

Are Green Jobs Advocates Their Own Worst Enemies?

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ABSTRACT

There is intense controversy in the USA concerning the definition of green jobs. We review the definitions being used, note their shortcomings, and summarize criteria for green jobs being utilized by advocates and politicians – including President Biden. We find that green jobs advocates can be their own worst enemies. They have significantly tightened the criteria for characterizing green jobs and have greatly reduced the number of jobs that can thus be defined as “green.” We find the overwhelming majority of green jobs do not adhere to these criteria and that that very strict criteria greatly reduce green jobs estimates. We conclude that utilization of these criteria will very seriously underestimate the size, importance, and rates of growth of the USA green economy and green jobs. This will hinder efforts to address pressing environmental and energy issues, to increase green jobs, and to implement the Democrats’ Green New Deal.

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Introduction

There is currently intense controversy in the USA concerning the definition of green jobs, their magnitude and distribution, the issue of net job creation, and the education, training, skills, and salary levels related to green jobs. These controversies are currently especially relevant due to, for example:

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

Literature Review: Defining USA Green Jobs

In the U.S. there is no simple answer to the questions “what is the green economy?” and “what is a green job?” U.S. researchers, data collectors, and policy-makers have yet to reach consensus on a methodology for identifying what is green. Such a methodology is needed to accurately estimate the green economy’s size and rate of growth, and to identify the jobs associated with it [2,3]. The definitional issue is not trivial. The industries that qualify as green serve as a benchmark for the current size of the green economy and a standard to estimate the rate by which the economy becomes greener. A rigorous definition is essential to facilitate government policy, research funding, business investment, and hiring decisions – including such major initiatives as the Green New Deal (GND) [4].

There are at least two empirical approaches to measuring green jobs: An industry approach and an occupational approach. The industry approach estimates the number of employees at a firm that, based on the firm’s output, makes the economy greener. An approach that uses occupations estimates the number of employees at all types of firms with work activities that contribute to the greening of the economy. The industry approach is akin to the industry-output side of green production. That is, counting the number of employees at firms that produce green products or services – also termed “green making”.

Different U.S. studies often include multiple (often inconsistent) definitions of a “green job”. For example, an approach -- used by kMatrix -- to assessing the scale of the U.S. green economy within the global context utilizes the “Low Carbon and Environmental Goods and Services Sector” dataset [5]. This is based on the “Environmental Goods and Services Sector” (EGSS) and research by the UK government into the “low carbon” economy. While empirical data for the U.S. are available from numerous sources, the major difficulty is that U.S. researchers, data collectors, and policy-makers have yet to determine a means for defining what is green. What is green and how can it be estimated?

According to the Pew Charitable Trusts, “A clean energy economy generates jobs, businesses and investments while expanding clean energy production, increasing energy efficiency, reducing greenhouse gas emissions, waste and pollution, and conserving water and other natural resources”. Pew used an industry output approach to categorize and estimate the number of U.S. green jobs [6]. The industry output approach to estimating green jobs -- if a firm’s products or services are green, then that firm’s employees can be considered green -- has its challenges. For example, the North American Industry Classification System (NAICS) industry codes are often not specific enough to separate the core green firms from those that are green-related in a secondary or tertiary

sense [7]. Pew used a proprietary database that, in contrast to the standard government industry definitions used to report economic data, allowed researchers to define industries based on specific products.

The occupational approach to estimating green jobs is somewhat similar to the industry-input side of green production. That is, irrespective of a firm's output, the approach estimates the number of green jobs based on whether the occupational activities of the job make production greener. In other words, the green economy demands or uses certain types of green jobs as labor input (with certain sets of green skills) and those jobs are counted as green.

Thus, the major obstacle to understanding and measuring the U.S. green economy and green jobs is defining them. In the U.S., the task of defining and enumerating green jobs in the economy has been attempted by many disparate parties, including industry groups, labor unions and other worker's rights activists, academic and policy institutions, local, state, and federal governments, and workforce development and labor market information organizations [8]. There are dozens of different definitions and approaches. Environmental and workforce advocates brought green to national prominence, but it has generally been the labor market economists and workforce development analysts that have been at the forefront of measuring the U.S. green economy. Reports undertaken by labor market analysts have been the most influential among labor economists in defining and counting green jobs, including the Bureau of Labor Statistics, the Department of Commerce, the Department of Energy, the Occupational Information Network, and the Workforce Information Council – as discussed below.

The bottom line is that the major difficulty is defining the U.S. green industry and green jobs. Questions that must be addressed in defining green include, for example:

- Is being green the same as being environmentally friendly? If so, how is environmentally friendly defined?
- Does it include just products and services that are environmentally friendly?
- What about environmentally friendly production processes?
- Environmentally friendly can be a continuum, so how green does a product or process have to be to count?
- If a product is environmentally friendly but it is packaged, delivered, and marketed in an environmentally unfriendly way, is it still green?

In the U.S. these questions and attempts to answer them have led to at least three types of green definitions:

1. The social justice/worker-centered definition, which makes green contingent on the job quality and its potential to address poverty and related social and economic issues.
2. The renewable energy and energy efficiency (RE/EE) definition, which defines green as activities in the sectors related to renewable energy and increasing energy efficiency, also known as “clean energy”.
3. The broad environmental definition, which defines green as anything relating to environmental protection and quality [9].

The social justice/worker-centered definition is primarily employed by union groups, community advocates, the Vice President's Middle-Class Task Force, and some research institutions. Examples of these groups include Green for All, the Apollo Alliance, the BlueGreen Alliance, and numerous state and local level organizations [10-13]. Reports produced by these organizations, which are numerous, share their emphasis on job

quality and are focused on getting traditionally disadvantaged workers into this “emerging” sector of the economy. In general, these reports are advocating for greater investment in green workforce development targeted towards low-income individuals and families, and policies to promote a green economy, which they assert will benefit these workers. While this concept of green jobs and “green collar workers” may increase political support for green jobs, it is not useful for rigorous analysis.

The RE/EE definition is the most measurable and concrete definition, and is also consistent with federal legislation. The RE/EE definition encompasses everything related to clean energy -- investments in reducing energy and fossil fuel consumption (i.e., energy efficiency), including “green construction”/retrofitting homes and buildings, engineers who design new, hybrid, electric, and hydrogen vehicles, workers who build these vehicles, and all work on renewable energies such as wind, biomass, solar, geothermal, hydrogen, oceanic (wave and tidal), hydropower, and, in some cases, nuclear energy. The RE/EE definition is used by some states and the U.S. Energy Employment Reports (USEER), and all reports on the green economy include RE/EE as a primary component.

The broad environmental definition is expansive and the most widely-used by labor market analysts and economists. This definition, which encompasses all environmental activities, includes environmental protection and remediation, and generally any activity that enhances, preserves, or restores the quality of the environment. Reports aside, the RE/EE definition is the one favored by the national (and some state) legislation, such as the Green Jobs Act, ARRA, and the proposed New Green Deal. However, while in these there is no stated definition of what green jobs are or what the green economy is, it is clear that the RE/EE definition is employed [14-16].

Nevertheless, in the U.S. what green is and what the green economy and green jobs constitute is still a matter of contention. These “green” concepts, which broadly refer to an increasing environmental awareness among both consumers and producers, are both ambitious and ambiguous. There are many different stakeholders advocating for increased attention to and investment in “green.” Proponents, such as those advocating the Green New Deal, contend that green jobs will revitalize the American economy and are well-paying jobs providing pathways out of poverty for a large number of historically under-served, under- and unemployed workers [17]. Others counter that the green economy is much overrated and is a politically useful but economically overhyped sales pitch [18].

Numerous studies have been conducted attempting to understand the green economy, and the quality of these vary greatly. Industry groups have also published reports on the green economy, as have individual states, research institutes, international organizations, task forces, think tanks, etc. All reports related to the green economy confront the same problem: How to define and quantify an amorphous concept. There is as much political advocacy as there is research and rigorous empirical research using different methods and scope making comparison nearly impossible. Nevertheless, there are important points of consensus.

While there is currently no universally accepted definition or methodology, the definition adopted by most reports is inclusive and generally includes economic activity related to enhancing or preserving the environment and natural resources. Among the studies that are research and not advocacy, there is a clear

preference for an industrial, survey-based approach. Such an “industrial” approach makes sense as a way to track macro-economic impacts and the relative “greening” of specific sectors. However, such an approach may not be helpful for the millions of unemployed workers hoping to train for and obtain a “green” job. Although there has been some research conducted on what skills, knowledge, and abilities will be needed for workers in green jobs it is insufficient to draw large conclusions other than that green jobs are traditional jobs that will change very slightly or not at all, depending on the occupation [19]. Finally, the research about the wages for green jobs is inconclusive, although discussion on skills appears regularly in reports on “green jobs”, especially if they are setting or recommending policy.

Defining Green Jobs as the Null Set?

A major problem is that numerous USA organizations, advocates, and politicians have significantly tightened the criteria for defining and characterizing green jobs and have, paradoxically, greatly reduced the number of jobs that can according to these criteria or characteristics be legitimately defined as being “green”. The more stringent the criteria, the fewer the jobs that are defined as green. For example:

President Biden in his Presidential election campaign identified green jobs as [20]:

- Stable well-paying jobs.
- Good jobs offering good wages, benefits, and worker protections.
- Jobs that defend workers’ rights to form unions and collectively bargain.
- Incorporating skills training.
- Worker-centered and driven in collaboration with the communities they will affect.

Senator Elizabeth Warren in her Presidential campaign defined the specifics of green jobs as those [21]:

- Committed to investments in retraining, joint labor management apprenticeships, and strong career pipelines to ensure a continuous supply of skilled, available workers.
- Jobs with good wages and strong benefits for every worker.
- Jobs available to those who have traditionally been excluded -- especially women and communities of color.
- Jobs with expanded worker safety protections and strengthened anti-discrimination protections for workers from all backgrounds.

The Century Foundation identifies green jobs as [22]:

- Family-sustaining jobs that promote racial, economic, environmental, and intergenerational justice.
- Jobs that contribute to preserving or enhancing the well-being, culture, and governance of both current and future generations.
- Good, living-wage jobs.
- Decent, family-supporting jobs with fair and equitable wages and benefits, including the right to collectively bargain without retaliation, access to sick and family leave, vacation, full-time hours for those who want them, safe working conditions, health insurance, retirement, and advancement opportunities.
- Jobs that are inclusive of all workers across locations, genders, races, and ethnicities, and offer special support, training, and recruitment for workers from low-income, minority, under-employed communities, as well as communities most impacted by climate change.
- Jobs that ensure gender and racial equity.

Other advocacy organizations have also identified stringent green jobs criteria, for example:

- According to the Apollo Alliance, green jobs are well paid, career track jobs that contribute directly to preserving or enhancing environmental quality and include opportunities for advancement in both skills and wages [23].
- The Sunrise Movement defines green jobs as guaranteed jobs to build a just, sustainable, and people-centered economy to anyone who wants one [24].
- Good Jobs First defines two essential characteristics of a good green job: If the job is unionized or if it is covered by a Job Quality Standard (that is, a state rule attached to an economic development subsidy; as a quid pro quo for the subsidy, the company must pay a certain wage -- and sometimes benefit--level) [25].
- Xprize specified green jobs as decent jobs paying a living wage and that offer the dual benefits of both good jobs and new ways to tackle climate change and nature crises [26].
- The Green Economy Coalition states that green jobs must be good jobs, offering equal access to women and men, providing workers with social protection, and ensuring that workers are safe [27].
- The Green Alliance defines green jobs as attractive jobs that provide job security and positive working conditions -- positive in the sense of decent pay, predictable hours, adequate breaks and holidays, and are guaranteed jobs of the future [28].
- The UNEP defines green jobs as those that result in improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities and create decent employment opportunities, promote sustainable trade, and reduce poverty [29].
- The ILO defines green jobs as those that are decent jobs providing decent employment and income opportunities, are socially inclusive, facilitate improved human well-being and social equity, and facilitate retraining of workers and upgrading of skills [30].

Thus, it would seem that that to qualify as a green job, the job must, at a minimum:

- Result in improved human well-being and social equity.
- Be a well-paid career track job.
- Be a “decent job” providing decent employment and income opportunities.
- Be socially inclusive, facilitate improved human well-being and social equity, and facilitate retraining of workers and upgrading of skills.
- Be unionized or covered by a Job Quality Standard.
- Offer equal access to women and men, providing workers with social protection and ensuring that workers are safe.
- Provide job security and positive working conditions -- decent pay, predictable hours, adequate breaks and holidays, and is a guaranteed job of the future.
- Be family-sustaining and promote racial, economic, environmental, and intergenerational justice.
- Contribute to preserving or enhancing the well-being, culture, and governance of both current and future generations,
- Be a decent, family-supporting job with fair and equitable wages and benefits, including the right to collectively bargain without retaliation, access to sick and family leave, vacation, full-time hours, safe working conditions, health insurance, retirement, and advancement opportunities.
- Be inclusive of all workers across locations, genders, races, and ethnicities, and offer special support, training, and recruitment for workers from low-income, minority, under-

- employed communities.
- Ensure gender and racial equity.
- Be committed to investments in retraining, joint labor management apprenticeships, and strong career pipelines.
- Have good wages and strong benefits for every worker.
- Be available to those who have traditionally been excluded -- especially women and communities of color.
- Have expanded worker safety protections and strengthened anti-discrimination protections for workers from all backgrounds.
- Be stable and well-paying.
- Incorporate skills training
- Be worker-centered and driven in collaboration with the communities affected.

In reality, some, but not all of these criteria may apply to a very small subset of ideal or idealized green jobs, such as Ecologist, Environmental Lawyer, Solar Energy Engineer, Fuel Cell Researcher, Hydrologist, Environmental Compliance Manager, Sustainable Building Consultant, Geoscientist, Hydrogen System Designer, etc. Nevertheless, while perhaps commendable and aspirational, adhering to these criteria would greatly reduce estimates of the number of jobs in the U.S. identified as being green. Further, in some respects achievement of these criteria are impossible to achieve. For example, it is mathematically impossible for all green jobs – or any large category of jobs – to pay “above average wages,” just as it is laughably impossible for all of the children in Lake Wobegon, to be “above average” [31].

In addition, many jobs universally classified as green would not meet these criteria. Consider an obvious example. The U.S. Bureau of Labor Statistics (BLS) forecasts that Wind Turbine Technicians will be the most rapidly growing occupation in percent terms over the next decade, increasing 61% by 2029 (although from a very low base of jobs) [32]. Accordingly, a Wind Turbine Technician is highly publicized and promoted by advocates as a dream green job of the future. However, does this job adhere to the criteria listed above? It may or may not be unionized, pay good wages, have good benefits, etc., but the working conditions may certainly not be commendable. For example, consider a Wind Turbine Technician working on servicing and maintaining a wind turbine 300 feet high in North Dakota in February where the wind may be blowing strongly and the wind chill factor is -30o Fahrenheit (-34 o Celsius) [33]. This is not anyone’s definition of good, safe, or healthy working conditions. Thus, this job would not be classified as a green job according to the criteria listed above.

Similarly, BLS forecasts that Solar Photovoltaic Installers will be the third most rapidly growing occupation over the next decade, increasing 51% by 2029 (but again from a very low base) [34]. The job may or may not be unionized, pay good wages, have good benefits, etc., but the working conditions may certainly not be commendable. Consider a Solar Photovoltaic Installer who is installing, maintaining, or cleaning photovoltaic panels for a solar power station in the Arizona desert (which has a very favorable insolation factor) in August with the temperature at 120o Fahrenheit (49o Celsius). This is also not anyone’s definition of good, safe, or healthy working conditions. Thus, this job would also not be classified as a green job according to the criteria listed above.

Similar considerations are applicable to many jobs otherwise classified as being green, such as, for example:

- Hazardous Materials Removal Worker
- Asbestos Disposal Worker
- Recycling Plant Employee
- Insulation Installer
- Environmental Field Laborer
- Waste Management, Treatment, and Disposal Facilities Worker
- Emergency Response Services Technician
- Oil and Gas Well Capping Worker
- Mold Remediation Worker
- Medical Waste Disposal Worker
- Frac Tank Cleaning Roustabout
- Class B Hazmat Driver
- Decontamination & Disinfecting Technician
- Septic Tank Cleaner
- Trash Collector
- Etc.

Thus, most current or future green jobs in the U.S. may not be relatively well paying, have good working conditions, provide generous benefits, or be unionized. There is considerable evidence that many green jobs may pay substantially less than the jobs they are displacing and that unionization rates for green jobs are relatively low.

The USEER studies found that energy industry workers employed by solar and wind power companies earn significantly less than those who mine coal or drill for natural gas [35]. For example, the median wage for solar workers is \$24.48 an hour compared with \$30.33 for those employed

by the natural gas sector, which amounts to a roughly \$12,000 annual wage gap [36]. Such wage disparities threaten to undermine green energy advocates’ contention that the U.S. can initiate a multitrillion-dollar assault on climate change while growing its economy and transitioning workers to well-paying green jobs.

Energy workers on the whole earn more than the typical U.S. worker, but the highest-paying positions are skewed heavily toward nuclear, utility, natural gas, and coal industry workers. Wind, solar, and “green” jobs were well below them on the median pay scale. According to former U.S. Department of Energy (DOE) Secretary Ernest Moniz, “The big message is that the energy industry has a significantly higher median wage than does the economy as a whole. There’s clearly a distribution of wages -- as there is in any other sector -- because of the level at which specialized skills are needed” [37].

The median hourly wage for all U.S. energy workers is \$25.60 -- 34 percent higher than the national median hourly wage of \$19.14. And, while the energy sector has suffered during the COVID-19 pandemic, it has lost fewer jobs than other parts of the economy. Utility employees were the highest paid among energy industry segments, with a median wage of \$41.08 per hour, which would amount to nearly \$85,500 per year, while mining and fossil fuel extraction workers followed at \$36.32 per hour, or more than \$75,500 a year. The high concentration of utility jobs in the electric power generation and transmission, distribution, and storage sectors also means that workers in those positions earn higher than average wages.

Jobs in energy-specific construction, which would increase significantly under green initiatives, pay about \$25.53 per hour, or just above \$53,000 annually. Manufacturing jobs earned a

median wage of \$23.02, or nearly \$48,000 per year. Many fossil fuel jobs pay very well. For example, Rotary Drill Operators, Oil and Gas, earn about 28.35 per hour, or \$60,000 per year, and coal miners earn about \$25.80 per hour, or \$52,500 per year [38].

It is difficult to compare wages across energy technology sectors because of factors such as accessibility, skill, experience, education and training requirements, and geographic distribution [39].

Jobs that pay significantly higher than the national median wage are also likely to require more experience, education, training, and certifications.

Workers in the nuclear industry receive a median hourly wage of \$39.19, equivalent to \$81,515 a year -- more than double the national median, although the industry accounts for less than one percent of total energy jobs. Nuclear industry workers tend to need advanced training and other requirements, increasing their earning power. However, they face a wave of nuclear plant retirements, with five nuclear reactors scheduled to close during 2021 [40]. Shutdowns of nuclear plants could also threaten the U.S. effort to address climate change: According to Moniz, "Without the nuclear fleet carrying on, our carbon goals just become all that much more difficult because nuclear remains the single highest zero-carbon electricity source" [41].

Energy efficiency workers, including those engaged in building efficiency improvements such as weatherization, comprised 28.4 percent of total energy employment in 2019. However, workers in that sector have a median wage of \$24.44 an hour -- significantly lower than nuclear industry workers and nearly \$6 lower per hour than natural gas workers, who make \$30.33/hr. Fast-growing sectors in the renewable energy sector, solar and wind, also have median wages below that of fossil fuel workers: \$24.48 for solar and \$25.95 for wind [42].

More generally, while many of the jobs generated pay higher than average salaries, many others do not (Figure 1). For example, three types of the most numerous green jobs created -- Refuse and Recycle Workers, Insulation Workers, and Septic Tank Cleaners -- pay below average wages. Thus, it is not valid to contend that jobs generated by the green economy pay wages and salaries that are significantly higher -- or lower -- than average.

The bottom line here is that, ironically, in terms of some of the key criteria listed above, including wages, benefits, working conditions, and unionization, many "non-green jobs" score higher than green jobs. In any case, it is clear that a very strict list of necessary criteria will greatly reduce the estimate of the number of green jobs in the economy.

We estimated the total number of jobs generated (direct, indirect, and induced) by the green economy [43-48]:

- Direct jobs are those created directly in the specific activity or process.
- Indirect jobs are those created throughout the required interindustry supply chain.
- Induced jobs are those created in supporting or peripheral activities.
- Total jobs are the sum or all of the jobs created.

Thus, for example, as shown in Table 1, most of the employees of a wind turbine factory include standard occupations such as Assemblers, Mechanical Engineers, Maintenance and Repair

Workers, Machinists, Purchasing Agents, Customer Service Representatives, Janitors, Industrial Machinery Mechanics, Shipping and Receiving Clerks, Welders, Accountants, Electricians, etc. We classify all of these as "green" employees because they work in for a firm producing RE equipment.

Production of wind turbines also creates a large number of indirect jobs: Jobs that are generated in the supply train and supporting industries. These include jobs that produce the inputs required by the turbine factory, the inputs required by these inputs, and so forth -- the classic input- output/interindustry concept. Most of these indirect jobs probably do not meet the criteria listed above. Nevertheless, we classify them as "green" -- jobs that are created by the green economy.

Further, production of wind turbines also creates a large number of induced jobs: Jobs generated by the re-spending of income received from direct and indirect job creation. For example, these include jobs located near the turbine factory such as fast food, restaurant, and bar jobs, retail sales employees, a plethora of various service and support jobs, etc. To paraphrase USA energy economist Gene Sperling, "If a zero-emission vehicle (ZEV) plant or a wind turbine factory opens up, a Wal-Mart can be expected to follow. But the converse does not hold: A Wal-Mart opening definitely does not bring a ZEV plant or wind turbine factory with it" [49]. Most of these induced jobs almost certainly do not meet the criteria listed above. Nevertheless, we also classify them as "green" -- jobs created by the green economy.

The Labor Union Issue

President Biden, numerous politicians and green jobs advocate emphasize the close link between labor unions and green jobs. However, many USA labor union officials are concerned with potential discrepancies in green jobs salaries and those in the fossil fuel industries and the implications of a "just transition".

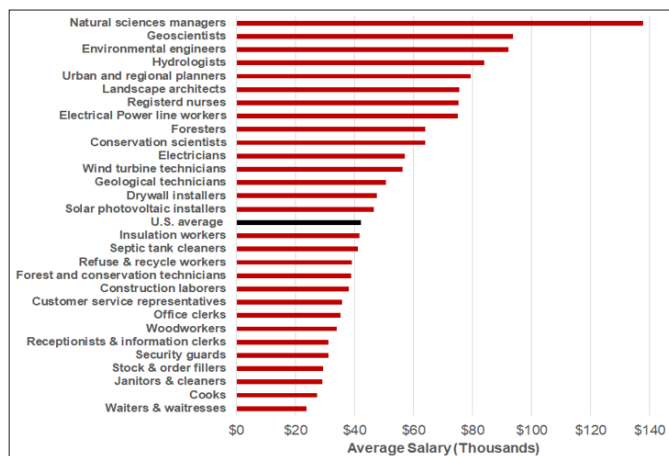
Nevertheless, while organized labor abhors the term "just transition," most green energy advocates and their allies continue to use it. Too often, though, the message gets subsumed in a broader culture war that paints Washington-conceived solutions as at best fools' gold, at worst a death sentence. According to Phil Smith, spokesman for the United Mine Workers, "They've got a long way to go to convince people that what could happen will actually be positive for them. Because right now, they don't believe that. There's never been such a thing as a just transition. Now, at least people are talking about the need for it, which is which is a step in the right direction. But there's been no example in this country of how to do that" [50]. UMW president Cecil Roberts stated "We believe that the Second Coming of the Lord is gonna get here before a just transition makes it our way" [51].

Similarly, Liz Shuler, President of the AFL-CIO, stated "There's members saying, 'If we're moving into this, if we're transitioning into all these new jobs, where's mine?' So outline specifically how the transition will be laid out. Is it going to be a bridge for those who are close to retirement? Is it going to be wage replacement? Is it going to be training up folks into the next opportunity?" Jeff Nobers, Executive Director of the Builders Guild of Western Pennsylvania, warns that "The skills learned in one area are less transferable than policymakers imagine [52]. Many clean-energy jobs are 'at the margins,' and tend to disappear once the solar panels and wind turbines are up and running" [53].

Labor groups are concerned that a green transition will eliminate the kind of steady, fixed-location jobs provided by coal mines or fossil fuel power plants, and instead will lead to temporary construction jobs that require mobility. But labor groups also worry that construction and installation jobs will be low paying and temporary. They contend that only manufacturing has traditionally offered higher pay and benefits and can sustain a work force for years [54].

A second concern is that wind farms, solar plants, and other green and climate-friendly power sources will need few workers to maintain them and keep them operating [55]. The prospect that workers would also receive significantly less pay only adds to green energy advocates' challenges in persuading workers that their strategy is also a jobs strategy. Brad Markell, Executive Director of the AFL-CIO Industrial Union Council, stated "For people that are in the fossil sector, the prospect of moving to the clean energy sector if you have to take a pay cut is not attractive". Crucially, green energy advocates are not trusted messengers: Many of them have long endorsed environmental policies that workers in fossil fuel-reliant sectors view as an assault on their employment and a danger to their communities. Green energy advocates contend that clean energy is the future, and the jobs are there. However, the jobs often are not in the right places or have adequate wages or benefits. President Obama and Presidential candidate Hillary Clinton both had plans for a coal country transition, but they are best remembered for Clinton's campaign-trail gaffe that "We're going to put a lot of coal miners and coal companies out of business", which still resonates [56].

Figure 1: Average 2020 USA Annual Salaries of Selected Jobs Generated by the Green Economy



Source: U.S. Bureau of Labor Statistics.

Table 1: Typical Employee Profile of a USA 250-person Wind Turbine Manufacturing Company, 2019

Occupation	Employees	Earnings
Engine and Other Machine Assemblers	31	\$33,359
Machinists	27	37,191
Team Assemblers	16	27,668
Computer-Controlled Machine Tool Operators	12	37,254
Mechanical Engineers	10	65,772
First-Line Supervisors/Managers of Production/Operating	10	54,705

Inspectors, Testers, Sorters, Samplers, and Weighers	8	37,202
Lathe and Turning Machine Tool Setters/Operators/Tenders	6	36,729
Drilling and Boring Machine Tool Setters/Operators/Tenders	4	36,509
Welders, Cutters, Solderers, and Brazers	4	36,530
Laborers and Freight, Stock, and Material Movers	4	28,466
Maintenance and Repair Workers	4	41,318
Tool and Die Makers	4	40,047
Grinding/Lapping/Polishing/Buffering Machine Tool Operators	4	31,899
Multiple Machine Tool Setters/Operators/Tenders	4	37,517
Industrial Engineers	3	64,659
Industrial Machinery Mechanics	3	42,315
Engineering Managers	3	99,404
Shipping, Receiving, and Traffic Clerks	3	29,516
General and Operations Managers	3	110,702
Industrial Production Managers	3	85,512
Industrial Truck and Tractor Operators	3	31,416
Purchasing Agents	3	51,702
Cutting/Punching/Press Machine Setters/Operators/Tenders	3	28,907
Production, Planning, and Expediting Clerks	3	41,601
Milling and Planing Machine Setters/Operators/Tenders	3	37,380
Mechanical Drafters	2	44,090
Customer Service Representatives	2	36,036
Bookkeeping, Accounting, and Auditing Clerks	2	32,760
Office Clerks, General	2	27,227
Sales Representatives, Wholesale and Manufacturing	2	50,757
Janitors and Cleaners	2	28,476
Sales Engineers	2	66,591
Accountants and Auditors	2	54,873
Tool Grinders, Filers, and Sharpeners	2	40,520
Executive Secretaries and Administrative Assistants	2	39,638
Mechanical Engineering Technicians	2	46,767
Electricians	2	45,570
Other employees	48	45,969
Employees, Total	250	\$57,680

Source: Management Information Services, Inc.

Conclusions

The reality is that the overwhelming majority of jobs created in and by the green economy will not adhere to the stringent criteria preferred by environmental and green jobs advocates and by many politicians. It is desirable that the wages, benefits, working conditions, and unionization rates of these jobs be improved, and in the USA, initiatives are under way to achieve this [57]. Nevertheless, the jobs are green and must be counted as such. To do otherwise would be unrealistic and, most ominously, would very seriously underestimate the size, importance, and rates of growth of the U.S. green economy and the jobs created by the green economy.

Environmentalists and green jobs advocates can be their own worst enemies. Numerous organizations, advocates, and politicians – including President Biden -- have significantly tightened the criteria for defining and characterizing green jobs and have, paradoxically, greatly reduced the number of jobs that can according to these criteria or characteristics be legitimately defined as being “green”. The more stringent the criteria, the fewer the jobs that are defined as green. It is clear that a very strict list of necessary criteria will greatly reduce the estimate of the number of green jobs in the economy.

Contrary to the publicity from environmental organizations and green jobs advocates, most green jobs are not necessarily glamorous, exciting, or desirable. Thus, current and forecast jobs openings for occupations such as Recycle Worker, Hazardous Materials Removal Worker, and Septic Tank Cleaner greatly exceed those for occupations generally promoted, such as Wind Turbine Technician, Solar Photovoltaic Installer, and Environmental Engineering Technician. It is thus essential to be realistic as to the “green jobs of the future” and to the education and training policies implemented concerning green jobs.

The major conclusion derived here is that utilization of strict criteria will very seriously underestimate the size, importance, and rates of growth of the U.S. green economy and the jobs created by the green economy. Since the jobs issue is critical, this will hinder efforts to address pressing environmental, climate, and energy issues and to expand the green economy. A Green New Deal will not be achieved based on unrealistic expectations.

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