numbers of jobs over a span of more than 30 years, not job-years). This should create a powerful argument for decarbonization, even though some specific jobs with high "legacy" wage rates will be lost. The issue of compensation for those who lose such jobs, coal miners and selected others, is an important topic that is beyond the scope of this article.

Recent WTO rulings, however, have struck down many national and subnational policies to promote renewable energy. After several successful U.S. challenges to other countries' domestic protection of clean energy, India's recent action against the U.S. suggests that the same could happen to anyone. An increase in U.S. energy sector imports could, according to our calculations, eliminate much or all of the net employment gains from clean energy, although our lower bound calculation is a logical limit, not a plausible policy result.

As Meyer (2015) notes, WTO actions that roll back protections for domestic renewable industries could undercut the coalitions necessary to adopt clean energy. Moreover, such WTO actions ignore the positive global externality of emission reduction that results from national renewables promotion.

In the other direction, more protectionist U.S. policies toward renewable energy could create more jobs, with an upper bound of 1.5 million per year, or 0.5 million above current conditions. This, too, is a logical limit rather than a policy option; attempts to pursue it in practice would run risks of retaliation from trading partners, another important problem that is beyond the scope of this article. Moreover, as noted above in connection with the Suniva case against solar tariffs, aggressive action to increase domestic content could raise prices and thereby slow adoption of renewable energy, a possibility we have not incorporated in our calculations.

Although the winds from Washington are currently blowing against renewable energy in general, the principal policy recommendation from this analysis is that it is important to preserve the current levels of domestic production in renewable energy and other energy inputs. We are roughly two-thirds of the way from the lower bound to the upper bound on job creation from renewable energy. Maintaining this level of domestic production means that clean energy could create a million net new jobs per year, no small accomplishment in itself, and a significant contribution to the politics of emission reduction.

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