DATA FOR *PROGRESS*

The CEPP Amplifies the Jobs Impacts of the 48C Tax Credit

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Summary and Highlights

President Biden has committed to achieving 80 percent clean electricity by 2030 on the way to 100 percent by 2035, while catalyzing innovation and building U.S. leadership in clean energy manufacturing. Both chambers of Congress have included policies to achieve these goals in the budget resolution framework advanced in August.

Specifically, the reconciliation package currently includes the 48C Advanced Energy Manufacturing Tax Credit for companies that build or retrofit facilities to manufacture clean energy technologies in the United States, and the Clean Electricity Performance Program (CEPP), which would provide incentives for electric utilities to rapidly deploy clean electricity to achieve a nation-wide average of 80 percent clean by 2030.

The macroeconomic analysis in this memo finds that federal investments of $8 billion through 48C, as included in the American Jobs in Energy Manufacturing Act of 2021 introduced by Senators Manchin and Stabenow in March, would directly and indirectly create nearly **140,000 jobs nationwide over the next several years, and would add over $27 billion to GDP.**

It also shows that the two policies are greater than the sum of their parts. The purpose of the 48C incentives is to drive innovation and create jobs in the manufacturing sector here in the United States. By increasing demand for clean energy technologies, CEPP amplifies the effect of the incentives and increases the importance of new domestic manufacturing capacity. **Our modeling estimates that 48C could directly create 15 percent to 30 percent more jobs if paired with CEPP.**

It is clear that these policies are best executed in tandem as they complement and amplify each other's impacts. To meet our innovation and climate goals, Congress should pursue both.

Introduction

In this memo, we employ a simple input-output (I-O) model and data from the U.S. Bureau of Economic Analysis (BEA) and U.S. Census Bureau to assess the effect of renewing the 48C Advanced Energy Manufacturing Tax Credit, which would subsidize capital investments by manufacturers to increase the production of inputs to domestic clean energy generation. In 2009, an initial round of 48C tax credits was authorized by the American Recovery and Reinvestment Act, but subsequent attempts to continue or expand it have thus far been unsuccessful.[1] However, a proposal to revive 48C is currently being considered by the Senate as part of the Fiscal Year 2022 Budget Resolution Agreement Framework.[2]

We also consider the impact of combining passage of 48C with enactment of the Clean Electricity Performance Program (CEPP) that is also included in this framework, and that aims to incentivize electric utilities to achieve 80 percent clean electricity nationwide by 2030. We find that these two policies have the potential to powerfully complement one another and to generate combined effects that are greater than the sum of their parts.

Analyses of the earlier round of 48C tax credits found that they likely helped to significantly boost domestic production of equipment for wind turbine assembly.[3] Assuming that such effects carry over to other areas of clean energy manufacturing, such as production of solar panels or batteries, the potential for a synergistic interaction between CEPP and 48C becomes clear. By boosting domestic output of clean technologies while at the same time increasing demand for those technologies on the part of utilities, combining CEPP with 48C substantially magnifies the overall macroeconomic effects.

The next two sections present results from our baseline analysis and from two alternative model runs that allow for these synergistic interactions. We then offer some background on I-O modeling and on the specifics of our methodology.

Baseline Results

The following table displays our estimation results for the effect of 48C on value added (GDP) and on employment during the period over which we assume the credits will be paid out, namely 2022-2026.[4] We decompose the employment effects into those that are "direct" and those that are "indirect" or "induced":[5]

TABLE 1 • **Increase in Value Added (GDP) and Employment Due to 48C, 2022-2026**

Year(s)	Cumulative Increase in Value Added (2020 dollars)	Cumulative Direct Increase in Employment Due to 48C	Cumulative Indirect/ Induced Increase in Employment Due to 48C	Cumulative Total Increase in Employment Due to 48C
2022-2026	$27.68 billion	39,762	98,748	138,510

Of course, we are interested not only in aggregate employment impacts but also in understanding the geographic distribution of the jobs that are likely to be created. To that end, we allocate the employment figures from our model across the nine Census divisions of the U.S. according to the following procedure:

- 50 percent of the jobs attributed to the direct effects of 48C are allocated in proportion to a region's share of the Census tracts that have experienced a coal mine closure since 1999 or a retirement of a coal-fired power plant retirement since 2009. This is motivated by the fact that the American Jobs in Energy Manufacturing Act reserves 50 percent of the available credits for companies located in or adjacent to such tracts;
- The remainder of the estimated jobs are allocated across regions in proportion to the geographic distribution of employment by industry as measured in the American Community Survey (ACS).

The following table shows the breakdown across the nine Census divisions of cumulative job creation due to 48C (i.e. the sum of direct, indirect, and induced effects) over the period 2022-2026. To put these figures in context, we also report the increases as a percentage of total employment in each region as measured in the 2019 ACS.

TABLE 2 • **Total Employment Effects by Census Division, 2022-2026**

Census Division	Cumulative Total Increase in Employment Due to 48C, 2022-2026
East North Central (IL, IN, MI, OH, WI)	29,585
South Atlantic (DE, DC, FL, GA, MD, NC, SC, VA, WV)	23,377
Pacific (AK, CA, HI, OR, WA)	17,407
Middle Atlantic (NJ, NY, PA)	16,684
West South Central (AR, LA, OK, TX)	15,247
West North Central (IA, KS, MN, MO, NE, ND, SD)	10,975
East South Central (AL, KY, MS, TN)	10,355
Mountain (AZ, CO, ID, MT, NV, NM, UT, WY)	9,257
New England (CT, ME, MA, NH, RI, VT)	5,625
TOTAL:	**138,510**

We can also project what the effects will be on union employment. Using data from the Census Bureau's Current Population Survey (CPS) on rates of union membership in different industries and regions, we can estimate how many of the new jobs created as a result of 48C will be union jobs. Our results are shown below in Table 3.

TABLE 3 • **Union Employment Effects by Census Division, 2022-2026**

Census Division	Net Increase in Union Employment, 2022-2030 (Cumulative)
East North Central (IL, IN, MI, OH, WI)	3,532
Pacific (AK, CA, HI, OR, WA)	1,969
Middle Atlantic (NJ, NY, PA)	1,771
South Atlantic (DE, DC, FL, GA, MD, NC, SC, VA, WV)	1,230
West North Central (IA, KS, MN, MO, NE, ND, SD)	1,139
East South Central (AL, KY, MS, TN)	1,002
West South Central (AR, LA, OK, TX)	844
Mountain (AZ, CO, ID, MT, NV, NM, UT, WY)	502
New England (CT, ME, MA, NH, RI, VT)	432
TOTAL:	**12,422**

This cumulative increase in union membership amounts to about 0.09 percent of the total union workforce of 14.3 million reported by the Bureau of Labor Statistics for 2020.[6]

It is worth mentioning, however, that these estimates assume current unionization rates in each industry remain constant, but this may not necessarily be the case going forward. In particular, the FY 2022 Budget Resolution Agreement Framework also includes provisions taken from the Protecting the Right to Organize (PRO) Act, which have the potential to significantly boost union membership across the board.[7]

Results Assuming Synergistic Effects of CEPP and 48C

The results above reflect the economic impact of 48C in isolation, and there is reason to believe this may be a significant underestimate of the policy's impact, given that it is expected to pass alongside other infrastructure and energy investments. As noted at the outset, the combined economic impact of CEPP and 48C could be greater than would be expected from analyzing the effects of each independently.[8] This is because 48C is intended not only to boost short-term demand but also to build up domestic clean energy manufacturing capacity. The added demand generated by CEPP should amplify the stimulative effect of 48C by ensuring that domestic manufacturers have a larger market to which to sell their products.

Below are results from two alternative scenarios, one in which we assume that 48C boosts overall domestic manufacturing capacity by 0.5 percent and one in which it boosts it by 1 percent.[9] The reported effects give the increments in value added and employment that we attribute to the interaction of CEPP with this increased capacity. We estimate these effects only for the period 2028-2030, since we assume that any increased capacity will not be fully realized until after all 48C-funded projects have been completed.

TABLE 4 • **Results from Alternative Scenario #1, Assuming 0.5 Percent Increase in Domestic Manufacturing Capacity Due to 48C**

Year(s)	Cumulative Incremental Increase in Value Added (2020 dollars)	Cumulative Incremental Increase in Employment Due to Interaction
2028-2030	$816.11 million	5,954

TABLE 5 • **Results from Alternative Scenario #2, Assuming 1.0 Percent Increase in Domestic Manufacturing Capacity Due to 48C**

Year(s)	Cumulative Incremental Increase in Value Added (2020 dollars)	Cumulative Incremental Increase in Employment Due to Interaction
2028-2030	$1.63 billion	11,908

In the first alternative scenario, a total of 5,954 additional jobs are added during the period 2028-2030, which represents 15.0 percent of the direct employment effect attributable to 48C that we reported in Table 1 (39,672). In the second scenario, a total of 11,908 additional jobs are added during 2028-2030, or 30.0 percent of the direct employment effect of 48C.

In other words, even by making fairly conservative assumptions about the effect of 48C on potential output in the domestic manufacturing sector, we find that the impact of this tax credit program is meaningfully enhanced by the spending induced through CEPP. By our assumptions, the additional jobs created down the road by the interaction of CEPP with 48C's boost to the domestic manufacturing share could amount to 15-30 percent of the direct employment impact of 48C.

We therefore believe that there is a strong rationale for moving forward with plans to include both provisions in the proposed budget framework.

Background on Input-Output Modeling

In this section, we describe the basics of the I-O framework used to calculate our estimates as well as some of the assumptions and methodological choices that are specific to our analysis. Appendix A contains even more detail about the mathematics underlying the model.

An I-O model is a simplified representation of an economy that uses data on the inputs that various industries require to produce their final outputs in order to illustrate the linkages among different sectors.[10] Knowing what these linkages look like allows policy analysts to understand how an initial increase or decrease in spending by governments, firms, or consumers — what economists would refer to as a change in *autonomous spending* — will filter through the economy, and what will be its ultimate effect on certain macroeconomic indicators of interest such as GDP or aggregate employment.

Input-output modeling assumes that such a change in autonomous spending has three types of effects on output and employment:

- **Direct effects** – the incremental economic activity and jobs created by the production of *final* goods and services brought about by the new spending;
- **Indirect effects** – the incremental economic activity and jobs created by the production of the *intermediate inputs* to those final goods and services;
- **Induced effects** – the incremental economic activity and jobs created by the expenditures of workers who are paid to produce these final and intermediate goods and services.

To model direct and indirect effects, we can make use of data on industry-level input requirements made available by the Bureau of Economic Analysis (BEA), which publishes a variety of different tables that can be used to construct an I-O model.[11] One of these tables is known as the *direct requirements matrix*, which shows, for each of a specified set of industries, how many dollars of inputs are required to be purchased from each of the other industries in order to produce one dollar of its output.

Another is known as the *total requirements matrix* or the *Leontief inverse matrix*, after the economist Wassily Leontief, a pioneer of I-O analysis. This shows, for each industry, how many dollars of goods each of the other industries must ultimately produce in order for the initial industry to produce one dollar of its output, taking into account the production of intermediate inputs. Thus, the total requirements matrix allows one to isolate indirect effects by comparing to estimates that would be obtained from calculations based on the direct requirements matrix alone.

Induced effects result from the fact that a portion of the income earned by firms in a given industry when selling their outputs will be paid out as labor income for workers, who will then spend some of that income on purchases of consumer goods. The question of how best to model induced effects is itself a potentially complicated one, but for the sake of simplicity we choose to follow the approach of Pollin, Garrett-Peltier, Heintz, and Hendricks (2014), who assume on the basis of relevant macroeconomic research that consumer spending has a multiplier of approximately 1.4.[12] That is, each dollar of economic activity associated with the direct and indirect effects of a change in autonomous spending by governments or firms will ultimately generate total economic activity of $1.40.

The requirements matrices allow us to assess the impact of a change in autonomous spending on the *gross output* of every industry, including both intermediate goods sold to other producers and final goods sold to consumers. If we are interested in computing the total impact of an initial stimulus on GDP, we need estimates of *value added* in each industry, which subtract off the costs of intermediate outputs.

To that end, we obtain measures of both gross output and value added by industry from the BEA for 2019, and use these to calculate industry-specific ratios of value added to output. Thus, we can take the gross output figures derived from our model and convert them into estimates of value added, which we can then sum across industries in order to obtain an estimate of the total impact on GDP in that year.

Modeling the Effects of Clean Energy Spending with "Synthetic Industries"

One difficulty in using I-O models to study the impacts of clean energy policy is that "clean energy" is not an identifiable industry in the BEA's classification scheme, nor are individual types of renewables, such as wind, solar, or geothermal. This makes it challenging to know how we ought to represent the spending induced by such policies in our I-O framework.

To deal with this problem we draw on the work of Garrett-Peltier (2016), who proposes a technique known as the *synthetic industry approach*.[13] This consists of modeling renewable energy industries that do not appear in the national accounts as "linear combinations" of some subset of those that do, based on data from other sources about the composition of activities in those renewable sectors.

For example, Garrett-Peltier observes that in the early 2000's,

> *"[The European Wind Energy Association] administered a survey of various European firms in the wind energy industry, eliciting data on the components and costs of wind turbine production. The EWEA publication shows that for wind turbine manufacturing, the various components and their shares of total costs are as follows:*
>
> *37% machinery*
>
> *26% construction*
>
> *12% fabricated metal products*
>
> *12% plastic products*
>
> *7% scientific/technical services*
>
> *3% mechanical power transmission equipment*
>
> *3% electronic connector equipment"*[14]

Thus, spending an additional dollar on wind turbines can be thought of as equivalent to spending an additional $0.37 on machinery, $0.26 on construction, $0.12 on fabricated metal products, $0.12 on plastic products, $0.07 on scientific/technical services, $0.03 on mechanical power transmission equipment, and $0.03 on electronic connector equipment. So while wind turbine manufacturing is not an industry that appears in the BEA accounts, we can represent it by means of a *synthetic industry*, or a weighted average of industries that *are* observable (with weights that sum to one).

Garrett-Peltier provides coefficients that can be used to construct synthetic industry representations of a number of different energy sectors, both renewable and nonrenewable. We use her coefficients for modeling expenditures on biomass, coal, oil and gas, hydropower, solar, storage (for which we use her coefficients for spending on "smart grids"), and wind. To model expenditures on nuclear power, we draw on cost information from Black and Veatch (2012).[15]

Estimating the Change in Autonomous Spending Associated with 48C

In order to use the I-O framework to analyze the likely effects of 48C and potential interactions with CEPP, we need to begin by estimating the changes in autonomous spending they can be expected to induce. Rather than relying only on direct government spending, 48C aims to incentivize domestic manufacturers to increase their capacity to produce renewable technologies. Hence, we want to know how much new capital spending will result from the credit, taking into account that coming from both the private and public sectors.

For 48C, we note that the current proposal included in the Senate budget resolution, which is based on the American Jobs in Energy Manufacturing Act of 2021 introduced earlier this year by Senator Joe Manchin (D-WV) and Senator Debbie Stabenow (D-MI), calls for $8 billion in credits to be made available, with 50 percent of the total set aside for "communities where coal mines have closed or coal power plants have retired." Because the credits offered under 48C are equal to 30 percent of qualified project investments, we can deduce that the total investment incentivized by the policy would be approximately $26.67 billion in nominal dollars, or approximately $24.65 billion in 2020 dollars.[16, 17]

TABLE 6 • **Summary of Expected Investments Resulting from 48C, 2022-2026**

Year(s)	Net Investment Due to 48C (2020 dollars)
2022	$5.13 billion
2023	$5.03 billion
2024	$4.93 billion
2025	$4.83 billion
2026	$4.74 billion
TOTAL:	**$24.65 billion***

* Inflation adjustments made using annual GDP deflators from St. Louis Fed, Federal Reserve Economic Data: https://fred.stlouisfed.org/series/USAGDPDEFAISMEI. For 2021 on, we assume a 2% annual rate of inflation."

The next challenge is to decompose this spending by industry. We refer here to a March 2021 report for the think tank Third Way, produced by the consultants Industrial Economics, Incorporated (IEc) and Inforum.[18] Based on analysis of the original round of 48C credits, they conclude that the industry breakdown of spending would be as follows:

- 62.6% allocated to "Electrical Equipment, Appliances, and Components"
- 20.5% allocated to "Machinery Manufacturing"
- 2.8% allocated to "Motor Vehicles"
- 10.0% allocated to "Other Transportation Equipment"

- 1.8% allocated to "Chemical Products"
- 2.1% allocated to "Utilities"
- 0.3% allocated to "Pipeline Transportation"

Finally, we follow IEc and Inforum in assuming that these credits would be paid out over a five-year period beginning in 2022, and that 50 percent of the direct employment effects would be realized in states with "at least one coal mine closure since 1999 or… at least one coal-fired power plant retirement since 2009." The latter assumption is again based on the 50 percent carveout for select Census tracts in the American Jobs in Energy Manufacturing Act.[19]

Modeling the Synergistic Effects of CEPP and 48C

For the sake of tractability, we have used the BEA's 2019 domestic requirements matrix for computing our baseline estimates. In reality, we would expect the pattern of linkages among industries to evolve over time. Modeling such evolution is complex, however, so we initially maintain the assumption of a constant set of input requirements for each industry over time.

However, one way to model the effect of 48C on domestic manufacturing capacity is to modify the coefficients of the Leontief matrix. As explained earlier, the entries in each column of the matrix give the total amount of production (in dollars) required to generate one dollar of final output in the industry corresponding to that column. Equivalently, the entries in each row give the total amount of production required by a given industry in order to produce one dollar of final output in each of the others.

Therefore, we can posit that an increase in domestic manufacturing capacity would show up in the Leontief matrix as an increase in the coefficients in those rows corresponding to manufacturing-related industries. This may seem somewhat counterintuitive in light of the fact that the Leontief matrix is a "requirements" matrix, and it might appear that increased manufacturing productivity should *decrease* the amount of inputs required in other industries.

However, a better interpretation would be that greater domestic manufacturing capacity boosts *domestic* requirements even as *total* requirements remain constant. That is, supplying one dollar of final output requires the same amount of overall production as before, but a greater share of that production is now domestic.

How should we estimate the effect of 48C on manufacturing capacity? As noted above, one analysis of the initial round of 48C claims that the policy increased the fraction of domestic wind turbine components supplied by U.S. firms by about 50 percentage points, but production of these and other clean energy technologies represents only a fraction of overall manufacturing in the U.S.[20]

Hence, one possibility is to compare our estimate of the direct employment effects of 48C, which plausibly represents that employment that is related to the enhanced manufacturing capabilities funded by the credits, to aggregate employment in domestic manufacturing. Over the assumed five-year payout period, we calculate that a total of 39,762 jobs will be added through the direct effects of 48C.[21]

According to our BEA data, total employment in manufacturing-related industries was 6,853,000 in 2019.[22]

Thus, the direct increase in employment due to 48C is on the order of 0.5 percent of all employment in U.S. manufacturing as of 2019. Supposing that increases in employment are proportional to increases in potential output, we can make the admittedly rough assumption that 48C will also increase the domestic inputs from manufacturing industries to production in every other industry by 0.5 percent.[23] Our second alternative scenario, in which we allow for capacity to expand by 1 percent, accounts for the possibility that increases in potential output are larger than increases in manufacturing employment. By feeding estimates of the additional energy investments due to CEPP from the Natural Resources Defense Council into versions of the model using both the original and alternative I-O tables, we are able to isolate estimates of the interaction effect.[24]

Conclusion

Using an input-output (I-O) model and data from the U.S. Bureau of Economic Analysis, the U.S. Census Bureau, and the Natural Resources Defense Council, we have estimated that enactment of a new round of the 48C Advanced Manufacturing Tax Credit contained in the Fiscal Year 2022 budget resolution would lead to a **cumulative increase in U.S. GDP of over $27 billion and cumulative net job creation of nearly 140,000 jobs by 2026, including more than 12,000 union jobs**.

While these baseline estimates assume no synergies between 48C and CEPP, we further show that **accounting for potential long-run effects of 48C on domestic manufacturing capacity increases our estimate of the cumulative employment impact by 6,000-12,000 jobs by 2030, or 15-30 percent of the direct employment impact of 48C**.

To reiterate, it is important for Congress to recognize this positive-sum dynamic in evaluating the package of climate and innovation proposals currently under consideration. **Our analysis suggests that pursuing both in tandem would do more good for the U.S. economy and American workers than enacting either in isolation.**

APPENDIX: MATRIX ALGEBRA OF I-O MODELING

In algebraic terms, we let the direct requirements matrix be denoted by A, the dimension of which is 71-by-71. The entry in the ith row and the jth column of A indicates how many dollars of industry i's output need to be purchased by industry j in order to produce one dollar of j's output.

Suppose we want to consider the direct economic effect of spending a certain amount of money on purchasing the product of industry j. We can model this spending with a vector X consisting of a single column and 71 rows, where the entry in the jth row is the amount that we want to spend on product j (and the entries in every other row are zero, if we are not purchasing anything else).

Premultiplying X by the matrix A gives us the product vector AX, which shows how much input we require (in dollars) from each of the industries in order to produce x_j dollars of industry j's output. (Simple matrix algebra shows that the entries of AX will be equal to the entries in the jth column of A multiplied by the scalar x_j.)

However, this calculation only provides us with a partial picture of the total impact that the initial influx of autonomous spending represented by vector X will have on the economy. This is because each of the industries that provide the inputs to allow industry j to produce its output will themselves have to purchase inputs from other industries, and each of *those* industries will have to purchase *their* own inputs, and so on. The *direct* effect of the spending represented by vector X will be AX, but the inputs needed to produce AX will be given by A^2X, the inputs needed to produce A^2X by A^3X, and so on.

Therefore, the total effect on the economy, *direct* effects plus *indirect* effects, will be given by the infinite sum:

$AX + A^2X + A^3X + A^4X + \ldots$

Through algebraic manipulation, it can be shown that this sum is equal to

$(I-A)^{-1}X$

where the matrix $(I-A)^{-1}$ is known as the *total requirements matrix* or the *Leontief inverse matrix*, after the economist Wassily Leontief, a pioneer of I-O analysis.

The entry in the ith row and jth column of the total requirements matrix gives the total amount of production (in dollars) by industry i that is brought about when industry j produces one dollar of final output. Thus, multiplying this matrix by the spending vector X gives the total economic impact of that initial stimulus.

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ENDNOTES

1. https://www.energy.gov/downloads/fact-sheet-48c-manufacturing-tax-credits.

2. https://www.democrats.senate.gov/imo/media/doc/MEMORANDUM%20for%20Democratic%20Senators%20-%20FY2022%20Budget%20Resolution.pdf.

3. Luis Mundaca and Jessika Ruth Richter (2015). "Assessing 'green energy economy' stimulus packages: Evidence from the U.S. programs targeting renewable energy," *Renewable and Sustainable Energy Reviews*, 42, 1174-1186, pg. 1179. Available at https://www.sciencedirect.com/science/article/pii/S1364032114008855#bib61

4. Estimates of employment increases are obtained by using BEA data to calculate the ratio of gross output to employment in each industry for 2019, and multiplying the output effects from our model by these ratios.

5. See the section entitled "Background on Input-Output Modeling" for a detailed explanation of the differences between these three categories of effects.

6. https://www.bls.gov/news.release/union2.nr0.htm.

7. news.bloomberglaw.com/daily-labor-report/democrats-budget-deal-seeks-to-penalize-labor-law-violators; https://brandonmagner.substack.com/p/would-the-pro-act-actually-deter.

8. For modeling of the likely macroeconomic impacts of CEPP, see Krishnaswami and Murrow (2021), "80% Clean Power by 2030: Achievable with Massive Benefits," and Darling, Hibbard, and Daniels (2021), *Economic Impact of a Clean Electricity Payment Program.*

9. See the section entitled "Modeling the Synergistic Effects of CEPP and 48C" for details on how we define domestic manufacturing capacity in the context of our model, and why we consider these values to be realistic estimates of the possible impacts of the policy.

10. For further background on I-O modeling, see Miller and Blair (2009), *Input-Output Analysis: Foundations and Extensions*, https://www.cambridge.org/core/books/inputoutput-analysis/69827DA658E766CD1E17B1A47BA2B9C3.

11. For our purposes here, all of the BEA tables that we use are for 2019 and rely on an industry classification scheme involving 71 industries based on the North American Industry Classification System (NAICS).

12. Pollin, Garrett-Peltier, Heintz, and Hendricks (2014), *Green Growth A U.S. Program for Controlling Climate Change and Expanding Job Opportunities*, https://peri.umass.edu/fileadmin/pdf/Green_Growth_2014/GreenGrowthReport-PERI-Sept2014.pdf.

13. Heidi Garrett-Peltier (2016), "Green versus brown: Comparing the employment impacts of energy efficiency, renewable energy, and fossil fuels using an input-output model," Economic Modelling 61, 439-447.

14. Garrett-Peltier (2016), 441.

15. https://refman.energytransitionmodel.com/publications/1921. Using Fig. 1 on pg. 11 as a starting point, we choose the following weights for our synthetic nuclear industry: 25% construction; 10% fabricated metal products; 10% machinery; 10% computer and electronic products; 10% electrical equipment, appliances, and components; 15% miscellaneous professional, scientific, and technical services; and 20% management of companies and enterprises.

16. https://www.govinfo.gov/content/pkg/USCODE-2013-title26/pdf/USCODE-2013-title26-subtitleA-chap1-subchapA-partIV-subpartE-sec48C.pdf.

17. If we assume that the nominal credit budget of $8 billion is spent over five years, then total expenditures will be slightly less than $26.67 billion in present dollars. These adjustments are made using annual GDP deflators from St. Louis Fed, Federal Reserve Economic Data (FRED), available at https://fred.stlouisfed.org/series/USAGDPDEFAISMEI. For 2021 on, we assume a 2% annual rate of inflation.

18. https://decarbamerica.org/wp-content/uploads/2020/12/Stimulus-Analysis-Report-03.31.21clean.pdf.

19. U.S. Energy Information Administration, “Form EIA-860 detailed data with previous form data (EIA-860A/860B), https://www.eia.gov/electricity/data/eia860/. U.S. EIA, “U.S. Energy Mapping System,” https://www.eia.gov/state/maps.php. The states we identify as having experienced one of these types of closures in the relevant time period are: Alabama, Alaska, Arizona, Arkansas, California, Colorado, Delaware, District of Columbia, Florida, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, Nevada, New Jersey, New Mexico, New York, North Carolina, North Dakota, Ohio, Oklahoma, Pennsylvania, South Carolina, South Dakota, Tennessee, Texas, Utah, Virginia, West Virginia, Wisconsin, Wyoming.

20. Mundaca and Richter (2015), pg. 1179.

21. Incidentally, the magnitude of this estimate seems quite reasonable when one considers that the original $2.3 billion round was estimated to have supported the direct creation of 17,000 jobs. https://www.energy.gov/articles/fact-sheet-23-billion-new-clean-energy-manufacturing-tax-credits.

22. These industries are: nonmetallic mineral products; fabricated metal products; machinery; computer and electronic products; electrical equipment, appliances, and components; motor vehicles, bodies and trailers, and parts; other transportation equipment; and miscellaneous manufacturing.

23. Even if we expect domestic manufacturing to expand anyway by then for other reasons, this exercise at least helps to isolate the portion of that increase plausibly attributable to 48C.

24. See NRDC report (SOURCE).

COVER PHOTO
American Public Power Association/Unsplash