DATA FOR *PROGRESS*

Economic Impacts of the Inflation Reduction Act's Climate and Energy Provisions

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Introduction and Summary of Findings

On August 16, 2022, President Biden signed the Inflation Reduction Act (IRA), marking the biggest climate investment in U.S. history. This landmark legislation aims to accelerate domestic clean energy production, catalyze technological innovation, and reduce greenhouse gas (GHG) emissions. The REPEAT Project at the Princeton University ZERO Lab estimates that the IRA puts the U.S. on track to achieve GHG emissions that are 30-42 percent below 2005 levels by the year 2030.[1] In addition to reducing GHG emissions and catalyzing clean energy production, the IRA will take steps designed to ensure that corporations and the wealthiest Americans pay their fair share in taxes and will create new, good-paying jobs.

In this memo, we employ the Data for Progress Jobs Model to project the output and employment effects of the climate and energy provisions of the IRA. Realizing the full potential of this legislation will require robust efforts to ensure that funds are appropriated at the levels authorized by the IRA. If such efforts are successful, we estimate that the spending contained in these provisions, together with the private investment that it would incentivize and support, would be responsible for an average of around 1 million jobs created or preserved from 2023 to 2032, and would contribute approximately $1.7 trillion to U.S. GDP over the same period. We find that nearly 50 percent of these jobs would be concentrated in the construction and manufacturing sectors, with environmental remediation, agriculture and forestry, and scientific and technical services accounting for significant portions of the overall employment impacts as well.

An average of around **1 million jobs** created or preserved from 2023 to 2032, and would contribute approximately **$1.7 trillion** to U.S. GDP over the same period.

1. Princeton University ZERO Lab, Rapid Energy Policy Evaluation and Analysis Toolkit (September 2022). "Electricity Transmission is Key to Unlock the Full Potential of the Inflation Reduction Act." Available at https://repeatproject.org/docs/REPEAT_IRA_Transmission_2022-09-22.pdf.

Breakdown of Climate and Energy-Related Spending in the Inflation Reduction Act

In an analysis of the IRA's climate and energy provisions, the Congressional Progressive Caucus Center grouped these provisions into seven major categories:[2]

1. **CLEAN ELECTRICITY AND ENERGY TRANSMISSION:** The IRA includes over $120 billion in clean electricity and energy tax incentives to advance the installation of renewable energy and to reduce household energy bills. Notably, it introduces enhanced Investment and Production Tax Credits for renewable energy projects, including those built in low-income communities, as well as a series of federal grant and loan programs to build energy transmission projects around the country.

2. **CLEAN TRANSPORTATION:** To decarbonize the transit sector, the IRA makes historic investments in clean transportation, including $3 billion to electrify the U.S. Postal Service's (USPS) delivery fleet. One of the key tax incentives is a tax credit of up to $7,500 for the purchase of a new electric vehicle (EV) and up to $4,000 for the purchase of a used EV.

3. **BUILDINGS AND ENERGY EFFICIENCY:** The law offers extensive tax credits, rebates, and grants in order to boost investment in energy efficiency across residential, commercial, and federal buildings. These investments are intended to help consumers and businesses save money, in addition to reducing GHG emissions.

4. **MANUFACTURING:** The IRA allocates $50 billion in tax incentives to support manufacturing of solar panels, wind turbines, batteries, and the processing of critical minerals domestically. The bill also provides an additional $11.5 billion for industrial emissions reduction programs and $500 million for the Defense Production Act to boost the manufacturing of energy-efficient technologies such as heat pumps.

5. **ENVIRONMENTAL JUSTICE:** The IRA makes wide-ranging investments in clean air, clean transportation, and the cleanup of toxic pollution in low-income communities and communities of color, including the establishment of a $27 billion Greenhouse Gas Reduction Fund. This fund is designed to provide low-cost financing for clean energy infrastructure projects around the country.

6. **CONSERVATION AND AGRICULTURE:** The law invests in climate resilience programs that conserve our natural resources, promote biodiversity, and prepare communities for extreme natural weather events. The legislation allocates nearly $20 billion to conservation programs for the U.S. Department of Agriculture (USDA), including over $8 billion for the Environmental Quality Incentives Program (EQIP), which provides technical and financial assistance to improve the management of natural resources by farmers and other agricultural producers. These provisions are intended to bring the U.S. closer to the goal of conserving at least 30 percent of U.S. lands and oceans by 2030.

2. Justin McCarthy (August 2, 2022). "Analysis of Climate and Energy Provisions in the 'Inflation Reduction Act of 2022.'" Congressional Progressive Caucus Center. Available at https://www.progressivecaucuscenter.org/climate-and-energy-provisions-in-the-inflation-reduction-act.

7. **FOSSIL FUELS:** The IRA includes several oil and gas reforms, including increasing rental and royalty rates for oil and gas development on federal lands, ending noncompetitive leasing, and setting minimum bids for federal parcels. The bill also creates a new Methane Emissions Reduction Program to target this potent greenhouse gas, which is more than an order of magnitude more effective than carbon dioxide at trapping heat in the atmosphere.

These are the provisions that we focus on in this modeling exercise (Appendix F provides a complete list of the specific sections included in our analysis). Table 1a shows the estimated public expenditures on climate and energy provisions for the period 2023 to 2032. These figures are based on the "estimated outlays" reported in the Congressional Budget Office's official score of the IRA.[3]

Nearly half of these expenditures are accounted for by the clean electricity and transmission provisions of the IRA, which include a host of tax credits intended to bolster production of renewables. Manufacturing provisions account for about one-sixth, and buildings and energy efficiency for about one-eighth. Fossil fuel spending makes up less than 1 percent of the total.[4]

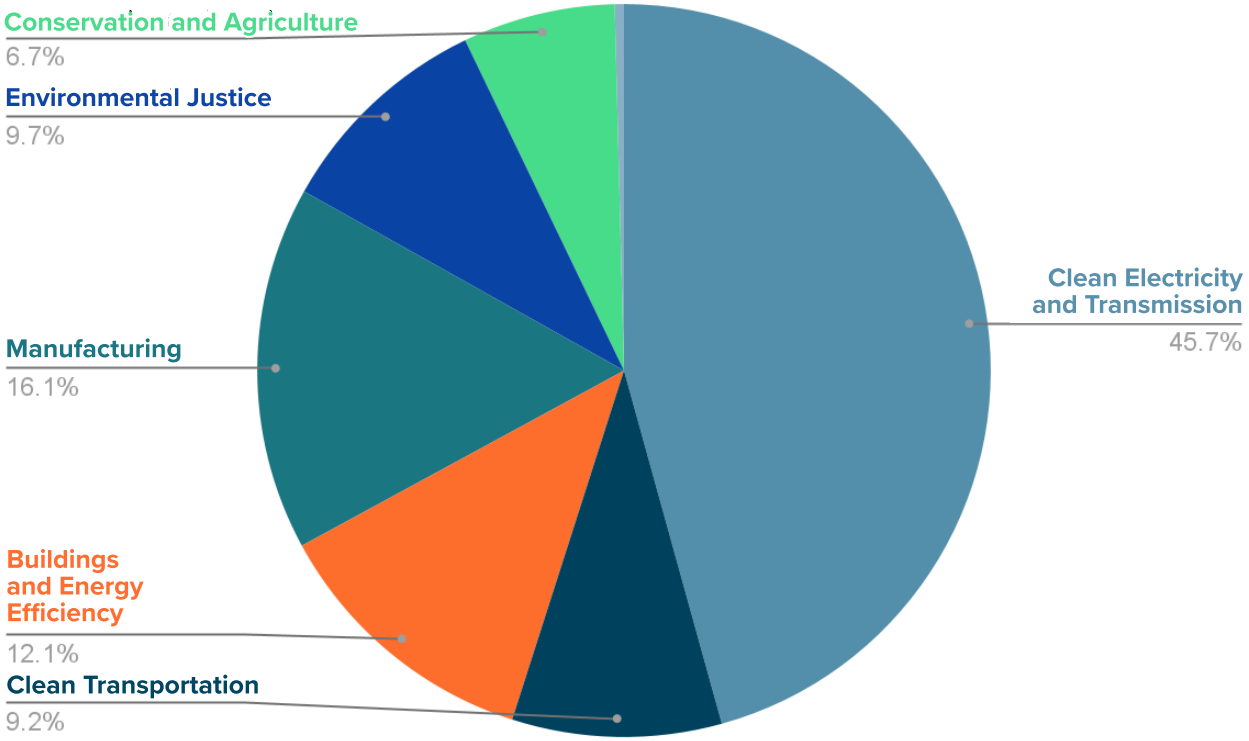
TABLE 1A: IRA CLIMATE AND ENERGY PROVISIONS — ESTIMATED PUBLIC EXPENDITURES (BILLIONS OF DOLLARS), 2023-2032

Category	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	TOTAL
Clean Electricity and Transmission	0.0	3.8	7.0	11.6	17.5	23.5	26.8	28.7	30.1	31.8	180.7
Clean Transportation	0.1	3.5	3.6	4.5	4.6	5.6	4.8	3.8	3.4	2.9	36.5
Buildings and Energy Efficiency	0.3	2.5	4.1	6.9	7.5	6.5	5.5	5.1	4.9	4.8	48.0
Manufacturing	0.0	3.6	4.9	5.7	7.6	8.5	8.5	8.5	8.2	7.8	63.5
Environmental Justice	0.0	0.9	4.0	7.2	9.0	7.7	4.2	2.0	1.7	1.6	38.5
Conservation and Agriculture	0.0	0.7	1.8	3.2	4.8	5.2	4.3	3.4	2.3	1.0	26.6
Fossil Fuels	0.0	0.1	0.2	0.3	0.5	0.3	0.0	0.0	0.0	0.0	1.6
TOTAL	0.4	15.1	25.6	39.4	51.4	57.4	54.1	51.5	50.5	49.9	395.4

3. Congressional Budget Office (CBO) (August 3, 2022). "Estimated Budgetary Effects of H.R. 5376, the Inflation Reduction Act of 2022." Available at https://www.cbo.gov/publication/58366. Note that the CBO's "estimated outlays" for certain provisions are sometimes less than the "budget authority" for the same, as CBO's projections of actual future spending can diverge from the amounts authorized by the statute. We make use of the estimated outlays because we believe these more accurately reflect the likely net increase in federal spending that will result from the IRA.

4. Note that we focus here only on spending and not on revenue generators. The net budgetary impact of the climate and energy provisions in the IRA is less than what is reported here if one considers the revenue side as well. See the CBO score for a fuller accounting of this net impact.

FIGURE 1A: IRA CLIMATE AND ENERGY PROVISIONS — ESTIMATED PUBLIC EXPENDITURE SHARES, 2023-2032



In Table 1b, we provide estimates of the *total expenditures,* both public and private, that we expect would be associated with the IRA's climate and energy provisions. These are based on projections of how much additional spending by individuals and/or businesses would be leveraged by a given amount of federal spending.[5]

For example, the reauthorized "48C" Clean Manufacturing Tax Credit offers either a 6 percent base credit or 30 percent bonus credit (if certain additional labor standards are met) for manufacturers to invest in the capacity to produce renewable energy technologies. This means that the total spending on projects claiming the credit will be greater than the nominal cost of the credit by a factor of either 16.67 or 3.33, depending on which rate applies.[6]

Such projections are also applied in cases where the law requires a state, local, or private partner match for a federal grant, such as the Neighborhood Access and Equity Grants Program of the Federal Highway Administration, designed to improve "walkability, safety, and affordable transportation access," among other objectives; or those in which a federal agency guarantees a loan made by another entity, such as the Tribal Energy Loan Guarantee Program administered by the Department of Energy.

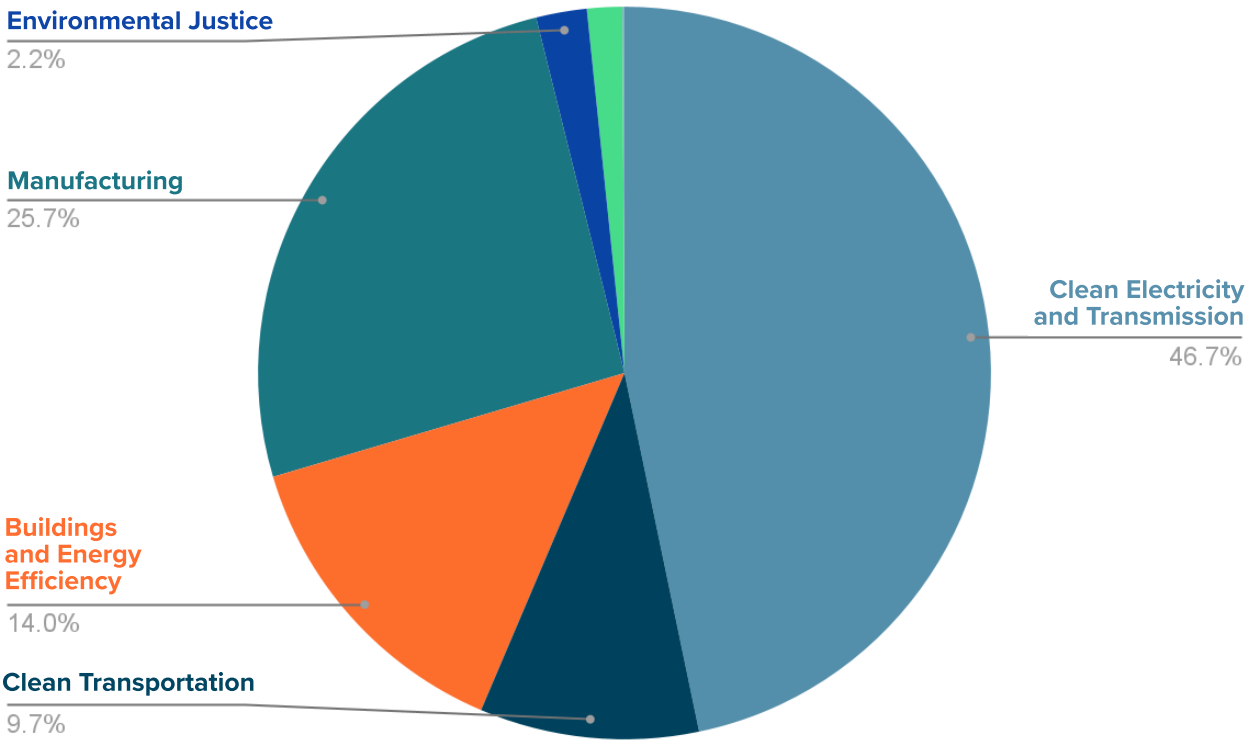
5. Note that this does not refer to the "indirect" or "induced" effects on overall economic activity described below, but rather to a change in private spending that directly accompanies or is incentivized by a given change in government spending.

6. This is not to suggest that some of this spending would not have taken place were it not for the credit; much of it may be "inframarginal," meaning that it is claimed by producers who would have spent money on an eligible project even if the credit were not available. However, our estimates of how much these credits will cost the federal government are based on the CBO's projections of their net budgetary impact, so it is reasonable to assume that much of this will in fact be new spending.

TABLE 1B: IRA CLIMATE PROVISIONS — ESTIMATED TOTAL EXPENDITURES, PUBLIC AND PRIVATE (BILLIONS OF DOLLARS), 2023-2032

Category	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	TOTAL
Clean Electricity and Transmission	0.0	11.6	31.3	61.6	101.3	129.8	131.5	120.6	111.5	107.8	807.0
Clean Transportation	0.5	16.3	16.2	18.9	17.4	22.7	19.1	17.6	18.7	19.6	166.9
Buildings and Energy Efficiency	0.9	28.0	23.0	26.9	28.7	28.5	27.8	27.1	26.1	25.1	242.2
Manufacturing	0.0	19.0	24.9	33.5	47.4	58.3	55.9	47.2	60.1	97.4	443.7
Environmental Justice	0.0	1.0	4.1	7.3	9.0	7.7	4.2	2.0	1.7	1.6	38.6
Conservation and Agriculture	0.0	0.7	1.8	3.2	4.8	5.2	4.3	3.4	2.3	1.0	26.8
Fossil Fuels	0.0	0.1	0.2	0.3	0.5	0.3	0.0	0.0	0.0	0.0	1.6
TOTAL	1.4	76.7	101.6	151.7	209.1	252.5	242.8	218.0	220.4	252.6	1,726.7

FIGURE 1B: IRA CLIMATE AND ENERGY PROVISIONS — ESTIMATED TOTAL (PUBLIC AND PRIVATE) EXPENDITURE SHARES, 2023-2032



In all of our modeling we assume that Congress will ultimately appropriate all funds authorized by the bill, whether these appropriations are made explicitly in the IRA itself or not, and that actual expenditures will follow the path projected by the CBO.

Model Results

The following table and figure display the results of using our model to estimate the average annual employment effects of the climate and energy provisions in the Inflation Reduction Act.[7] In total, we find that the bill would create or preserve about 1 million jobs on average from 2023 to 2032.[8] We disaggregate these effects into three categories, termed *direct, indirect,* and *induced* jobs.

The distinctions among these are explained in greater detail in Appendix A but, in brief, *direct* jobs are those created through hiring by recipients of appropriated funds, *indirect* jobs are those created along the supply chains that support the work of the direct hires, and induced jobs are those stemming from the economic stimulus provided by the spending of workers in the first and second categories.

TABLE 2: AVERAGE EMPLOYMENT EFFECTS, 2023-2032

Average Number of Jobs Created or Preserved (Direct)	Average Number of Jobs Created or Preserved (Indirect)	Average Number of Jobs Created or Preserved (Induced)	Average Number of Jobs Created or Preserved (Total)[9]
161,705	571,696	293,360	1,026,761

The calculation of induced jobs is based on certain assumptions about the *multiplier effect* associated with consumer spending,[10] the size of which is likely to fluctuate over the course of the business cycle. For that reason, one could interpret the sum of the direct and indirect jobs as a lower bound on our overall estimates.

All in all, we find that, over the next decade, the IRA climate and energy spending would create or preserve an average of about 162,000 jobs directly, about 733,000 in the direct and indirect categories, and about 1 million in all three.

In Table 3 and the accompanying figure, we show our projection of the impact that these measures would have on U.S. gross domestic product (GDP) over the same timeframe. The total contribution to GDP over this period is approximately $1.7 trillion, or around $170 billion per year.

7. Estimates of employment increases are obtained by using data from the Bureau of Economic Analysis (BEA) to calculate the ratio of gross output to employment in each industry in 2021 (the most recent year for which data are available), and then multiplying the output effects from our model by these ratios.

8. To be precise, our model provides annual employment estimates of how many jobs will be created or preserved by the bill's spending in that year. Summing up these figures across years yields an estimate of the aggregate impact in terms of job-years, where a job-year denotes one job for one year. Since specific jobs may last for different lengths of time, and since converting job-years into a total number of jobs would require additional assumptions about the average length of employment in different industries and locations, we report our results as annual averages for the sake of simplicity and clarity.

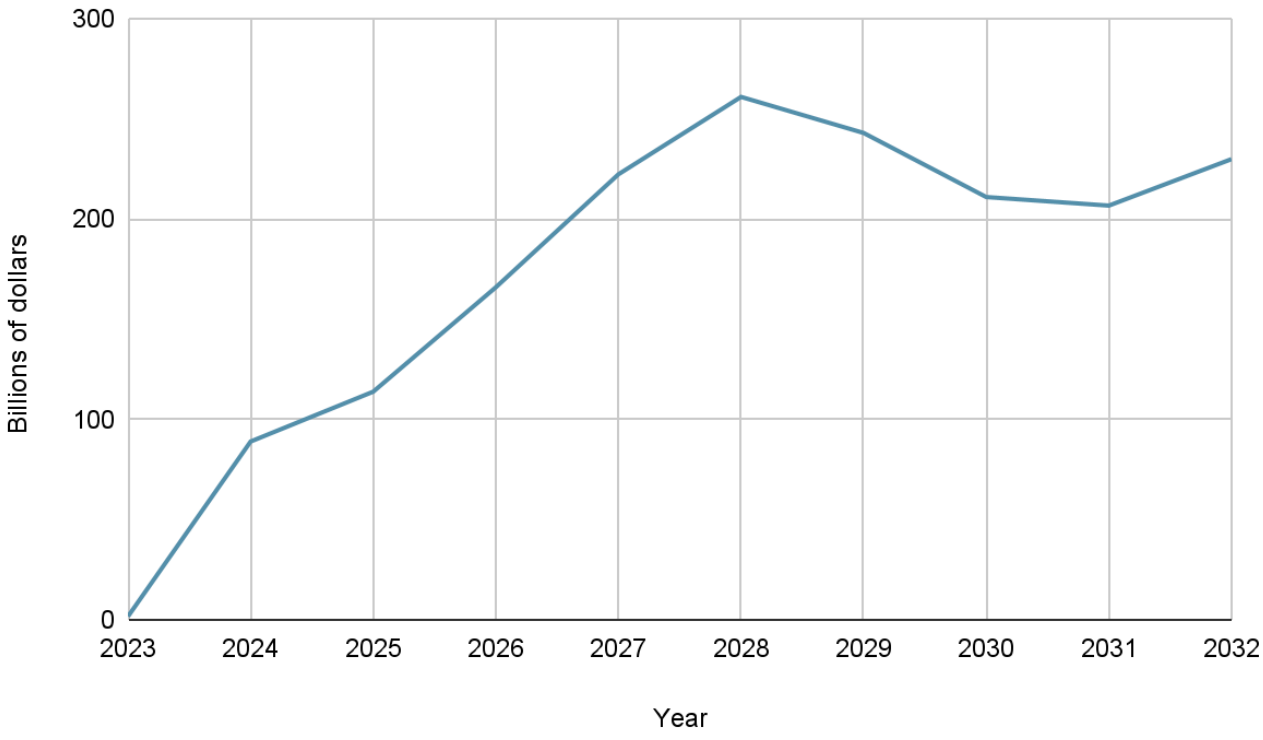
9. Values for each category do not exactly sum to total due to rounding.

10. See Appendix A for more detail on the assumptions underlying the estimation.

TABLE 3: AGGREGATE EFFECTS ON VALUE ADDED/GDP, 2023-2032

Year(s)	Annual Net Increase in Value Added (billions of 2022 dollars)[11]
2023	1.69
2024	88.99
2025	113.87
2026	166.00
2027	222.40
2028	261.03
2029	243.02
2030	211.04
2031	206.77
2032	229.96
TOTAL:	$1,744.76

FIGURE 2: AGGREGATE EFFECTS ON VALUE ADDED/GDP, 2023-2032



11. Inflation 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 future years, we assume a 3 percent annual rate of inflation.

In Table 4 we offer a breakdown of total estimated job creation by industry. We find that manufacturing and construction each account for about one quarter of total job creation. While our model does not directly allow us to estimate the likely wage distribution or other characteristics of the jobs supported by the IRA, we note that most of the tax credit provisions either have mandatory labor requirements or condition receipt of a preferential rate on adherence to more stringent guidelines, such as Davis-Bacon prevailing wage standards or apprenticeship requirements.[12] This suggests that many of the direct jobs created by this legislation are likely to be the sort of "good jobs" that progressive policy should strive to promote as part of a just transition to a clean energy economy.[13]

Scientific, professional, and technical services would account for around 13 percent of the jobs created, and agriculture and forestry for around 9 percent, consistent with the IRA's attention to rural development, wildlife conservation, and the adoption of renewable power sources and sustainable farming practices by the nation's agricultural producers. About 7 percent of the jobs would be concentrated in administrative, support, waste management, and remediation services, which likely reflects the fact that a significant amount of the bill's spending is channeled toward environmental cleanup and anti-pollution initiatives The remainder would be distributed across other sectors.[14]

TABLE 4: TOP FIVE INDUSTRIES BY AVERAGE EMPLOYMENT IMPACT, 2023-2032

Industry	Average Number of Jobs Created or Preserved
Construction	247,913
Manufacturing	245,971
Professional, Scientific, and Technical Services	132,915
Agriculture, Forestry, Fishing, and Hunting	87,560
Administrative and Support and Waste Management and Remediation Services	74,149

In addition to modeling the aggregate employment effects, we can also consider the likely distribution of jobs across states. To that end, we take the total estimates we obtain from our model and allocate them across states using information from the bill text that allows us to project the probable geographic patterns of the spending in each major category.[15]

The following table shows the breakdown of average annual jobs created or preserved by the IRA climate and energy provisions over the period 2023-2032, for the 10 states that see the largest impacts.[16]

12. The Davis-Bacon Act of 1931 is a federal law that requires contractors and subcontractors performing public works projects that receive federal funding to ensure that all workers are paid the "prevailing wage" (and prevailing fringe benefits) for their occupations in the local area where the work is being performed. Determinations of what constitutes the prevailing wage for a given place, occupation, and year are issued by the Department of Labor. For more details see https://www.dol.gov/agencies/whd/government-contracts/construction/faq#23.

13. Amanda Novello (July 9, 2021). "Job Creation for a Clean Jumpstart." Data for Progress. Available at https://www.dataforprogress.org/memos/job-creation-for-a-clean-jumpstart.

14. The industry categories here correspond to two-digit North American Industry Classification System (NAICS) codes, also known as "sectors." We present results for all 20 sectors in the full NAICS categorization scheme in Appendix E.

15. See Appendix C for more detail on this allocation procedure.

16. The full results for all states are available in Appendix D.

TABLE 5: AVERAGE EMPLOYMENT EFFECTS BY STATE, 2023-2032

State	Average Number of Jobs Created or Preserved (Direct)	Average Number of Jobs Created or Preserved (Indirect)	Average Number of Jobs Created or Preserved (Induced)	Average Number of Jobs Created or Preserved (Total)
CA	18,020	69,518	35,223	122,761
TX	13,317	53,846	26,995	94,158
FL	8,412	31,683	16,113	56,208
NY	7,520	26,831	13,810	48,161
IL	7,021	23,137	12,090	42,248
PA	7,142	21,756	11,586	40,484
OH	6,901	21,680	11,408	39,989
MI	5,802	18,773	9,835	34,410
NC	5,197	18,190	9,365	32,752
GA	5,226	17,663	9,176	32,065

Finally, we also break down our jobs estimates by major category in Table 6. Commensurate with the fact that it receives nearly half of the expenditures, clean electricity and transmission accounts for just under half of the total employment impacts.

TABLE 6: TOTAL EMPLOYMENT EFFECTS BY CATEGORY, 2023-2032

Category	Average Number of Jobs Created or Preserved
Clean Electricity and Transmission	453,952
Clean Transportation	93,281
Buildings and Energy Efficiency	161,226
Manufacturing	270,222
Environmental Justice	29,153
Conservation and Agriculture	17,920
Fossil Fuels	1,006
TOTAL	**1,026,760**

Conclusion

Using the Data for Progress Jobs Model, we find that the climate and energy provisions of the Inflation Reduction Act would create or preserve an average of around 1 million jobs from 2023 to 2032 and would contribute around $1.7 trillion to the U.S. GDP over the same period. We also find that many of the jobs created or maintained by this legislation would be concentrated in the areas of construction, manufacturing, science, agriculture, and environmental remediation.

The 117th Congress made historic strides in mitigating climate change by passing the IRA. Although much more certainly needs to be done to transition our economy and energy system toward lasting sustainability, particularly as partisanship may threaten to undo some of the IRA's accomplishments, the law nevertheless constitutes a historic investment in climate action and a strong foundation for future action — and one that supports the creation of millions of good jobs at the same time.

Appendix A: Background on Input-Output Modeling

In this section, we describe the basics of the I-O framework used to generate our estimates, as well as some of the assumptions and methodological choices that are specific to our analysis. Appendix B contains even more detail about the mathematics underlying the model.[17]

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.18 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; and
- **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.[19] 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 $1 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 $1 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

17. Even more background and a case study can be found in "Introduction to the Data for Progress Jobs Model," available at https://www.dataforprogress.org/memos/2022/2/28/introduction-to-the-data-for-progress-jobs-model.

18. For further background on I-O modeling, see Ronald E. Miller and Peter D. Blair (2009), Input-Output Analysis: Foundations and Extensions, 2nd Ed. Cambridge, U.K.: Cambridge University Press.

19. Robert Pollin, Heidi Garrett-Peltier, James Heintz, and Bracken Hendricks (2014), "Green Growth: A U.S. Program for Controlling Climate Change and Expanding Job Opportunities," available at https://peri.umass.edu/fileadmin/pdf/Green_Growth_2014/GreenGrowthReport-PERI-Sept2014.pdf.

a potentially complicated one, but for the sake of simplicity, in our baseline model run we choose to follow the approach of Pollin, Garrett-Peltier, Heintz, and Hendricks (2014),[20] who assume on the basis of relevant macroeconomic research that consumer spending has a multiplier of approximately 1.4. 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 each year, 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.

20. For our purposes here, all of the BEA tables that we use rely on an industry classification scheme involving 71 industries based on the North American Industry Classification System (NAICS). To access these tables, see the Bureau of Economic Analysis webpage on "Input-Output Accounts Data," available at https://www.bea.gov/industry/input-output-accounts-data.

Appendix B: 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 *i*th row and the *j*th 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 *j*th row, which we denote by x_j, 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 *j*th 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 itself have to purchase inputs from other industries, and each of *those* industries will have to purchase *its* 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

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

where the matrix $(I\text{-}A)^{-1}$ is known as the *total requirements matrix* or the *Leontief inverse matrix*.

The entry in the *i*th row and *j*th 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.

Appendix C: Methodology for Allocating Employment Impacts Across States

To estimate employment effects by state, we take our model results for employment effects by industry and allocate them geographically as follows:

- In all cases, indirect and induced jobs in each industry are distributed across states according to the existing geographic distributions of employment in that industry as measured by the American Community Survey (ACS)[21];
- Direct jobs are allocated in the same way for those sections of the bill that do not specify how funds will be distributed geographically; for the others, direct jobs are allocated as follows:
    - For Sections 40001 (Coastal Climate Resilience) and 60102 (Clean Ports), we allocate direct jobs in proportion to states' share of total coastline miles. Data are taken from Congressional Research Service (November 9, 2006), "U.S. International Borders: Brief Facts."
    - For Section 50122 (High-Efficiency Electric Home Rebate Program), we allocate 5 percent of direct jobs in proportion to each state's share of the population of federally recognized tribes and the remaining 95 percent according to the existing distributions of employment in each industry; for Sections 50145 (Tribal Energy Loan Guarantee Program), 80001 (Tribal Climate Resilience), 80003 (Tribal Electrification Program), and 80004 (Emergency Drought Relief for Tribes), we allocate all direct jobs in this manner. Tribal population data come from the Harvard Project on American Indian Economic Development.22
    - For Sections 13404 (Electric Vehicle Charging and Alternative Fuels Tax Credit) and 22004 (Rural Electric Cooperative Loans), we allocate direct jobs according to reweighted geographic distributions of employment in each industry, with weights based on the share of each state's population located outside of metropolitan areas, as calculated from the ACS (which we take to be a proxy for the rural population). For Section 22002 (Rural Energy for America Program), we allocate 50 percent of direct jobs in this manner.
    - For Section 60103 (Clean Energy Fund), we allocate 55.55 percent of direct jobs according to reweighted geographic distributions of employment in each industry, with weights based on the share of each state's population falling below the poverty line, as calculated from the ACS (which we take to be a proxy for the low-income population). For Section 60501 (Neighborhood Access and Equity Grants Program), we allocate 50.73 percent of direct jobs in this manner. In each case, the relevant percentage is based on the fraction of funding in that section reserved for low-income or disadvantaged areas.

21. Although ACS data are available through 2020, we make use of the 2019 data to avoid potential issues with the reliability of survey results and the resulting sampling weights from the early phase of the pandemic.

22. Harvard Project on American Indian Economic Development, COVID-19 Response and Recovery Policy Brief No. 7 (November 3, 2021), "Assessing the U.S. Treasury Department's Allocations of Funding for Tribal Governments under the American Rescue Plan Act of 2021." Available at https://ash.harvard.edu/files/ash/files/assessing_the_u.s._treasury_departments_allocations_of_funding_for_tribal_governments.pdf?m=1635972521.

- For Section 13501 (Clean Manufacturing Investment Tax Credit), we allocate 60 percent of direct jobs in proportion to a proxy for a state's share of qualifying Census tracts as defined in 26 U.S.C. 48C. This measure is constructed using data on mines from the U.S. Energy Information Administration's (EIA) Energy Atlas[23] and data on power plant retirements from EIA generator reports.[24] The remainder of the direct jobs are allocated according to the existing geographic distributions of employment in each industry. We thank Jake Higdon of the U.S. Department of Energy for his assistance with navigating these datasets.
- For Section 80002 (Native Hawaiian Climate Resilience), we allocate all direct jobs to Hawaii.

One point to note is that we do not attempt to model the geographic impact of provisions in certain sections of the bill that target spending at "energy communities." As some have pointed out, this term appears to be subject to definitional ambiguity that will likely be resolved through future guidance from the Treasury Department.[25]

23. Available at https://atlas.eia.gov/apps/all-energy-infrastructure-and-resources/explore.

24. Available at https://www.eia.gov/electricity/data/eia860/.

25. Daniel Raimi and Sophie Pesek (September 7, 2022), "What Is An Energy Community?" Resources Magazine. Available at https://www.resources.org/common-resources/what-is-an-energy-community/.

Appendix D: Estimated Average Annual Employment Effects for All 50 States/District of Columbia, 2023-2032

State	Average Number of Jobs Created or Preserved (Direct)	Average Number of Jobs Created or Preserved (Indirect)	Average Number of Jobs Created or Preserved (Induced)	Average Number of Jobs Created or Preserved (Total)
AL	2,564	8,226	4,311	15,101
AK	681	1,590	788	3,059
AZ	3,375	11,346	5,783	20,504
AR	1,510	5,318	2,736	9,564
CA	18,020	69,518	35,223	122,761
CO	2,897	11,764	5,869	20,530
CT	1,658	6,047	3,105	10,810
DE	353	1,321	672	2,346
DC	283	1,074	546	1,903
FL	8,412	31,683	16,113	56,208
GA	5,226	17,663	9,176	32,065
HI	476	1,917	958	3,351
ID	861	3,366	1,692	5,919
IL	7,021	23,137	12,090	42,248
IN	4,297	12,741	6,819	23,857
IA	1,958	6,886	3,528	12,372
KS	1,397	5,093	2,601	9,091
KY	2,411	7,638	3,970	14,019
LA	1,980	7,979	3,976	13,935
ME	799	3,380	1,666	5,845
MD	2,359	9,629	4,813	16,801
MA	3,172	12,005	6,108	21,285
MI	5,802	18,773	9,835	34,410
MN	3,256	10,440	5,481	19,177
MS	1,480	5,112	2,633	9,225
MO	3,065	10,257	5,341	18,663
MT	620	2,146	1,075	3,841
NE	1,036	3,780	1,929	6,745
NV	1,196	4,413	2,249	7,858
NH	823	3,052	1,558	5,433
NJ	4,052	13,771	7,180	25,003
NM	843	3,436	1,692	5,971
NY	7,520	26,831	13,810	48,161
NC	5,197	18,190	9,365	32,752
ND	456	1,771	869	3,096
OH	7,142	21,756	11,586	40,484
OK	2,509	6,895	3,511	12,915
OR	2,462	8,626	4,443	15,531
PA	6,901	21,680	11,408	39,989
RI	508	1,722	898	3,128
SC	2,666	9,274	4,785	16,725
SD	581	1,856	936	3,373
TN	3,703	12,289	6,420	22,412
TX	13,317	53,846	26,995	94,158
UT	1,532	5,519	2,827	9,878
VT	290	1,170	585	2,045
VA	3,674	13,792	6,992	24,458
WA	3,840	14,821	7,483	26,144
WV	967	2,649	1,395	5,011
WI	4,077	13,279	6,933	24,289
WY	311	1,230	603	2,144
TOTAL:[26]	**161,536**	**571,697**	**293,360**	**1,026,593**

26. Note that, due to rounding, the total jobs figure for the state allocation is not exactly equal to the figure reported for the U.S. as a whole.

Appendix E: Average Employment Impact by Industry, 2023-2032

Industry	Average Number of Jobs Created or Preserved
Construction	247,913
Manufacturing	245,971
Professional, Scientific, and Technical Services	132,915
Agriculture, Forestry, Fishing, and Hunting	87,560
Administrative and Support and Waste Management and Remediation Services	74,149
Transportation and Warehousing	37,782
Wholesale Trade	35,216
Other Services	29,990
Management of Companies and Enterprises	29,688
Retail Trade	25,523
Finance and Insurance	15,231
Accommodation and Food Services	14,757
Mining, Quarrying, and Oil and Gas Extraction	14,737
Public Administration	12,713
Utilities	7,462
Real Estate and Rental and Leasing	6,243
Information	5,693
Arts, Entertainment, and Recreation	1,834
Educational Services	1,266
Health Care and Social Assistance	119
TOTAL	1,026,761

Appendix F: Complete List of Inflation Reduction Act Climate and Energy Expenditures

Category	Section Number	Provision[27]	Estimated Total Public Spending, 2023-2032 (Millions of Dollars)[28]
Clean Electricity and Transmission	13101	Renewable Energy Production Tax Credit	51,061
	13102	Investment Tax Credit	13,963
	13103	Low-Income Solar and Wind Investment Tax Credit	N/A (Amount included in Sections 13101 and 13102)
	13104	Carbon Capture Tax Credit	3,228
	13105	Nuclear Production Tax Credit	30,001
	13701	Clean Electricity Production Credit	11,204
	13702	Clean Electricity Investment Credit	50,857
	13703	Cost Recovery for Qualified Facilities, Qualified Property, and Energy Storage Technology	625
	22001	Rural Renewable Energy Loans	1,000
	22004	Rural Electric Cooperative Loans	9,600
	50141	DOE Clean Energy Loan Guarantee Program	3,340
	50144	Energy Infrastructure Reinvestment Financing	3,495
	50145	Tribal Energy Loan Guarantee Program	75
	50151	Transmission Facility Loans	1,460
	50152	Interstate Transmission Line Grants	725
	50153	Interregional Transmission Planning Investments	100
Clean Transportation	13401	Electric Vehicle Tax Credit	7,539
	13402	Used Electric Vehicle Tax Credit	1,346
	13403	Commercial Electric Vehicle Tax Credit	3,582
	13404	Electric Vehicle Charging and Alternative Fuels Tax Credit	1,738
	13201	Biodiesel Tax Credit	5,571
	13203	Aviation Fuel Tax Credit	49
	13704	Alternative and Clean Fuels Production Tax Credit	2,946
	70002	USPS Electric Vehicles	3,000
	60102	Clean Ports	3,000

27. Descriptions of provisions draw on those from McCarthy (2022), "Analysis of Climate and Energy Provisions in the 'Inflation Reduction Act of 2022" and CBO (2022), "Estimated Budgetary Effects of H.R. 5376, the Inflation Reduction Act of 2022."

28. CBO (2022). Estimated total public spending refers to what the CBO terms "estimated budgetary impacts" or "estimated outlays." This often but does not always coincide with the amounts authorized by the law.

	60101	Zero-Emissions Trucks and Buses	1,000
	60501	Neighborhood Access and Equity Grants Program	2,800
	50172	National Laboratory System	2,000
	22002	Rural Energy for America Program	1,977
Buildings and Energy Efficiency	13301	Residential Energy Efficiency Tax Credit	12,450
	13302	Residential Clean Electricity Tax Credit	22,023
	13303	Commercial Energy Efficiency Tax Deduction	363
	13304	New Energy Efficient Home Tax Credit	2,042
	50121	Home Electrification and Energy Efficiency Rebates	4,300
	60502	GSA Federal Building Investments	250
	50122	High-Efficiency Electric Home Rebate Program	4,500
	50123	State-Based Home Energy Efficiency Contractor Training Grants	200
	30002	Affordable Housing Resilience and Efficiency Investments	990
	50131	Efficient Building Code Adoption Grants	905
Manufacturing	13204	Clean Hydrogen Tax Credit	12,864
	13501	Clean Manufacturing Investment Tax Credit	6,255
	13502	Wind, Solar, and Battery Manufacturing Production Tax Credit	30,623
	30001	Defense Production Act	475
	50142	EV Manufacturing Loans	920
	50143	EV Manufacturing Grants	2,000
	50161	Industrial Emissions Reduction Investments	5,250
	60116	Low-Embodied Carbon Labeling for Construction Materials	100
	60503	Use of Low-Carbon Materials	2,150
	60504	General Services Administration Emerging Technologies	975
	60505	Environmental Review Implementation Funds	95
	60506	Low-Carbon Transportation Materials Grants	1,700
	70006	FEMA Building Materials Program	61
Environmental Justice	13601	Reinstatement of Superfund	10,516
	60103	Clean Energy Fund	19,980
	60104	Diesel Emissions Reductions	60
	60105	Funding to Address Air Pollution	281
	60106	Funding to Address Air Pollution at Schools	50
	60108	Funding for Section 211(O) of the Clean Air Act	15
	60109	Funding for Implementation of the American Innovation and Manufacturing Act	39
	60110	Funding for Enforcement Technology and Public Information	25

	60111	Greenhouse Gas Corporate Reporting	5
	60114	Climate Pollution Reduction Grants	4,050
	60201	Environmental and Climate Justice Block Grants	3,000
	60401	Environmental and Climate Data Collection	33
	80001	Tribal Climate Resilience	235
	80002	Native Hawaiian Climate Resilience	25
	80003	Tribal Electrification Program	150
	80004	Emergency Drought Relief for Tribes	13
Conservation and Agriculture	21001	Environmental Quality Incentives Program (EQIP)	15,314
	21002	Agricultural Conservation Technical Assistance	1,400
	22003	Biofuel Production Grants	500
	23001	Federal Forest Restoration Investments	2,145
	23003	Non-Federal Forest Conservation Grants	2,000
	40001	Coastal Climate Resilience	2,550
	40002	Facilities of the National Oceanic and Atmospheric Administration (NOAA) and National Marine Sanctuaries	200
	40003	NOAA Efficient and Effective Reviews	20
	40004	NOAA Oceanic and Atmospheric Research and Forecasting for Weather and Climate	200
	40005	NOAA Computing Capacity and Research for Weather, Oceans, and Climate	190
	40006	NOAA Acquisition of Hurricane Forecasting Aircraft	100
	50221	National Parks and Public Lands Conservation and Resilience	250
	50222	National Parks and Public Lands Conservation and Ecosystem Restoration	250
	50223	National Park Service Employees	500
	50224	National Park System Deferred Maintenance	200
	50231	Bureau of Reclamation Domestic Water Supply Projects	550
	50232	Canal Improvement Projects	25
	60301	Endangered Species Act Recovery Plans	125
	60302	Funding for the United States Fish and Wildlife Service to Address Climate-Induced Weather Events	125
Fossil Fuels	60113	Methane Emissions Reduction Program	1,550
TOTAL			**395,444**