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DO GREEN PROGRAMS CREATE JOBS OR DESTROY JOBS?

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ABSTRACT: Green jobs are of intense interest in the USA – especially the issue of net job creation: Do green programs create jobs or destroy jobs?We determine that there are two issues: 1) the issue of when investing a specified amount in a green jobs initiative, how many jobs are created compared to investing the same amount in other programs; 2) the issue of whether the creation of jobs via green initiatives destroys "non-green" jobs.Here we address thesecritical questions by analyzing the major studies conducted. We find that there are numerous studies finding both that green programs create jobs and that green programs destroy jobs. Nevertheless, we conclude, with caveats, that rigorous review of the existing research indicates that investments in environmental and green economy programs will likely have substantial net positive impacts on the economy and jobs. We caution that the net positive economic and jobs impacts, while significant for policy purposes, should not obscure the fact that the major purpose of these programs is the energy and environmental and benefits they will create -- jobs benefits are an important secondary benefit, but must be evaluated as such.

KEY WORDS: *green jobs; USA green jobs; net green jobs; green jobs creation; green jobs vs. non-green jobs*

I. Introduction

There is currently intense controversy concerning green jobs, especially the issue of net job creation: Do green programs, initiatives, and investment create jobs or destroy jobs?This controversy is currently relevant due to, for example:

- The increasing prevalence of green jobs in the U.S. economy.
- The rapid growth of these jobs that is forecast.
- The increasing emphasis on environmental and climate concerns.
- The Biden Administration's infrastructure, Green New Deal, clean energy, and related initiatives.[1]
- The skepticism expressed by organized labor with respect to potential job displacement and salary differentials.

The issue of net jobs is critical, but is rarely addressed in green jobs studies. There are at least two different concepts of net green jobs:

- First, there is the issue of when investing a specified amount of funds in a green jobs initiative or program, how many jobs in total would be created compared to investing the same amount of funds in other programs or initiatives.
- Second, there is the question of whether environmental regulations or the creation of green jobs via green initiatives destroys "non-green" jobs, and if so, how many compared to the green jobs created.

These issues are analyzed here.[2]

II. Comparative Jobs Per Dollar Invested

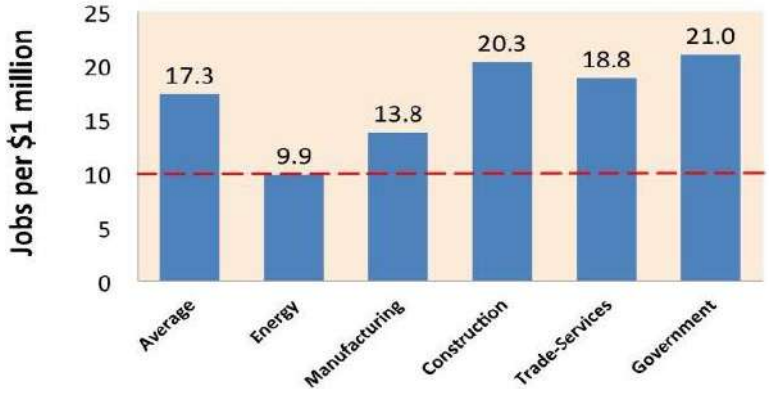
Numerous studies have assessed the issue of when investing a specified amount of funds in a green jobs initiative or program, how many jobs in total would be created compared to investing the same amount of

funds in other programs or initiatives – that is, comparative jobs per dollar invested. Several of the more significant of these are summarized below.

The American Council For an Energy Efficient Economy (ACEEE) contends that energy efficiency creates net gains in employment which extend well beyond the jobs that shift among industries in two ways. First, an initial effort or investment will create opportunities for workers. This stimulates opportunities for the construction sector and industries that support it. Second, energy bill savings that stem from the initial effort or investment will free up funds to support additional employment throughout the economy. Thus, energy efficiency investments not only inject funds into the economy to stimulate job creation, but they can also alleviate systemic unemployment by reducing energy bills and making those dollars available to support broader economic activity.[3]

ACEEE states argues that it is important to consider how efficiency diverts funds away from less labor-intensive sectors of the economy in order to support greater overall employment. On average, $1 million spent in the U.S. economy supports approximately 17 total jobs, including direct, indirect, and induced jobs – Figure II-1. It is important to note that the $1 million expenditure does not divide neatly into workers' salaries.Investments directed towards a specific industry may support greater or fewer jobs depending on the industry. As illustrated in Figure II-1, manufacturing supports 14 jobs per $1 million investment, while the trade-services sector supports 19 jobs.[4]

Figure II-1
Jobs Per Million Dollars of Revenue by Key Sectors of the U.S. Economy



Source: American Council For an Energy Efficient Economy.

Thus, an investment in energy efficiency will first create opportunities for workers in industries that are more labor intensive than average. For example, a retrofit project will create jobs in the construction sector, which supports approximately 20 jobs per $1 million, compared to the all-sector average of 17. Then, it will continue to support jobs year after year by saving energy. The energy savings generated by the investment diverts spending away from power generation and distribution, which supports just under 10 total jobs per $1 million (Figure II-1) back into the overall economy (which supports 17 jobs per $1 million).

The Institute for Governance & Sustainable Development (IGSD) noted that stimulating investments in the upgrade of the workforce and U.S. infrastructure that increase resource productivity will build new opportunities for millions of new jobs and careers over the next two decades. It estimated the job creation that can be stimulated by new investments in end-use energy efficiency, decarbonization, and clean renewable energy systems compared to new investments in traditional fossil fuel technologies.[5]

IGSDcharacterized the job and the scale of economic benefits of a 40% savings in the cost of the nation's retail electricity bills. It then asked the question: What if we imagine a much larger opportunity if we were to transform the nation's entire energy structure. The analysis found that mobilizing a cumulative investment of $1.2 trillion over the years 2021 through 2040 can reduce electricity end-use costs by 40% in the year 2040.[6]This stimulates an average net employment benefit of 2.8 million new jobs/year even as USA GDP increases more than $580 billion (in constant 2012 dollars) by 2040. The resulting reduction of GHGs and air pollution results in an average annual benefit of a further $112 billion in avoided air pollution and health costs (2020 dollars). The cumulative benefit of this economic reboot would be $2.1 trillion through 2040 (2020 dollars).

If policy-makers increase energy expendituresby 40%, IGSDestimated that the economic reboot would generate an average of 8.7 million net new jobs/year through 2040. Further, a complete 100% transformation of the overall energy system within the U.S. away from conventional fossil fuels and nuclear energy power plants to clean renewable energy would result in an average of 20 million new net jobs/year by 2040.[7]

The International Monetary Fund (IMF)estimated output multipliers for clean energy and biodiversity conservationspending, as well as for spending on non-ecofriendly energy and land use activities. IMF found that every dollar spent on key carbon-neutral or carbon-sink activities can generate more than a dollar's worth of economic activity – Table II-1. Although not all green and non-ecofriendly expenditures in the dataset are strictly comparable due to data limitations, estimated multipliers associated with spending on renewable and fossil fuel energy investment are comparable, and the former (1.1-1.5) are larger than the latter (0.5-0.6) with over 90% probability. These findings survive several robustness checks and lend support to bottom-up analyses arguing that stabilizing climate and reversing biodiversity loss are not at odds with continuing economic advances.[8]

Table II-1
Cumulated Multipliers associated to Green (Renewable) and Non-Eco-Friendly (Non-Renewable) Energy Investment Spending

Horizon	Green (Renewable) Energy Investments Multiplier	Non-Eco-Friendly Energy Investments Multiplier
Impact	1.19*	0.65*
1 Year	1.20*	0.64*
2 Years	1.19*	0.62*
3 Years	1.17*	0.59*
4 Years	1.14*	0.55
5 Years	1.11	0.52

*Multipliers with credible intervals, delimited by the 16th and the 84th percentiles that exclude zero.
Source: International Monetary Fund

IMFcontends these results are intuitive on three grounds:

1. Clean energy is more labor intensive than carbon-based fuels spending.
2. Clean energy implies a higher domestic content.[9]
3. Clean-energy investments produce far more jobs at all pay levelsthan the fossil fuel industry.[10]

The National Resources Defense Council (NRDC) found that clean-energy investments create more jobs than spending on fossil fuels across all levels of skill and education, and that the largest benefits will accrue to workers with relatively low educational credentials.[11]NRDC analyzed a $150 billion annual level of clean-energy investments in the U.S. economy. It found that out of the 1.7 million net increase in job creation, about 870,000 of the newly available jobs would be accessible to workers with high school degrees or less.[12] Approximately 614,000 of the newly expanded number of jobs available for workers with high school degrees or less will offer decent opportunities for promotions and rising wages over time. The job creation within this category is seven times larger than the number of jobs that would be created in this category by spending the same amount of money within the fossil fuel industry.

NRDC estimated that the net increase of 1.7 million jobs will generate about a 1% reduction in the unemployment rate. This should raise earnings for low-income workers by about 2%. Thus, NRDC found that this investment would create more jobs across all educational levels: 3.2 times more jobs overall than fossil-fuel in-vestments; 3.6 times more jobs requiring high school degrees or less; 2.6 times more jobs requiring college degrees or more; 3.0 times more jobs requiring some college.

Heidi Peltier contends that it is important that budgetary decisions be made that not only improve quality of life, but also that create jobs.[13]She also noted that conservation of land and water is generally an area with broad support, as nature appeals not only to lovers of natural beauty but also recreational enthusiasts, including hikers, park-goers, hunters, and anglers. In addition, conservation creates jobs. For each $1 million spent in conservation activities, between 17 and 31 jobs are supported depending on the industry where the investment is made, as shown in Table II-2.Alternative uses of the funds would, in many cases, created fewer

jobs, as shown in Table II-3. For example, she estimated Oil and Gas supports 8 jobs per $1 million spending, while Aviation supports 8.4jobs per $1 million spending.[14]

Table II-2
Conservation and related jobs per $1 million spending

	Direct	Indirect	Induced	Total
Support Activities for Forestry[5]	21.7	1.0	8.0	**30.8**
Forestry[6]	11.1	4.4	7.7	**23.1**
Conservation lands (including parks and conservation areas)[7]	10.9	3.7	6.0	**20.6**
Environmental and Technical Consulting[8]	9.0	2.8	8.0	**19.8**
Hunting-Trapping[9]	13.9	1.6	3.8	**19.3**
Fishing[10]	11.5	1.4	3.9	**16.8**

Source: Heidi Peltier.

Table II-3
Job creation potential of other areas, per $1 million spending

	Direct	Indirect	Induced	Total
Road and Bridge Repair[11]	9.7	3.9	7.5	**21.1**
Finance[12]	4.2	4.5	5.7	**14.4**
Solar power - design, manufacture, and install[13]	4.5	3.2	5.2	**12.9**
Oil and Gas[14]	1.7	3.1	3.6	**8.4**
Aviation[15]	2.4	2.0	3.6	**8.0**

Source: Heidi Peltier.

A Rockefeller Foundation (RF) report explored a "what if" scenario – what if the world took action to harness the full potential of distributed renewable energy technologies (DREs)to end energy poverty, setting in motion a green power transition across the energy poor world?[15] It combined qualitative case studies with predictive economic modelling to explore the job creation potential that would flow from a rapid increase in investment in DREs across 63 energy-poor countries in Asia and Africa. RF estimated that this would require $130 billion/year of capital investment over the coming decade. It would result in 25 million new jobs created globally in the power sector itself, which is more than 30 times the number of jobs that would be created by a comparable investment in fossil fuels. RF estimated that 491 million additional new jobs can be created in an array of downstream applications across agriculture, enterprises of various sizes, health, education etc. Further, hundreds of millions of existing jobs would be improved by the availability of clean, reliable power.[16]

RF determined that 19 million permanent jobs and almost 6 million temporary jobs are created in designing, building, operating, and maintaining new DRE power generating facilities. Almost half of these jobs are located in South Asia, the majority in India; a quarter are located in the Sub-Saharan Africa region, and a quarter in the East Asia & Pacific region. Modest grid-tied systems that could service a medium-sized business or a cluster of small enterprises engaged in activities such as milling, carpentry, or tailoring, represent 46% of these direct jobs. Installing off-grid solar systems for individual households and micro enterprises accounts for another 20% of total direct jobs created. By comparison, investing in large, centralized fossil fuel assets would create less than half a million jobs, the great majority of which are temporary, focused on the construction of power plants.[17]

RF found that direct jobs are dwarfed by the unique potential for DREs to grow employment throughout the economy by the utilization of the new electricity generatedfor so-called "productive uses." Based on a detailed assessment of 75 productive uses across 8 key economic sectors, RF estimated that:[18]

- Almost 500 million new jobs could be created in these downstream applications.
- Close to 700 million jobs could be improved.

Zachary Shahanestimated that if the U.S. national goal is to create jobs, investing in clean energy is several times more effective than investing in fossil fuel or nuclear jobs.[19] Thus, "The basic facts are simple. When we invest, say, $1 million in building the green economy, this creates about 17 jobs within the United States. By comparison, if we continue to spend as we do on fossil fuels and nuclear energy, you create only about 5 jobs per $1 million in spending. That is, we create about 12 more jobs for every $1 million in spending -

- 300% more jobs -- every time we spend on building the green economy as opposed to maintaining dependence on oil, coal, natural gas, and nuclear power."[20]

The UNEP/Sustainable Energy Finance Initiative (SEFI)analyzed the jobs impact of green initiatives compared to other programs.[21] UNEP/SEFI noted that there is substantialcontroversy about the desirability and effectiveness of such initiatives,and the following questions must be addressed:

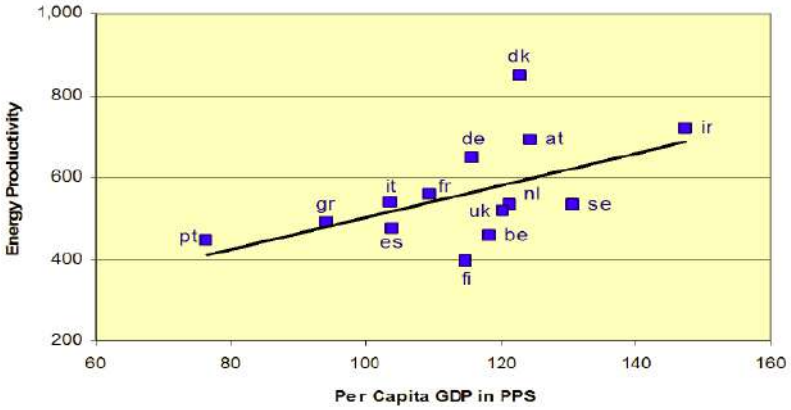
1. Do green programs facilitate economic growth and job creation?
2. Do green programs create more or fewer jobs than other types of economic stimulus programs, per dollar of spending?
3. How do the stimulus effects of green spending programs compare to those of tax cuts?

Issue 1: UNEP/SEFIfound that green programs facilitate economicgrowth and job creation. Investments in these programs stimulateeconomic growth and job creation, as well as providing various other economic andenvironmental benefits. It thus concluded that there is a strong positive relationshipbetween clean energy/energy efficiency/environmental investments and economicand job growth.For example:

- Figure II-2 shows that the relationship between economic efficiency and economic prosperity is positive: The more energy efficient the economy, the more prosperous it is.
- Figure II-3 shows net job creation in California from investments in green energy programs – total job gains in excess of the jobs lost in the fossil fuel industries and the carbon fuel supply chain. By 2007, annual net job creation totaled nearly 450,000 in the state.

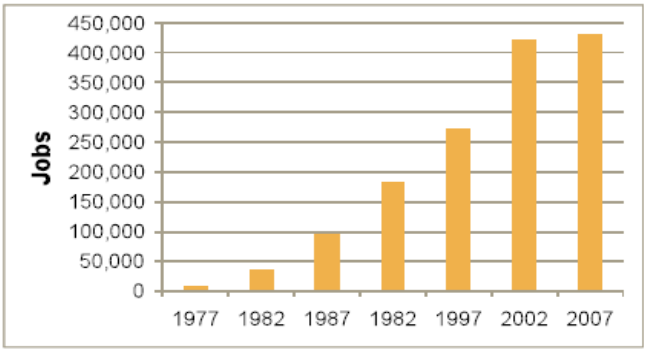
Thus, investments in clean energy and energy efficiency programs increase GDP,incomes, and jobs, reduce pollution and greenhouse gas (GHG) emissions, and save energy. Further, the relationshipbetween i) clean energy, energy efficiency, and environmental programs and ii)economic growth and job creation is positive, not negative.

Figure II-2:
Energy Efficiency and Economic Prosperity - 2006



Source: UNEP/SEFI.

Figure II-3:
Net Job Growth in California Resulting From GreenProgram Investments

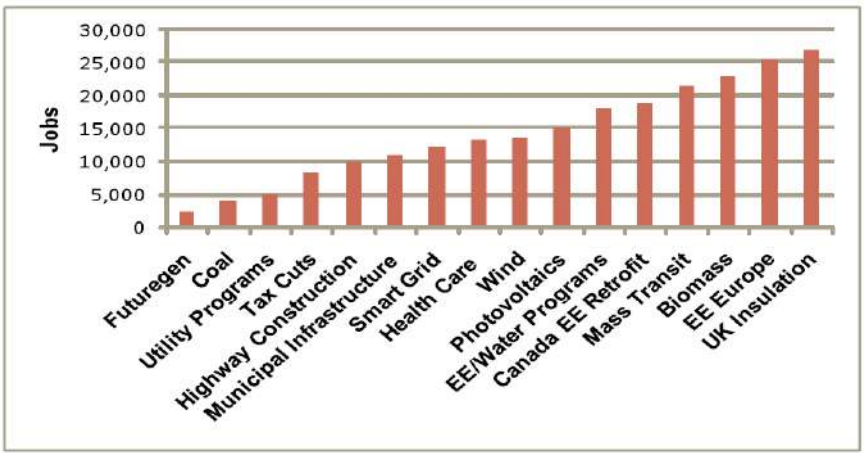


Source: UNEP/SEFI.

Issue 2: UNEP/SEFIfoundthat spending on greenstimulus programs is, dollar for dollar, more effective in creating jobs as is equivalentspending on more traditional alternatives, such as road construction or fossil fuelenergy programs. These findings are summarized in Figure II-4, which illustrates therelative job creation of different types of spending programs. Forexample, it shows that per dollar of spending:

- Photovoltaics create 50% more jobs than highway construction.
- Biomass creates twice as many jobs as does health care
- Insulation programs create three times as many jobs as municipal infrastructure.
- Mass transit creates four times as many jobs as utility programs.

Figure II-4
Jobs Generated Per Billion Dollars ofExpenditure on Selected Programs
(billion constant 2008 U.S. dollars)

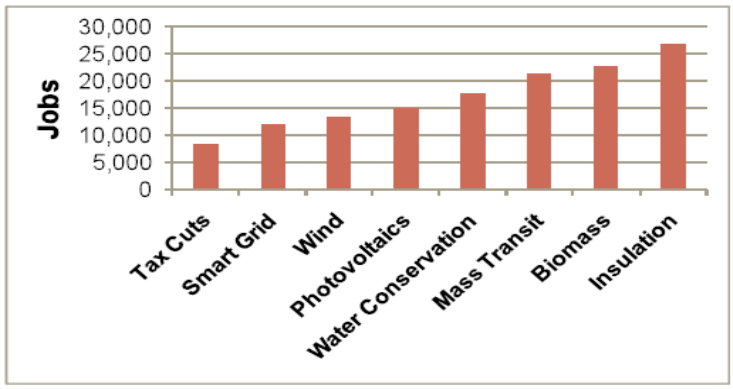


Source: UNEP/SEFI.

Issue 3: UNEP/SEFI found that green stimulus programs generate 3 to 4 times as many jobs/dollar, as tax cuts. Figure II-5 shows that, per billiondollars:

- Smart grid investments create 50% more jobs than tax cuts.
- Wind programs create 60% more jobs than tax cuts.
- Photovoltaics creates twice as many jobs as tax cuts.
- Water conservation programs create than twice as many jobs as tax cuts.
- Mass transit creates three times as many jobs as tax cuts.
- Biomass creates three times as many jobs as tax cuts.
- Insulation programs create three times as many jobs as tax cuts.

Figure II-5: Jobs Generated Per Billion Dollars of
Expenditure on Tax Cuts and Selected Green Programs
(billion constant 2008 U.S. dollars)



Source: UNEP/SEFI.

The World Resources Institute (WRI), the New Climate Economy (NCE), and the International Trade Union Confederation (ITUC)compared thenumber of jobs created per $1 million in a varietyof types of green infrastructure versus unsustainableinfrastructure.[22]Analyzing 12 studies, WRI/NCE/ITCU assessed the near-term job effects from cleanenergy versus fossil fuels, public transportation versusroads, electric vehicles versus internal combustion enginevehicles, and nature-based solutions versus fossil fuels.For each of these investment types they also investigatedjob quality, focusing on wages andbenefits, work security, opportunities for growth, worksafety, opportunities for social dialogue, and inclusivity ofmarginalized communities.

WRI/NCE/ITCUdetermined that $1 millionin green investments creates more neartermjobs than an equivalent amount of unsustainableinvestments, and sometimes significantlymore. They concluded that, from a jobs perspective,green investments should generally take precedenceover unsustainable investments when there is a choicebetween the two.[23] Further:

- Investments in mass transit, walking infrastructure, and cycling infrastructure generally create more jobs than investments in roads, and increase the productivity and inclusivity of the economy.
- Rail investments may create relatively fewer near-term jobs per unit of investment in the U.S., but railways and mass transit both create more long-term operations and maintenance jobs than roads do.
- The transition to electric vehicles (EVs) will lead to net job gains in the overall economy, but jobs are expected to be lost in the manufacturing sector.[24]
- Nature-based solutions like ecosystem restoration and sustainable agriculture can create many more jobs than investments in fossil fuels, reduce emissions, improve resilience to climate impacts, and benefit marginalized communities.[25]

III. Do Green Jobs Create or Displace Jobs?

III.A. Does the Green Economy Create Jobs?

Various studies have addressed the question of whether environmental regulations or green jobs initiatives destroys “non-green” jobs, and if so, how many compared to the green jobs created. The studies concluded that these regulations, initiatives, andclimate policiesresult in a net gain in jobs.For example:

- The Apollo Alliance proposed an investment of $500 billion over ten years to create five million green-collar jobs in a range of industries including renewable energy, energy efficiency, transit and transportation, and RD&D.[26]
- Arnold, Forrest, and Dujack examined claims about the costs of environment regulations by reviewing the available research.[27] They concluded that the view that environmental regulation harms the U.S. economy is not valid.
- Barret and Heorner assessed the impact of policies designed to increase energy efficiency and reduce carbon emissions, while improving overall economic efficiency.[28] They estimated that an additional 660,000 net jobs would be created in 2010 and 1.4 million in 2020.
- Bliese reviewed dozens of studies that tested the assertion that environmental protection harms the economy.[29] The results of these studies indicate that environmental protection normally has positive economic and jobs effects.
- Bernow, Cory, Dougherty, Duckworth, Kartha, and Ruth examined the impact of implementing a policies designed to bring the U.S. in compliance with the Kyoto Protocol.[30]They estimated that by 2010 almost 900,000 net new jobs would be created, relative to the baseline.
- The Center for American Progress and the Political Economy Research Institute estimated that spending $100 billion over two years would create two million jobs in building retrofitting, expansion of the transit and freight rail grids, construction of a “smart” electrical grid, wind and solar power, and next-generation biofuels.[31]
- The Environmental Policy Research Centre found that environmentally friendly technologies are associated with higher work intensity and increase in employment compared to conventional technologies.[32]
- Global Insight forecast that renewable power generation, building retrofitting, and renewable transportation fuels will generate 1.7 million new jobs and another 846,000 related engineering, legal, research and consulting positions. That total would increase to 3.5 million by 2028 and 4.2 million by 2038.[33]
- Meyer tested the hypothesis that pursuit of environmental quality hinders economic growth and job creation.[34] He found no evidence to support a negative relationship between environmental regulation

and economic performance, and his results showed the opposite: States with the most ambitious environmental programs had the highest levels of economic growth and job creation.

- The New Apollo Initiative proposed an economic development plan for the U.S. based on diversifying energy sources, making the U.S. less dependent on foreign oil, investing in green industries, andpromoting energy efficient buildings. It estimated that an annual $30 billion investment for 10 years would add 3.3 million jobs to the economy and increase GDP by $1.4.[35]
- The Political Economy Research Institute (PERI) assessed clean energy spending and compared spending on fossil fuels.[36] PERI found that on average, 2.7 full-time-equivalent (FTE) jobs are created from $1 million spending in fossil fuels, while that same amount of spending would create 7.5-7.7 FTE jobs in renewables or energy efficiency. "Thus each $1 million shifted from fossil to green energy will create a net increase of five jobs."[37]
- Renner found that creating an environmentally sustainable economy has already generated an estimated 14 million jobs worldwide.[38] He concluded that investing in the environment, in renewable energy, and energy efficiency will generate more jobs than investing in extractive industries and fossil fuels.
- University of California, Berkeley researchers found that California's efforts to reduce emissions have bolstered the state's economy and created more than 37,000 jobs.[39]
- The Union of Concerned Scientists analyzed the effects of implementing a renewable electricity standard (RES) that would require electric utilities to supply a set percentage of their electricity from renewable sources. It found that under a national RES of 20% by 2020, the USA would increase its total renewable power capacity 11-fold and create more than 355,000 new jobs.[40]
- University of Illinois research staff analyzed the Midwest's Clean Energy Development Plan, which advocated energy efficiency and renewable energy technologies. They estimated that implementing the plan would create more than 200,000 new jobs across the 10-state Midwest region by 2020.[41]
- Yapijakis found that widespread fears of job losses from environmental protection are unfounded and that, when job creation aspects of pollution control policies are factored in, environmental protection has increased net employment in the U.S.[42]

Several other examples are discussed in more detail below.

Bezdek, Wendling, and DiPerna analyzed the relationship between environmental protection, the economy, and jobs in the U.S.[43]They estimated the size of the U.S. environmental industry and the numbers of environment-related jobs at the national level and in the states of Florida, Michigan, Minnesota, North Carolina, Ohio, and Wisconsin.

They derived five major findings:

1. Environmental protection, economic growth, and jobs creation are complementary and compatible: Investments in environmental protection create jobs and displace jobs, but the net effect on employment is positive.
2. Environment protection has grown rapidly to become a major sales-generating, job-creating industry – $300 billion/yr. and 5 million jobs in 2003.
3. Most of the 5 million jobs created are standard jobs for accountants, engineers, computer analysts, clerks, factory workers, etc., and the classic environmental job (environmental engineer, ecologist, etc.) constitutes only a small portion of the jobs created.
4. At the state level, the relationship between environmental policies and economic/job growth is positive, not negative – Tables III-1and III-2. Thus, states can have strong economies and simultaneously protect the environment.
5. Environmental jobs are concentrated in manufacturing and professional, information, scientific, and technical services, and are thus disproportionately the types of jobs all states seek to attract.

Consoli, Marin, Marzucchi, and Vonaanalyzed labor force characteristicsassociated with environmental sustainability.[44]Using U.S. data,they compared green and non-green occupations to detect differences in terms of skill content and ofhuman capital. They found that green jobs use high-level abstractskills significantly more than non-green jobs. Further, green occupations exhibithigher levels of education, work experience, and on-the-job training.

Table III-1
Summary of the Environmental Industries in Six States in 2003

	Environmental industry (billions) ($)	Environmental jobs	Environmental industry as a percent of		State environmental industry as a percent of		Private sector environmental jobs	
			State GDP (%)	State jobs (%)	Total US environmental industry (%)	Total US environmental jobs (%)	Manufacturing (%)	Professional, scientific, technical (%)
Florida	15.4	220,000	3.1	3.0	5.0	4.4	7	22
Michigan	12.9	217,000	3.9	4.9	4.3	4.4	29	29
Minnesota	5.1	92,000	2.6	3.5	1.7	1.8	21	23
North Carolina	9.1	112,000	3.1	2.9	3.0	2.9	24	20
Ohio	12.2	176,000	3.2	3.3	4.1	3.5	29	25
Wisconsin	5.4	97,000	2.9	3.5	1.8	2.0	31	16

Source: Bezdek, Wendling, and DiPerna

Table III-2
Environmental-related Jobs in Each State, by Industry

Industry	Florida employment		Michigan employment		Minnesota employment		N. Carolina employment		Ohio employment		Wisconsin employment	
	Total	Environmental	Total	Environmental	Total	Environmental	Total	Environmental	Total	Environmental	Total	Environmental
Agriculture, forestry, fishing and hunting	2300	192	3515	216	800	86	3700	120	1564	129	2500	208
Mining	4900	459	5226	627	5200	515	4000	293	10,505	678	1300	145
Utilities	26,800	4973	24,136	6914	12,000	2902	14,000	2114	26,109	5949	11,600	2782
Construction	445,900	9966	173,244	8633	125,200	4497	211800	4732	212,409	7061	123,500	4295
Manufacturing	388,800	9849	659,736	38,895	344,300	11,974	604300	14,013	805,716	28,149	506,500	17,460
Wholesale trade	313,200	3692	178,545	4021	127,800	2151	163,600	1827	243,493	3634	113,000	1752
Retail trade	920,400	5833	503,576	351	301,700	1778	432,500	2502	591,557	322	319,000	1962
Transportation and warehousing	202,100	1300	90,412	544	80,100	507	110,700	632	130,002	516	94,600	555
Information	171,800	4278	86,397	170	62,600	1751	75,600	1797	103,334	148	49,700	1382
Finance and insurance	330,900	1962	168,065	202	138,100	1062	143,700	855	248,397	209	129,800	861
Real estate and rental and leasing	153,400	1680	61,676	278	37,900	527	47,800	577	66,212	248	27,900	416
Professional, scientific, and technical services	384,400	28,606	195,553	39,432	118,200	12,922	146,300	11,616	221,765	24,657	89,000	9341
Management of companies and enterprises	65,600	1032	152,641	2188	59,000	1385	61,200	971	134,502	1848	37,600	861
Administrative/support/waste management/ remediation services	897,500	41,971	294,857	25,287	117,300	7622	213700	10,801	319,058	17,242	118,200	7586
Educational services	108,400	3198	70,286	2537	48,400	1676	61,600	1753	97,489	3186	46,100	1807
Health care and social assistance	777,200	4364	516,974	1269	318,300	2099	366,600	1848	678,618	1205	320,500	2330
Arts, entertainment, and recreation	157,200	1030	52,009	449	36,900	247	44,000	240	58,265	399	35,500	229
Accommodation and food services	651,300	5286	327,545	188	196,200	1525	291,000	1837	410,303	187	209,500	1641
Other services	317,800	3107	175,892	2676	118,900	1330	162,400	1335	229,701	2465	131,300	1310
Public administration	1,055,500	86,723	670,515	81,624	402,400	35,545	644,600	52,865	801,500	77,877	411,800	40,337
State total	7,285,400	219,500	4,411,800	216,500	2,651,300	92,100	3,803,100	112,007	5,390,999	176,109	2,778,900	97,200

Source: Bezdek, Wendling, and DiPerna

Their major finding is that green occupations exhibit significant differences from non-greenoccupations. In particular, green jobs are characterized by higher levels of non-routinecognitive skills and higher dependence on formal education, work experienceand on-the-job training. The empirical evidence also indicates that the greening of theeconomy is in progress, and that work activities are not characterized by a high degreeof routinization. Their findings indicated that formaleducation, work experience and on-the-job training are more prominent among existingoccupations that are undergoing qualitative change due to the greening of the economycompared to similar non-green jobs.

The Donald Vial Center on the Green Economy assessed the economic impacts of California's major climate programs in the San Joaquin Valley: Cap and trade, the renewables portfolio standard, and investor-owned utility (IOU) energy efficiency programs.[45]It found that total net economic benefits the three programs

was $13.4 billion.The findings indicate that despite the fears of job losses, California's climate policies have been a net economic boon to the San Joaquin Valley:

- Net economic impacts from the cap-and-trade program through December 2016 include $200 million in total economic impact, including $4.7 million in state and local tax revenue. These programs have created 1,612 total jobs in the Valley, including 709 direct jobs. This figure increases to nearly $1.5 billion when accounting for total impact on the economy. These projects will create 10,500 jobs, including 3,000 direct jobs.
- The state's Renewables Portfolio Standard (RPS) is a key source of job creation. Construction on RPS-related projects resulted in a total economic impact of $11.6 billion in the Valley, and over 2002-15 RPS created 88,000 jobs, including 31,000 direct jobs.
- Energy efficiency projects in the Valley have had a net economic benefit of $1.18 billion and created 17,400 jobs in the Valley over 2006-2015, including 6,700 direct jobs.

Huntington noted that if green energy power projects provide more new jobs than conventional energy projects, they may stimulate more additional jobs as incomes expand.[46]He analyzed widely quoted estimates supporting the substantial benefits of renewable energy jobs, placed them in the context of other possible government responses, and provided a framework for comparing claims for job-creation on a consistent basis.

He derived job-creation estimates for power generation options and compared two estimates each for solar photovoltaic (PV), wind, and biomass with single estimates for coal and natural gas – Table III-3. The job estimates included only the direct impacts -- employment from construction, manufacturing, and installation of new facilities as well as the operations and management as well as fuel-processing costs of generating power. They excluded the indirect, inter-industry impacts. Even ignoring these effects, however, the estimates show renewable energy sources to be major job-generators.[47]

The job-creation effects were standardized on megawatts of capacity, adjusted for the percent of time each option was used over a typical year -- megawatts averaged (MWa). These conversions were made to emphasize how much each option was used to generate electricity rather than how much capacity was available. These estimates are reported in the first column of Table III-3.

The top four entries for renewable energy sources look extremely attractive relative to those for natural gas and coal. The job ratios shown in column (5) are the ratio of job creation for each technology relative to that for natural gas. These estimates suggest that solar PV may be about 8-11 times more effective in creating jobs than either coal or natural gas.[48]

Table III-3
Job Creation Associated with Different Generation Technologies

	(1)	(2)	(3)	(4)	(5)	(6)
					---Job Ratio---	
	Jobs/MWa	Jobs/GWh	Jobs/$MM	$/KWh	MWh	$
Solar PV	7.41	0.846	3.18	$0.2664	7.80	1.55
Solar PV	10.56	1.205	4.53	$0.2664	11.12	2.21
Wind	0.71	0.081	1.64	$0.0495	0.75	0.80
Wind	2.79	0.318	6.43	$0.0495	2.94	3.14
Biomass	0.78	0.089	1.80	$0.0496	0.82	0.88
Biomass	2.84	0.324	6.54	$0.0496	2.99	3.19
Coal	1.01	0.115	3.72	$0.0310	1.06	1.81
Natural Gas	0.95	0.108	2.05	$0.0529	1.00	1.00

Explanation:
Column (1), source: Kammen, Kapadia & Fripp (2006).
Column (2) = column (1) * (10^6) / 8760.
Column (3) = column (2) / column (4).
Column (4), source: Metcalf (2005), converted from cents per KWh.
Columns (5) & (6): Jobs Index (where natural gas equals 1.00).

MW = megawatts = capacity.
MWa = used capacity averaged over the year = (% capacity factor) x (capacity).
GWh = 1000 * megawatt hours = (1000) x (24 hours) x (365 days) x (% capacity factor) x (capacity).
GWh = MWa x 1000 x 8760.

Source: Hilliard Huntington

Konrad noted that not all green policies improve economic efficiency. For example, subsidies for not-yet-economic types of renewable energy like wave power and solar installations may be justifiable on the grounds that they are helping to promote needed future technologies, but they probably come at a net cost to near-term jobs (even if they may create more jobs in the long term by allowing the creation of new types of businesses).[49]

On the other hand, he contends that policies to promote energy efficiency will be strong net creators of jobs, because the cost of energy efficiency is typically only a fraction of the cost of the energy saved. The very existence of opportunities to save significantly on energy bills at modest cost is proof that the energy market is inefficient. In an efficient market, all such opportunities would have already been taken. Further, "After the energy efficiency measure has been installed, the cost savings can be used for useful economic activity, rather than wasted on unneeded fuel. This money will then spur additional activity and stimulate jobs."[50]

MISIestimated the economic and jobs impact of the USAdisplacing 1.2 billion tons of carbon emissions annually by 2030 using energyefficiency and renewable energy –the Tackling Climate Change (TCC) initiative. MISI:[51]

- Assessed the technologies deployed, their costs, and the necessary time frames.
- Estimated the job impacts of the policy.
- Determined that it would generate more than 4.5 million *net jobs*.
- Disaggregate the jobs created by industry, occupation, skill, and salary.
- Discussed the policy implications of the findings.
- Concluded that climate mitigation initiatives can be a major net job creator for the U.S.

Table III-4 summarizes the net costs and jobs impact of the TCCinitiative in 2020 and 2030.It illustrates that the net costs of the EE and REcomponents of the TCC initiative differ dramatically among technologies and over time.For example, in 2020, the net costs are –$67 billion; in 2030, the net costs are+$4 billion; in 2020, EE has net savings of $85 billion, while all of the RE technologiesexcept biofuels have net costs; in 2030, EE has net savings of $17 billion, while all of theRE technologies except wind and biofuels have net costs. The net savings from EEdecline significantly over the forecast period, from $85 billion in 2020 to $17 billion in2030: Biofuels net savings increase from $1 billion in 2020 to –$8 billion in 2030;biomass costs increase from $3 billion in 2020 to $4 billion in 2030; PV costs increasenearly three-fold, from $5 billion in 2020 to $16 billion in 2030; concentrating solar costsdecrease 60%, from $5 billion in 2020 to $2 billion in 2030; geothermal costs increase byover one-half, from $4 billion in 2020 to almost $7 billion in 2030. Annualized costsover the entire period also differ dramatically, from a –$108 billion for EE to more than$9 billion for biofuels and nearly $7 billion for concentrating solar.

Table III-4
Net costs and jobs resulting from the TCC initiative

	Net costs			*Net jobs*	
	Annualised	*2020*	*2030*	*2020*	*2030*
	Billion 2005 dollars			*Thousand FTE*	
Energy efficient	–$107.9	–$84.8	–$17.4	3,533	3,360
Wind	$0.0	$0.3	–$0.4	149	93
Biofuels	$9.2	–$0.5	–$7.6	261	257
Biomass	$2.6	$3.3	$4.5	122	172
Photovoltaics	$4.7	$5.3	$16.0	105	340
Concentrating solar	$6.6	$5.2	$2.2	156	147
Geothermal	$2.5	$4.0	$6.7	96	144
Total	–$82.3	–$67.2	$4.0	4,419	4,513

Source: MISI.

III.B. Does The Green Economy Destroy Jobs?

Other studies have addressed the question of whether environmental regulations or the creation of green jobs via green initiatives destroys "non-green" jobs, and if so, how many compared to the green jobs created and have concluded that these regulations, initiatives, andclimate policieswould result in net job losses.They contendthat there are no sound economic arguments to support an assertion that green energy policies will increase the total level of employment. For example, more people may be employed in manufacturing wind turbines and constructing wind farms, but this neglects the diversion of investment from the rest of the economy.Thus, it is necessary to assess macroeconomic and labor market policies to influence the level and composition of employment.[52]Several of these studies are summarized below.

The Beacon Hill Institute (BHI) contends that jobs, green or otherwise, are not benefits but are instead costs.[53] According to BHI, based on arbitrary assumptions or faulty methodologies, the forecasts of future greenjobs are completely unreliable. When BHI applies its own general equilibrium model to a cap andtrade proposal inIndiana, it estimates net job losses rather than gains.[54]In viewing thecreation of jobs as a benefit, green job studies make a fundamental error: Jobsare a cost in the process of production; the services a job provides are the benefit. Green jobadvocates claim that so-called sustainable technology for power generation, transport, orfood production will require more labor per unit of output than do conventional methods. This isa major cost of their proposals – not a benefit as they claim.

Epstein argues that President Biden's contention that his policies to eliminate U.S. CO_2 emissions using renewable energy will create millions of well-paying "green jobs" -- far more than will be destroyed in the fossil fuel industry – is false. Rather, a largely RE-based energy system will necessarily destroy far more well-paying U.S. jobs than it creates because the "green jobs" will be 1) far less productive, 2) largely in China, and 3) cause job losses in other industries. Specifically:[55]

- "Green jobs" are far less productive than the fossil fuel jobs that Biden is destroying -- so they cannot possibly pay as well.
- "Green jobs" mostly exist in China, which has a huge competitive advantage in mining, processing, and manufacturing. The main jobs involved in solar and wind energy are mining jobs, processing jobs and manufacturing jobs. Those jobs exist largely in China.
- By making American energy unaffordable and unreliable, it will destroy American industry and with it, American jobs. The biggest cost of "green jobs" is unaffordable and unreliable energy.

Epstein thus concludes that Biden's "green energy jobs" will cause "green joblessness" throughout the economy, with those connected to the fossil fuel industry being hardest hit. He notes that The Global Energy Institute estimates that a fracking ban alone "would eliminate 19 million jobs."[56] He thus concludes "Biden's energy plan will create a handful of unproductive 'green energy jobs' that will cause mass 'green joblessness' in not just the fossil fuel industry but in every other industry as well."[57]

Hafstead and Williams assessed the impact of environmental regulations on the labor market to demonstrate the strengths and weaknesses of current economic modeling related to jobs and environmental policy. They found that:[58]

1. Policymakers should be very cautious about relying on empirical job estimates or simulation modeling of job effects when making policy decisions.
2. The effects of environmental policy on overall employment are likely to be small, especially in the long run.
3. Environmental policy can cause substantial job reallocation: Fewer jobs in some industries and more jobs in others.
4. Different types of environmental policy have different impacts on the labor market.
5. Both the scope and scale of environmental policy are an important determinant of short-term labor market effects, but are less important for long-term effects.

They conclude that "Political conversations about whether environmental regulations kill or create jobs often miss the mark. Our paper sheds light on how environmental policies interact with the labor market, but our analysis is unable to address a broad range of questions often raised by policymakers: more economic research is necessary to build a better understanding about how new environmental policies will actually impact jobs and labor markets."[59]

The Heritage Foundation analyzed the Waxman-Markey bill and estimated that it would cause a loss of 1,145,000 jobs. These are net job losses, after any "new" green jobs are taken into account.[60] Heritage contended that real world experience confirms this: Governments that subsidize or mandate green jobs reap

fewer overall jobs and a weaker economy. It noted that green job advocates once emphasized Spain's aggressive alternative energy policy as a model for the U.S. America. However, in reality, Spain's green-jobs program should serve as a warning.

Unemployment in Spain reached 18%, nearly twice that of the U.S.Gabriel Calzada estimated that each green job Spain creates prevents 2.2 other jobs from being created.[61]The Danish think-tank CEPOS recently studied wind energy in Denmark, another oft-cited model for America. CEPOS found than each wind energy job there costs the government $90,000 to $140,000 annually -- much more than the jobs pay.[62]Nor are these jobs sustainable. Once the government handouts end, so do the jobs.

According to Heritage, the same lesson applies to the U.S.California has led the states in pursuing a green jobs agenda and environmentalists cite it as a model for nation. However, California has higher unemployment and energy costs and a weaker economy than nearly every other state.

Thus, Heritage concluded "Waxman-Markey would take the nation down the same job-killing path. Some jobs would be destroyed entirely. Others would be outsourced to nations that don't drink the cap-and-trade Kool-Aid."[63]

The Institute for Energy Research contends that Europe's policy and strategy for supporting the so-called "green jobs" orrenewable energy dates back to 1997, and has become one of the principaljustifications for U.S. "green jobs" proposals. However, an examination of Europe'sexperience reveals these policies to be terribly economically counterproductive.[64] The Spanish experience isa leading example followed by many policy advocates and politicians.This study marks the first time a critical analysis of the actual performance andimpact has been made and it demonstrates that the Spanish/EU-style"green jobs" agenda now being promoted in the U.S. in fact destroys jobs, detailing thisin terms of jobs destroyed per job created and the net destruction per installed MW.

They found that for every renewable energy job that the State manages to finance, Spain'sexperience reveals that the U.S. should expect a loss of at least 2.2 jobson average, or about 9 jobs lost for every 4 created, to which we have to addthose jobs that non-subsidized investments with the same resources wouldhave created.[65]Therefore, while it is not possible to directly translate Spain's experience withexactitude to claim that the U.S. would lose at least 6.6 million to 11 millionjobs, as a direct consequence were it to actually create 3 to 5 million "greenjobs" as promised (in addition to the jobs lost due to the opportunity cost ofprivate capital employed in renewable energy), the study clearly reveals thetendency that the U.S. should expect such an outcome.These costs do not appear to be unique to Spain's approach but instead arelargely inherent in schemes to promote renewable energy sources.

Lomborg contends that the major problem in green jobs analyses is that they fail to recognize the higher costs or job losses that these policies will cause. Alternative energy sources such as solar and wind create significantly more expensive fuel and electricity than traditional energy sources.[66]Increasing the cost of electricity and fuel will hurt productivity and reduce employment and disposable income. Nevertheless, many studies used by green jobs advocates have not addressed these costs -- overlooking both the cost of investment and the price hikes to be faced by end users.

The fundamental problem is that green-energy technologies are still very inefficient and expensive compared to fossil fuels. Deploying less efficient, more expensive alternative-energy sources will hurt businesses and consumers, not help them.Lomborgstates that in order for the whole planet to make a sustainable shift away from fossil fuels, we need to make low-carbon energy both cheaper and more efficient. That requires a substantial increase in research and development into next-generation green-energy alternatives. In the meantime, he concludes that the public should be cautious of politicians' claims that deploying existing inefficient, expensive technology will result in windfall benefits at no cost.

Lynch contends that, since green jobs proposals requires extensive expenditures and subsidies it seems counter-intuitive that argue that they might not create jobs. The answer usually involves the difference between gross versus net jobs. Spending money to hire workers creates jobs, but taking money out of the broader economy to pay for them destroys jobs.[67]

Spending taxpayer money to support, for example, the building of solar power farms will create the jobs involved in the manufacture and installation of the solar panels, which is what advocates of such policies typically focus on. These jobs are easy to measure after the fact, and can be estimated beforehand with a degree

of confidence. But the impact on the broader economy of taking money from taxpayers and customers to pay for those jobs is less visible and the impact often ignored.

For all the talk of how cheap renewable energy is, the fact remains that government support has been vital in the growth of solar and wind, and investment in those energies has tended to fall sharply when support was reduced. The implication is that the overall economy suffers from spending on renewables, as most projects create energy at above-market prices, something all too often glossed over or misrepresented. Simply put, it means less money in the economy.

FTI published a report trying to parse out the effects of such a program, and the results are illuminating.[68] It concluded that the first four years would see an employment loss of about 0.5%, several years of minimal impact, and three years of nearly 1% extra employment. This would seem a reasonable result, reflecting the costs of transition from such a program, and the Biden infrastructure proposal would probably have a similar impact. Lynch concludes that "Needless to say, there are many other complicating factors involved, but the general principles are sound even if the details are somewhat uncertain."[69]

Morriss, Bogart, Dorchak, and Meiners contended that analysis in the green jobs literature is deeply flawed, restingon a series of myths about the economy, the environment, and technology. They summarized the mythologiesof green jobs:[70]

- *Creating green jobs will boost productive employment.* Green jobs estimates include huge numbers of clerical, bureaucratic, and administrative positions that do not produce goods and services for consumption. Much of the promised boost in green employment is in non-productive positions that raise costs.
- *Green jobs forecasts are reliable.* The forecasts for green employment predict an employment boom. Unfortunately, the forecasts are unreliable because they are based on questionable estimates by interest groups of tiny base numbers in employment, extrapolation of growth rates from those small base numbers, and a pervasive, biased, and highly selective optimism technologies.
- *Green jobs promote employment growth.* Green jobs estimates promise greatly expanded employment. This promise is false. The green jobs model is built on promoting inefficient use of labor, favoring technologies because they employ large numbers rather than because they make use of labor efficiently.

IV. Conclusion: Net Jobs Increase or Decrease?

Extensive review of the literature reveals that there are a large number of studies contending both that environmental regulations and green initiatives create substantial numbers of jobs and just the opposite – that they destroy jobs. So, what is the reality? Several points are worth noting.

First, as usual in economic or policy debates, it is largely a case of whose study or research we wish to cite. Many of the studies' results can be anticipated by the source or funder of the research. Thus:

- It is hardly surprising that research from organizations such as the Apollo Alliance, the Center for American Progress, PERI, the Blue Green Alliance, the Green Jobs for America Campaign, NRDC, IGSD, WRI, NCE, ITCU, UCS, and similar organizations find that environmental and green initiatives are net job creators.
- Similarly, it is not surprising that the Global Energy Institute, the Heritage Foundation, BHI, IER, the American Petroleum Institute, the Competitive Enterprise Institute, the American Enterprise Institute, and similar organizations conclude that environmental and green initiatives are net job destroyers.

Nevertheless, rigorous review of the existing research indicates that investments in environmental and green economy programs will likely have substantial net positive impacts on the economy, energy, jobs, and employment. There are important caveats:

- The jobs impacts of different types of green programs and initiatives vary markedly.
- Poorly designed or implemented green initiatives can have harmful economic, energy, and jobs impacts.
- It is not necessarily true that any single green program will have positive economic or jobs impacts compared to any alternative use of the funds – it depends critically on the types of programs being compared.

- The impacts on specific industries, jobs, skills, wages, and education and training requirements can vary widely.

However, more basically, the net jobs issue is largely a red herring. Very often environmental and green spending programs are given much more scrutiny with respect to net economic or jobs impacts than are other types of programs-- especially by those skeptical of such programs. For example:

- Numerous studies of the economic and jobs impacts of Department of Defense (DOD) spending have been conducted. These find that DOD spending invariable creates huge positive local, state, and national benefits. However, very rarely if ever do any of these studies try to determine if equivalent expenditures on other programs – such as, for example, housing, health care, education, or environmental programs -- would have created larger benefits.[71]
- Numerous studies have found that government RD&D is a classic public good, that the benefit cost ratio of this RD&D is high, and that it creates very favorable economic and jobs benefits. However, very rarely if ever do any of these studies try to determine if equivalent expenditures on other programs – such as, for example, housing, health care, education, or environmental programs -- would have larger benefits.[72]
- When a local government wishes to build a new convention center, sports stadium, or commercial or industrial facility it invariably produces a study estimating the tremendous economic and employment benefits that would result from the project. However, very rarely if ever do any of these studies try to determine if equivalent expenditures on other programs – such as, for example, housing, health care, education, or environmental programs -- would have larger benefits.[73]
- During the 2021 U.S. Congressional debate over the infrastructure bill, the "Infrastructure Investment and Jobs Act," many competing estimates were quoted of the economic benefits and large numbers of jobs that would be created from such spending.[74] However, little discussion was given to whether, equivalent expenditures on other programs – such as, for example, housing, health care, education, or environmental programs -- would have larger benefits.[75]

Spending $1 billion, $100 billion, or $1 trillion on green initiatives will have large economic impacts and will create large numbers of jobs. Of course, investments of these magnitudes in almost anything will also create large numbers of jobs. Nevertheless, the bottom line is that the balance of research indicates that investments in environmental and green programs have favorable net positive economic and jobs benefits. At least as important though, the net positive economic and jobs impacts, while significant and powerful for policy purposes, should not obscure the fact that the major purpose and rationale for these programs are the energy and environmental benefits they will create. The cart should not be put before the horse: The energy and environmental and benefits are the reason these programs are necessary and desirable. Jobs benefits are an important secondary benefit, and should be evaluated as such.

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Endnotes

[1]https://www.whitehouse.gov/bipartisan-infrastructure-law/.

[2]For a more detailed discussion see Management Information Services, Inc., "Defining and Estimating the U.S. the Green Economy and Green Jobs, prepared WorkingNation, January 2022. https://workingnation.com/the-green-economy-its-bigger-than-you-think-and-growing-rapidly/.

[3]American Council for an Energy Efficient Economy, "How Does Energy Efficiency Create Jobs?" https://www.aceee.org/sites/default/files/pdf/fact-sheet/ee-job-creation.pdf.

[4]Ibid.

[5]Institute for Governance & Sustainable Development, "Investing in US Energy Efficiency and Infrastructure Creates More Nationally-Distributed Jobs while Saving Money and Protecting the Climate," http://www.igsd.org/wp-content/uploads/2021/03/Investing-in-US-Energy-Efficiency-and-Infrastructure-Creates-More-Nationally-Distributed-Jobs-while-Saving-Money-and-Protecting-the-Climate.pdf

[6]A reduction in electricity costs can be achieved through energy efficiency, or by switching to a more productive means of electricity generation and distribution; for example, switching from fossil-fuel based to clean renewable forms of electricity generation and reducing losses that occur in the generation and transmission process. Thus a 40% reduction in electricity costs does not necessarily mean that consumers or businesses consume 40% less electricity at their homes or businesses.

Rather, that 40% reduction in electricity costs could be achieved through a combination of factors, including more efficient and less wasteful production, generation, transmission, distribution and consumption of energy.
[7]Institute for Governance & Sustainable Development, op. cit.
[8]International Monetary Fund, "Building Back Better: How Big Are Green Spending Multipliers?" https://www.elibrary.imf.org/view/journals/001/2021/087/article-A001-en.xml#:~:text=The%20estimated%20multipliers%20associated%20with.on%20sectors%2C%20technologies%20and%20horizons.
[9]Ibid and https://www.irena.org/media/Files/IRENA/Agency/Publication/2016/IRENA_Measuring-the-Economics_2016.pdf.
[10]https://e2.org/reports/clean-jobs-better-jobs/.
[11]National Resources Defense Council, "Green Prosperity: How Clean-Energy Policies Can Fight Poverty and Raise Living Standards in the United States," https://www.nrdc.org/resources/green-prosperity-how-clean-energy-policies-can-fight-poverty-and-raise-living-standards.
[12]Ibid.
[13]https://www.bu.edu/pardee/files/2020/06/Employment_Impacts_of_Conservation_Spending-Peltier20 20.pdf.
[14]https://www.bu.edu/pardee/files/2020/06/Employment_Impacts_of_Conservation_Spending-Peltier20 20.pdf.
[15]https://www.rockefellerfoundation.org/report/transforming-a-billion-lives-the-job-creation-potential-from-a-green-power-transition-in-the-energy-poor-world/.
[16]Ibid.
[17]Ibid.
[18]Ibid.
[19]Zachary Shahan, "Over 3 Times More Green Jobs Per $1 Invested Than Fossil Fuel or Nuclear Jobs," https://cleantechnica.com/2013/03/20/over-3-times-more-green-jobs-per-million-than-fossil-fuel-or-nuclear -jobs/.
[20]Ibid.
[21]*Why Clean Energy Public Investment Makes Economic Sense – The Evidence Base*, https://wedocs.unep.org/handle/20.500.11822/8016;jsessionid=E3B084484C4FC925E53E4CC92455BCD4.
[22]https://www.wri.org/research/green-jobs-advantage-how-climate-friendly-investments-are-better-job-creators.
[23]Ibid.
[24]Ibid.
[25]Ibid.
[26]http://apolloalliance.org/apollo-14/the-full-report/.
[27]https://www.scribd.com/document/296634230/EE-0422-01.
[28]https://www.epi.org/publication/studies_cleanenergyandjobs/.
[29]https://www.taylorfrancis.com/chapters/mono/10.4324/9780429496486-3/environment-versus-economy-myth-john-bliese.
[30]Stephen Bernow, W. Dougherty, M. Duckworth, S. Kartha, M. Lazams, and M. Ruth. *America's Global Warming Solutions*. Boston, Massachusetts: Tellus Institute and Stockholm Environment Institute, 1999.
[31]http://www.americanprogress.org/issues/2008/09/pdf/green_recovery.pdf.
[32]https://energypedia.info/images/f/fc/Green_Jobs_-_Impacts_of_a_Green_Economy_on_employment. pdf.
[33]http://www.usmayors.org/pressreleases/uploads/GreenJobsReport.pdf.
[34]Stephen S. Meyer. "Environmentalism and Economic Prosperity: Testing the Environmental Impact Hypothesis." Massachusetts Institute of Technology Project on Environmental Policies and Policy, Cambridge, Massachusetts, October 1992.
[35]https://cows.org/wp-content/uploads/sites/1368/2021/01/2004_New-Energy-for-America-The-Apollo-Jobs-Report.pdf
[36]https://www.sciencedirect.com/science/article/abs/pii/S026499931630709X.
[37]Ibid.
[38]http://link.sandiego.edu/portal/Working-for-the-environment--a-growing-source-of/FGksbID8Wec/.
[39]https://escholarship.org/uc/item/14p0h9mp.
[40]https://www.ucsusa.org/resources/renewable-electricity-standard.
[41]https://www.michigan.gov/documents/nwlb/Job_Jolt_RepoweringMidwest_235553_7.pdf.
[42]ConstantineYapijakis. "The Myth of 'Jobs Versus the Environment.'" Environmental Research Laboratory, Cooper Union School of Engineering, New York, 1999.
[43]https://www.researchgate.net/publication/6569002_Environmental_Protection_the_Economy_and_Jobs_National_and_Regional_Analyses.
[44]https://www.sciencedirect.com/science/article/abs/pii/S0048733316300208.
[45]The San Joaquin Valley is comprised of the eight California counties of Fresno, Madera, Merced, Kern, Kings, San Joaquin, Stanislaus, and Tulare.
[46]https://web.stanford.edu/group/emf-research/docs/occasional_papers/OP64.pdf.
[47]The estimates excluded the indirect impacts from additional spending from the higher direct earnings (the economy's multiplier effect). Excluding the expenditure multiplier effects is appropriate for comparing the options if the multipliers are similar for clean and conventional energy sources, which Hunnington found to be reasonable.
[48]https://web.stanford.edu/group/emf-research/docs/occasional_papers/OP64.pdf.
[49]https://www.renewableenergyworld.com/storage/the-microeconomics-of-green-jobs/#gref.
[50]Ibid.
[51]https://www.researchgate.net/publication/344240794_The_jobs_impact_of_GHG_redction_strategies_in_the_USA.
[52]http://www.windwatchni.com/uploads/1/6/4/9/16490250/green-jobs.pdf.

[53]https://www.beaconhill.org/BHIStudies/GreenJobs09/BHIGreen_Collar_Job_Critique090625.pdf.
[54]Ibid.
[55]https://energynow.com/2021/04/commentary-the-truth-about-green-energy-jobs-alex-epstein/.
[56]https://www.globalenergyinstitute.org/sites/default/files/2019-12/hf_ban_report_final.pdf.
[57]https://energynow.com/2021/04/commentary-the-truth-about-green-energy-jobs-alex-epstein/.
[58]Jobs and Environmental Regulation (rff.org).
[59]Ibid.
[60]https://www.heritage.org/environment/commentary/green-job-subsidies-will-destroy-far-more-jobs-they-create.
[61]https://instituteforenergyresearch.org/wp-content/uploads/2015/05/090327-employment-public-aid-renewable.pdf; http://www.windaction.org/posts/26329-gabriel-calzada-alvarez-speaks-to-the-u-s-congress- about -green-jobs#.YWWuwNrMK70.
[62]http://www.windaction.org/posts/22149-wind-energy-the-case-of-denmark#.YWWvutrMK70.
[63]https://www.heritage.org/environment/commentary/green-job-subsidies-will-destroy-far-more-jobs-they-create.
[64]https://instituteforenergyresearch.org/wp-content/uploads/2015/05/090327-employment-public-aid-renewable.pdf.
[65]Ibid.
[66]https://economictimes.indiatimes.com/green-jobs-propaganda-fails-to-meet-economic-reality/article show/7512576.cms?from=mdr.
[67]https://www.forbes.com/sites/michaellynch/2021/04/06/the-bad-economics-beyond-green-job-creation/ ?sh=4daaac78551f.
[68]https://www.remi.com/wp-content/uploads/2018/10/The-Economic-Fiscal-and-Emissions-Impacts-of-a-Revenue-Neutral-Carbon-Tax.pdf.
[69]https://www.forbes.com/sites/michaellynch/2021/04/06/the-bad-economics-beyond-green-job-creation/ ?sh=4daaac78551f.
[70]https://leeds-faculty.colorado.edu/bhagat/green-jobs-myth.pdf.
[71]See, for example, https://www.ncsl.org/research/military-and-veterans-affairs/military-s-impact-on-state-economies.aspx; https://www.whiteman.af.mil/Portals/53/documents/Economic%20Impact%20State ments/FY19%20Economic%20Impact%20Report.pdf?ver=2020-07-22-134515-417; https://www.hrpdcva. gov/uploads/docs/Economic%20Impact%20of%20the%20DoD%20in%20Hampton%20Roads-%20 DRAFT.pdf; https://www.rand.org/content/dam/rand/pubs/research_reports /RR1100/RR1119/RAND _RR1119.pdf.
[72]See, for example, Jeff Dowd, "Aggregate Economic Return on Investment in the U.S. DOE, U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, October 2017; https://energy. gov/sites/prod/files/2015/05/f22/evaluatingrealized_rd_mpacts 9-22-14.pdf; Michael Gallaher, Troy Scott, Zachary Oliver, Kyle Clark-Sutton, and Benjamin Anderson, "Benefit-Cost Evaluation of U.S. Department of Energy Investment in HVAC, Water Heating, and Appliance Technologies," RTI International, September 2017; Albert N. Link, Alan C. O'Connor, Troy J. Scott, Sara E. Casey, Ross J. Loomis, and J. Lynn Davis, "Benefit-Cost Evaluation of U.S. DOE Investment in Energy Storage Technologies for Hybrid and Electric Cars and Trucks," RTI International, December 2013; A. O'Connor, R. Loomis, and F. Braun, "Retrospective Benefit-Cost Evaluation of DOE Investments in Photovoltaic Energy Systems," RTI International, August 2010; M. Gallaher, A. Rogozhin, and J. Petrusa, "Retrospective Benefit-Cost Analysis of U.S. DOE's Geothermal Technologies R&D Program Investments," RTI International, August 2010; Tom Pelsoci, "Retrospective Benefit-Cost Evaluation of U.S. DOE Wind Energy R&D Program: Impact of Selected Energy Technology Investments," Delta Research Co., June 2010; Al Link, "Retrospective Benefit-Cost Evaluation of U.S. DOE Vehicle Combustion Engine R&D Program: Impacts of a Cluster of Energy Technologies," prepared for the U.S. Department of Energy, May 2010; Jeffrey Rissman and Hallie Kennan, "Case Studies on the Government's Role in Energy Technology Innovation: Advanced Diesel Internal Combustion Engines," American Energy Innovation Council, March 2013; Chris Coons, "R&D is Essential For Boosting the American Economy," *The Hill*, July 11, 2017; Kimberly Amadeo, "NASA Budget, Current Funding, History, and Economic Impact, *The Balance*, February 27, 2020.
[73]See https://www.brookings.edu/articles/sports-jobs-taxes-are-new-stadiums-worth-the-cost/.
[74]https://www.reuters.com/world/us/democratic-divide-over-spending-priorities-tests-bidens-deal-making-skills-2021-10-19/; https://www.congress.gov/bill/117th-congress/house-bill/3684.
[75]Upon passage of the bill, President Biden stated "Jobs will be created, the vast majority of which would not require a college degree. This is a blue-collar blueprint to rebuild America." https://www. washingtonpost.com/politics/2021/11/08/here-comes-biden-infrastructure-pr-blitz/.