

Seven Myths About Green Jobs

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August 2010

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Published by International Policy Press, a division of
International Policy Network

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This is a shortened and international version of “The
Mythologies of Green Jobs” by the same authors,
originally published in March 2009 as: *University of Illinois
Law & Economics Research Paper No. LE09-001 and Case
Western Reserve University Research Paper Series No. 09-15*.
The longer article can be found on SSRN and contains
more extensive documentation.

The study draws on work which was originally funded
by the Institute of Energy Research (Houston, Texas and
Washington, D.C.) An expanded version will appear in a
forthcoming book – *The False Promise of Green Energy* – to
be published by the Cato Institute (Washington, DC).

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Designed and typeset in Latin 725 by MacGuru Ltd
info@macguru.org.uk

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Executive Summary

A group of studies, rapidly gaining popularity, promise that a massive program of government mandates, subsidies, and forced technological interventions will reward us with an economy brimming with “green jobs.” Not only will these jobs allegedly improve the environment, but they will pay well, be very interesting, and foster unionization. These claims are built on seven myths about economics, forecasting, and technology. Our team of researchers, specializing in law and economics in various US universities, surveyed this green jobs literature, analyzed its assumptions, and found that the special interest groups promoting the idea of green jobs have embedded dubious assumptions and techniques within their analyses. We found that the prescribed undertaking would lead to restructuring and possibly impoverishing societies around the world. Therefore, citizens deserve careful analysis and informed public debate about these assumptions and resulting recommendations before the world can move forward towards a more eco-friendly nation. To do so, we need to expose these myths so that we can see the facts more clearly.

The myths and the facts

Myth 1: Everyone understands what a “green job” is.

Fact 1: No standard definition of a “green job” exists.

According to the studies most commonly quoted, green jobs pay well, are interesting to do, produce products that environmental groups prefer, and do so in a unionized workplace. Such criteria have little to do with the environmental impacts of the jobs. In order to build up a supporting political coalition, “green jobs” have become a mechanism to deliver something for members of many special interests, be it unions or local businesses, in order to buy their support for a radical transformation of society. Committing hundreds of billions of dollars to something which lacks a transparent definition – as advocated by many politicians and interest groups – cannot be justified.

Myth 2: Creating green jobs will boost productive employment.

Fact 2: Green jobs estimates in these oft-quoted studies include huge numbers of clerical, bureaucratic, and administrative positions that do not produce goods and services for consumption.

These green jobs studies mistake any position receiving a paycheck for a position creating value. Simply hiring people to write and enforce regulations, fill out forms, and process paperwork is not a recipe for creating wealth. Much of the promised boost in green employment turns out to be in non-productive – and expensive – positions that raise costs for consumers. These higher paying jobs that fail to create a more eco-friendly society dramatically skew the results in both number of green jobs created and salary levels of those jobs.

Myth 3: Green jobs forecasts are reliable.

Fact 3: The green jobs studies make estimates using poor economic models based on dubious assumptions.

The forecasts for green employment in these studies optimistically predict an employment boom that will take us to prosperity in a new green world. The forecasts, which are sometimes amazingly detailed, are unreliable because they are based on:

- a) Questionable estimates by interest groups of the small number of existing green jobs,
- b) Extrapolation of growth rates from those low figures, that does not take into consideration that growth rates eventually slow, plateau and even decline, and
- c) A biased and highly selective optimism about particular technologies.

Moreover, the estimates use a technique (input-output analysis) that is inappropriate to the conditions of

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technological change presumed by the green jobs literature itself. This yields seemingly precise estimates that give the illusion of scientific reliability to numbers that are actually based on faulty assumptions.

Myth 4: Green jobs promote employment growth.

Fact 4: By promoting more jobs instead of more productivity, the green jobs described in the literature actually encourage low-paying jobs in less desirable conditions. Economic growth cannot be ordered by national governments or by the United Nations (UN). Government interference in the economy – such as restricting successful technologies in favor of speculative technologies favored by special interests – will generate stagnation.

Green jobs estimates promise greatly expanded (and pleasant and well-paid) employment. This promise is false. The green jobs model is built on promoting inefficient use of labor. The studies favor technologies that employ large numbers of people rather than those technologies that use labor efficiently. In a competitive market, the factors of production, including labor, are paid for their productivity. By focusing on low productivity jobs, the green jobs literature dooms employees to low wages in a shrinking economy. The studies also generally ignore the millions of jobs that will be destroyed by the restrictions imposed by governments on disfavored products and technologies.

Myth 5: The world economy can be remade by reducing trade and relying on local production and reduced consumption without dramatically decreasing our standard of living.

Fact 5: History shows that individual nations cannot produce everything that citizens need or want. People and countries have talents that allow specialization in products and services that make them ever more efficient, lower-cost producers, thereby enriching all people.

The green jobs literature rejects the benefits of trade and specialization. This is a recipe for an economic disaster. Even favored green technology, such as wind turbines, requires great expertise largely provided by foreigners. The twentieth century saw many experiments in creating societies that did not engage in trade and did not value personal welfare. The economic and human disasters that resulted should have conclusively settled the question of whether nations can withdraw inside their borders.

Myth 6: Government mandates are a substitute for free markets.

Fact 6: Companies react more swiftly and efficiently to the demands of their customers/markets, than to cumbersome government mandates.

Green jobs supporters want to reorder society by mandating preferred technologies and expenditures through government entities. But the responses to government mandates are not the same as the responses to market incentives. We have powerful evidence that market incentives prompt the same resource conservation that green jobs advocates purport to desire. For example, the rising cost of energy is a major incentive to redesign production processes and products to use less energy. People do not want energy; they want the benefits of energy. Those who reduce energy used to produce desired goods and services – and thus reduce the cost of production – will be rewarded. On the other hand, we have no evidence to support the idea that command-and-control regimes accomplish conservation.

Myth 7: Wishing for technological progress is sufficient.

Fact 7: Some technologies preferred by the green jobs studies are not capable of efficiently reaching the scale necessary to meet today's demands.

The technologies given preference in the green jobs literature face significant problems in scaling up to the levels they propose. These problems are well documented in readily available technical literature, yet are resolutely ignored in the green jobs reports. At the same time, existing viable technologies that fail to meet the green jobs supporters' political criteria are simply rejected out of hand. This selective technological optimism/pessimism is not a sufficient basis for remaking society to fit the dreams of planners, politicians, or special interests.

Introduction

A push for a green economy is underway in the United States, the United Kingdom, Australia, the European Union, Japan and Canada, as well as in rapidly developing countries such as China and South Korea. Politicians now routinely assert that investing in “green jobs” can improve environmental quality and reduce unemployment.

Advocates of green jobs see no downside to these green job policies, which will cost hundreds of billions of public and private dollars to implement. Governments, non-governmental organizations (NGOs), and the United Nations¹ are all promoting the creation of green jobs. As Table 1 shows, numerous countries have devoted a portion of their fiscal stimulus to “green measures”.

Given claims that every dollar spent on green job programs will be repaid many times over, it is hard to see how creating new green jobs or “greening” existing jobs could be seen as anything other than a fantastic opportunity. However, when examined closely the green jobs rhetoric is rife with contradictions, vagueness, dubious claims, and a complete disregard of basic economic principles.

This paper examines claims about green jobs that have appeared in various green jobs reports, most notably a 2008 report titled “Green jobs: towards decent work in a sustainable, low-carbon world.” This report is the joint product of the United Nations Environmental Programme (UNEP) and the Worldwatch Institute, an environmental advocacy group noted for promoting population reduction,² with the assistance of the Cornell University Global Labor Institute, a pro-union organization.³ Co-sponsors include the International Labour Office (ILO), the International Trade Union Confederation (ITUC) and the International Organization of Employers (IOE).

The UNEP report explains what is at stake in the green jobs discussion, and does not pretend that this is a simple matter. It does not assert, as many national reports do, that green jobs programs are all win-win or pretend to know exactly how many green jobs will be created decades from now. It does not pretend that the costs can be known exactly, nor does it sugarcoat the structural changes that would be needed to force massive change.

But the UNEP report is representative of wider calls for green jobs as far as it proposes comprehensive social change. The report’s authors call for major actions to force what they see as a more efficient use of resources and to reform economic activity so as to significantly reduce carbon and other greenhouse gas emissions. Virtually every aspect of daily life – from where people live, where their food comes from, how they commute to work, to what they do at work – would be dramatically altered. It would mean a worldwide restructuring of almost all economic activity and employment, as the report concedes.⁴

Such massive social change is costly in both monetary terms and in terms of the disruption of lives. Before launching a program to transform the lives of billions of people at a cost of hundreds of billions of dollars, we should be sure not only that this is the future we want but that the theory underpinning this vision is correct. The history of the twentieth century is in part the history of failed efforts to remake societies according to visions that proved unsustainable. Before launching yet another effort, on an even grander scale, we need to thoroughly critique the vision.

Our analysis has three major parts. First, we examine the attempts to define when a job qualifies as “green.” Second, we analyze how the green jobs literature treats

Table 1 **International green stimulus**

Country	Amount spent on fiscal stimulus	Amount spent on green measures	Green measures as a percentage of total stimulus
Australia	\$26.7 billion	\$2.5 billion	9%
United Kingdom	\$30.4 billion	\$2.1 billion	7%
Canada	\$31.8 billion	\$2.6 billion	8%
France	\$33.7 billion	\$7.1 billion	21%
South Korea	\$38.1 billion	\$30.7 billion	81%
European Union	\$38.8 billion	\$22.9 billion	59%
Italy	\$103.5 billion	\$1.3 billion	1%
Germany	\$104.8 billion	\$13.8 billion	13%
Japan	\$485.9 billion	\$12.4 billion	3%
China	\$586.1 billion	\$221.3 billion	38%
United States	\$972.0 billion	\$112.3 billion	12%

Original Source: HSBC, "A climate for recovery" 25/2/09 http://www.globaldashboard.org/wp-content/uploads/2009/HSBC_Green_New_Deal.pdf

key economic concepts. Third, we provide an assessment of the assumptions and methods in the reports. Our analysis reveals that the reports' conclusions are unacceptable due to (a) a lack of standard definitions of "green jobs," (b) fundamental economic errors, and (c) poor assumptions combined to produce flawed methodology and thus flawed assessments. We conclude by suggesting that policymakers should view the hyperbolic claims of the green jobs literature with deep skepticism. We recommend continuing the debate with the facts – not myths.

Green plans in developing countries

China plans to spend \$221.3bn on green measures.⁵ Over \$51.1bn will go to renewable energy projects. Brazil has reportedly created nearly a million jobs a year through the biofuels sector – a strategy that has been recommended to other countries like Nigeria and Venezuela.

Green plans in the United States

In the United States, a 2008 report from the U.S. Conference of Mayors, *Current and Potential Green Jobs in the U.S. Economy*, contends that investing in green jobs would produce a remarkable range of benefits – from technological innovation to increased income. It also claims that these jobs would yield lower energy costs for business and individuals while improving environmental quality.⁶ A think tank with close ties to the Obama and Clinton Administrations asserts that "a green economic recovery program ... could create about 2 million new jobs within the U.S. economy over two years."⁷

Green plans in the European Union

The European Union's target to cut CO₂ emissions by 20% and obtain 20% of energy from renewables by 2020 is also touted as "an opportunity that should create thousands of new businesses and millions of jobs in Europe" by the likes of European Commission President Barroso. The Commission's 2006 renewable roadmap argues that over half a million jobs could be created by 2020, while other models produced by the EU point to 2.5 million jobs.⁸ Green technology in Germany – one of the EU's green champions – is expected to reach 16 percent of manufacturing output by 2030 and employ more people than the country's auto industry.⁹

Estimates for the United Kingdom are no less enthusiastic. One study from the Carbon Trust believes that the UK could benefit from 250,000 jobs and up to £70 billion from offshore wind and wave technology by 2050.¹⁰ All major political parties, including both parties in the ruling coalition, pledged a greening of the economy prior to the election. The Liberal Democrats promised 100,000 new green jobs, while the Conservative Party pledged "to generate thousands of green jobs."¹¹

Defining “green” jobs

There are four crucial problems relating to the definitions given to green jobs by their supporters.

A. What counts as “green” and what counts as a “job”?

Studies differ on what constitutes a green job. This is true for both existing jobs and jobs that might be created by new environmental initiatives. Estimates on how many green jobs could be created and sustained vary from study to study, depending on how the study defines “green.” These differences mean that it is useless to compare estimates, and they make it difficult to conduct an informed policy debate. More importantly, the varying definitions make important, but often controversial, assumptions about environmental policy, economics, and quality of life. In the hands of policymakers, these questionable assumptions have the potential to produce counterproductive effects: harming the environment, dampening economic growth, and reducing the quality of life for many people.

What counts as “green”?

Being green means different things from study to study. For example, the UNEP report defines a “green” job as:

Work in agricultural, manufacturing, research and development (R&D), administrative, and service activities that contribute substantially to preserving or restoring environmental quality. Specifically, but not exclusively, this includes jobs that help to protect ecosystems and biodiversity; reduce energy, materials, and water consumption through high-efficiency strategies; de-carbonize the economy; and minimize or altogether avoid generation of all forms of waste and pollution.¹²

As the report notes, “not all green jobs are equally green.”¹³ To their credit, the authors insist that the “bar needs to be set high” when defining green jobs so that the term doesn’t become meaningless and so that we can achieve the goal of “dramatically reduc[ing] humanity’s environmental footprint.”¹⁴ But while the UNEP definition excludes certain industries such as all jobs related to nuclear power and many recycling jobs, it also expands “green jobs” to mean all jobs asserted to “contribute substantially to preserving or restoring environmental quality.”¹⁵

This broad definition allows the authors to claim credit for many jobs. Wind turbine towers involve “large amounts of steel” and so the UNEP study considers the jobs in the steel industry that provide steel for turbines to be “green jobs.”¹⁶ The steel jobs themselves are not required to have a low environmental impact, only that the steel they produce go into a green product. Such value judgments are rife in studies on green jobs, and yet are not explained.

Some analyses consider almost anything to be “green” as long as the technology does not use fossil fuel, without even considering its environmental impact. For example, a US report touts biomass as a “group of technologies where additional investment and jobs will help to develop the nation’s alternative energy infrastructure.” It extols the virtues of generating energy using “wood waste and other byproducts” and “several waste products.”¹⁷ Biomass is included “because of the short time needed to re-grow the energy source relative to fossil fuels.”¹⁸ In other words, biomass counts as green because it is not a fossil fuel, even though it can cause environmental and health problems.

It is not surprising that “not all fuels derived from biomass necessarily offer meaningful carbon emission

advantages over fossil fuels, and some may even impose new environmental costs," as UNEP concedes.¹⁹ While we do not claim to be familiar enough with the issue to provide a final judgment on how green particular biomass and biofuel programs are, advocates of green jobs do not either. They make simplistic assertions about which energy sources can be counted on to replace fossil fuels and offer only vague estimates of the cost and environmental impacts.

Also, when deciding what a "green job" is, studies often introduce criteria that have nothing to do with the environmental impact of the job or production process. For example, recycling is generally touted as a major source of green employment.²⁰ But in the UNEP report many current jobs in recycling industries are excluded because they are "characterized by extremely poor practices, exposing workers to hazardous substances or denying them the freedom of association."²¹

There may be good reasons to deny public support for jobs that fail to meet certain working conditions, such as the ability to form labor unions. However, those reasons have nothing to do with the environmental impact of the job, and including such criteria in a definition of a "green" job obscures the issues. It seems, rather, that supporters of green jobs do not engage in serious analysis of whether a particular job is "green" but instead simply label jobs as green if they are found within a favored industry.²²

These definitional issues are not simply inconveniences that make it impossible to compare different reports and estimates.²³ More importantly, they represent fundamental confusion about the idea of a "green job," a confusion that must be resolved before committing hundreds of billions of taxpayer dollars and even larger sums of private resources. Many studies in the green jobs literature suffer from a lack of transparency and hide controversial assumptions that underlie various definitions. In the end, this lack of definition will create incentives for special interest groups to lobby to have their jobs designated as "green" and for their rivals' to be excluded. Developing open, clear definitions is critical to avoid turning the policy debate into a special-interest extravaganza that has little to do with the environment.

What counts as a "job"?

Another major problem with studies on green jobs is their tendency to assume that jobs always add value when calculating the success of spending programs. But employment created by green stimulus spending that does not add value should be counted as a cost. And the definition according to the UNEP report, for example, labels as green jobs "scientific and technical, administrative, and service-related activities that contribute substantially to preserving or restoring environmental quality."²⁴ A US estimate of green jobs found that the single biggest increases from green programs were secretarial positions; management analysts; then bookkeepers; followed by janitors. Another study estimated that there would be fewer new jobs for environmental scientists than any of these other categories.²⁵

The purpose of a business, green or not, is not to *use* resources (e.g. labor, energy, raw materials, or capital). The purpose is to *produce* a good or service desired by consumers that can be sold for more than the cost of production. If one business uses more resources than another to produce the same amount, it is less efficient and has higher costs. Yet many jobs created in response to government programmes are not a *benefit* of environmental measures but a *cost* of such programs. Regardless of whether these costs are worth incurring for the benefits a program produces, they must still be counted as costs and not as benefits.

Classifying lawyers and administrators as beneficiaries of green job spending brings up a significant problem. Making labor the *end*, rather than treating labor as a *means* to production of environmentally friendly goods and services, is a serious mistake. By promoting inefficient use of labor, green jobs policies steer resources towards technologies, firms, and industries that will be unable to compete in the marketplace without permanent subsidies from government. This will not only waste funds, but effectively doom the "environmentally friendly" sector to an unending regime of subsidies, and harm any efforts to build a competitive and environmentally friendly economy.

B. Forecasting

Forecasts of green jobs are too optimistic. Forecasts of how many green jobs there will be in the future are reached by extrapolating from recent growth rates in the numbers of green jobs. As the green jobs industry is a new phenomenon, it has shown the rapid growth common to all industries at their outset. Forecasts that assume that trend will continue indefinitely are likely to be over-optimistic. In addition, these calculations are largely based on guesses and surveys by interest groups rather than on real statistics from neutral sources. At the very least, more robust proof that green jobs will increase at sustainable rates in future is needed before we spend billions pursuing that assumption.

Yet many supporters of green jobs believe, like UNEP, that “[a]long with expanding investment flows and growing production capacities, employment in renewable energy is growing at a rapid pace, and this growth seems likely to accelerate in the years ahead.”²⁶ The UNEP report endorses optimistic forecasts such as:

- Spending on wind power installations is expected to expand from \$8 billion in 2003 and \$17.9 billion in 2006 to \$60.8 billion in 2016.²⁷
- Markets for the manufacturing and installation of solar PV modules and components are slated to grow from \$4.7 billion in 2003 and \$15.6 billion in 2006 to \$69.3 billion by 2016.²⁸
- The biofuels market of \$20.5 billion in 2006 is projected to grow to more than \$80 billion by 2016.²⁹
- Geothermal power “might” become a \$35 billion industry by 2020.³⁰

These forecasts predict very rapid growth in production and sales of technologies that are of dubious technical practicality and economic viability.³¹

There are five major problems with these sunny forecasts:

- 1) **Small base numbers:** Many of the sectors declared green are tiny. Even minor changes in capacity would lead to large percentage increases in growth. In other words, it is easy to double the number of jobs when you have one job, but not as easy when you have 1,000 jobs.

- 2) **Huge growth forecasts:** The growth rate forecasts are huge by any standard. This raises serious questions about their reliability. In the energy field, the projections assume an astonishingly fast spread of new technologies, some of which do not even currently exist in economically viable forms. Such assumptions are inconsistent with past experience with other technologies.

- 3) **Selective technological optimism:** Studies on green jobs show biased optimism about certain technologies, while ignoring potential developments for others. They ignore problems that might slow implementation of favored technologies and ignores the likelihood of technological improvements of disfavored ones. Selective optimism biases the forecasts, and is not supported by evidence of systematically faster growth in favored technologies over their competitors. While there is no doubt that assorted renewable energy sources can do more, much of this is purely speculative.

- 4) **Unreliable underlying statistics:** Many industries seen as key sources of green jobs are small and new, so no official statistics are available. As a result, many forecasts are based not on statistics collected by neutral analysts, but on estimates made by interest groups who seek a particular outcome.³² We must be careful about making policy decisions based on unsubstantiated numbers estimated by special interest groups.

The UNEP estimates of worldwide green jobs – 2.3 million in renewables, 300,000 in wind, 170,000 in solar photovoltaics, and 600,000 in solar thermal – are not numbers collected by a neutral statistical agency.³³ They are estimates by the Worldwatch Institute, which not only has a vested interest in the outcome but also has demonstrated a record of historical inaccuracy with respect to its forecasts. Virtually every green jobs calculation depends at some point on estimates made by organizations with vested interests. These figures are simply not objective, verified numbers on which to base an analysis.

Many of the sources quoted by the UNEP show similar bias. It cites, for example, the following sources for its calculations:

Box 1: Subsidized wind power in Europe

Wind power is often touted for its potential role in expanding green energy. However, wind turbines are very much like iPods, where the U.S. captures most of the economic value, but China gets the assembly work (which is little more than one percent of its retail value).⁴⁰ Wind turbine technology and patents are largely European. The United States imports most high-valued turbine parts. The largest maker, Vestas, is Danish, at about a quarter of the market. Gamesa from Spain and Enercon from Germany are next at about 15 percent of the market each. Turbine technology is highly technical and not easy to replicate. Hence, most wind energy work in the U.S. consists of importing the key technology and performing the assembly work.⁴¹

But this does not necessarily support the case for subsidizing wind energy in Europe. As soon as Vestas laid off nearly 2,000 workers in 2009, it announced investment in Chinese plants. In fact, it has become apparent that it is far cheaper to produce turbines and solar energy equipment in countries with lower manufacturing costs.⁴² Incentives and subsidies made Germany the world's largest market for photovoltaic installations, yet these measures are increasingly benefiting China and other countries, and not Germany's businesses or labour-force. China recently overtook Germany as the top world producer of solar cells.⁴³ In March 2010, German subsidies to solar energy were cut.⁴⁴ Previously, one of the country's leading solar-power businesses had asked that subsidies be cut so that the industry would become cost-effective.⁴⁵

- forecasts from "Clean Edge," which it describes as a "U.S.-based research and advocacy group;"³⁴
- a study by the "Blue-Green Alliance (a joint effort of the Sierra Club – America's oldest grassroots environmental organization – and the United Steelworkers union)" showing 820,000 jobs possible from renewable energy investments;³⁵
- a report by the "Apollo Alliance" – a coalition "working to catalyze a clean energy revolution in America"³⁶ – that showed 420,000 jobs from a 10-year, \$36 billion investment.³⁷

All of these sources are from organizations with strong vested interests in green job policies and outcomes. Such interests do not mean that these groups necessarily do bad work but they do mean that their estimates must be treated with caution.

- 5) **False precision masking large variations across estimates:** The reports often provide job creation forecasts that appear precise, giving the illusion of scientific certainty. Yet these apparently precise forecasts vary widely from estimate to estimate, between and even within reports.

Many reports, including UNEP's, provide impressive-looking statistical backing for recommendations, illustrated with a dazzling array of tables and charts filled with seemingly precise numbers in their forecasts. But there are immense problems with these apparently precise numbers, making these reports an unreliable basis on which to formulate policies on green jobs.

The UNEP does acknowledge that green job counts differ significantly,³⁸ but it still goes on to estimate that by 2030, worldwide, there could be 2.1 million new jobs in wind energy, 6.3 million in solar, and 12 million in biofuels.³⁹

C. Turning a blind eye to unseen costs

Many estimates focus only on the number of green jobs created and economic activity stimulated without considering unseen economic costs such as the jobs that will be lost as employment shifts away from disfavored industries and to favored industries. The case for supporting new green jobs loses much of its merit if it represents a loss of jobs overall. And yet, even when studies attempt to calculate job losses, they lack methodological rigor.

Those advocating green jobs claim that their programs will create jobs and other benefits as those hired into green jobs spend their paychecks. This is the “economic multiplier” analysis – the idea that an increase in activity by one firm will lead to an increase in activity by other related firms. It is routinely used to advocate for public subsidies for industries, sports stadiums, and higher education.⁴⁶ For example, the contractor for a new football stadium buys concrete, the concrete subcontractor buys new tires for its trucks, all the firms’ workers go out to dinner, and so forth. Multipliers are difficult to observe and must be estimated by indirect means.

The usual technique for assessing the reality of any multiplier is inappropriate for green jobs for technical reasons (discussed in detail in our longer paper). The multipliers used to argue for green jobs are further flawed by the regular assumption that all green jobs are new jobs, rather than substitutes for existing employment.

The proper measure is not total jobs that exist in an area receiving a subsidy but additional *net* new employment. Many green jobs are substitutes for existing jobs. An increase in electricity generation from wind, solar, or other sources will substitute for energy from, say, coal-fired generation, which in turn will reduce employment in coal mining and processing. The multiplier should only be applied to the *net addition* in jobs, which is lower than the gross number of jobs.⁴⁷

Many green jobs reports assume that spending public money will stimulate additional economic activity. However, studies of public projects have shown that the resulting job creation often is of dubious value, because the cost-per-job-created is so high. For example, Camden Yards – the Baltimore Orioles stadium – was billed as a job creating project.⁴⁸ However, the estimated cost per job created was \$127,000.⁴⁹ Similarly, in France one study noted that subsidies for the French fishing fleet were commonly justified by on-shore job “multipliers in the range of 3–5 jobs per seaman” but detailed analysis showed that only 1.4 to 1.5 on-shore jobs existed for every fishing fleet job.⁵⁰

D. Promoting inefficient use of labor

Studies prefer increasing the number of “green” jobs, even if it means using a less efficient means of production. For example, the UNEP report calls for hand-picked fruit rather than fruit picked by machinery, even though the former would make fruit more expensive and scarce. Low labor productivity, such as hand-picking fruit rather than using machinery, does not necessarily lead to a lower environmental impact, yet is a drag on the economy. The example above is also revealing of how actors who are dissatisfied with a market-based economy use environmental issues to achieve political objectives. In many cases, the labor movement hides behind the rhetoric of “green jobs” to push its own unrelated policy aims.⁵¹

Green jobs proponents have an inconsistent attitude toward efficiency. On the one hand, they see efficient use of non-labor inputs such as energy and raw materials as crucial to creating a green economy. The UNEP report states that “[g]reater efficiency in the use of energy, water, and materials is a core objective.”⁵² On the other hand, green jobs proponents see reducing the efficiency of labor as a virtue, not a cost. The UNEP report laments “[e]conomic systems that are able to churn out huge volumes of products but require less and less labor to do so pose the dual challenge of environmental impact and unemployment.”⁵³ It goes on to criticize “the fact that labor is being extruded from all points” in food and agriculture, as well as the steel and oil industries.⁵⁴

It is highly problematic to measure the success of a task by the maximum number of jobs it requires to achieve that task. First, the ultimate goal of economic activity is not the employment of labor or of other resources. The ultimate goal is the production of goods and services that satisfy human needs and wants. If we can produce more goods and services for the same cost, we can improve the standard of living for everyone.

Second, studies on green jobs mistakenly assume that labor-intensive production methods are always better for the environment than capital-intensive ones. In fact the extent to which a process is labor-intensive tells us little about whether particular techniques are better or worse for the environment or for the individuals engaged in the labor.

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Third, even in green industries, increasing the efficiency of labor has been an important component in making technologies more commercially viable. For example, the cost of corn-based ethanol in the United States was reduced in part by economies of scale in farm operations and the advanced technology necessary to convert crops into ethanol.⁵⁵ If instead we had thousands of workers diligently squeezing corn and sugarcane by hand we would not produce more biofuel, but we would vastly inflate the number of green jobs and dramatically increase the cost of the fuel.

The green jobs literature glorifies inefficient labor practices, with the aim of maximizing the number of jobs and human wellbeing. But in doing so, it ignores three economic truths:

- *Decreasing labor productivity limits opportunity.* Many environmentalists have advocated reduced consumption for decades, but reducing the goods and services available to people is not the answer for those seeking to improve human wellbeing.
- *Low labor productivity produces low wages.* Green jobs advocates promote a future of high-paying, low productivity jobs. Such a vision is economically unsustainable. In a market economy, wages and productivity are not negatively correlated.
- *Subsidizing labor at the expense of capital will delay the development of new technologies that can help conserve scarce resources.* For example, petroleum refining is a highly capital intensive process, but that capital intensity has meant that we are able to extract far more fuel and specialty chemicals from a barrel of crude oil. Innovations have allowed much more efficient use of natural resources. Discouraging capital intensity in production reduces the incentive to produce such innovations.

The problems detailed in this section question the underlying framework of the green jobs literature. They are grounds for caution in accepting the literature's ultimate conclusions and recommendations. Before trillions of dollars in public and private resources are directed into promoting a green jobs economy, we need to have a better understanding of the meaning of that goal and of the details of how such programs will reach that ill-defined end. What jobs will be considered

“green” and why? Who will decide which jobs are “green enough”? We should be skeptical about projections based on rapid early growth and rapid expansion of technologies that are not well developed. We should worry about proposals that glorify low labor productivity and would thereby reduce our standard of living.

Mistakes in economic analysis

As just reviewed, various studies on green jobs fail to agree on what defines a “green job”, but also contain highly problematic assumptions about the economics of employment. We now turn to some of the studies’ peculiar assertions about economics in general.

A. Rejecting comparative advantage

Studies often assert that green jobs are both desirable and achievable throughout the whole world.⁵⁶ For example, one US report states that green jobs will be created “in every region and state of the country.”⁵⁷ The UNEP report concludes that green jobs should include a high local content as this means “a more equitable distribution of wealth since the money saved is invested back into the local economy.”⁵⁸ Where a purely local strategy cannot be followed, the green jobs literature is critical of the role of trade. An example is the UNEP report’s discussion of biofuels where the main flaws are the potential sacrifice of “the interests of local communities” and that “human needs, especially of the poor and marginalized, all too easily lose out to profit interests.”⁵⁹

Such beliefs reject the economic principle of comparative advantage: that specialization and trade makes all parties better off. Yet this anti-trade – or “buy local” – sentiment is embedded throughout various studies on green jobs and is part of a larger criticism of the global economy. The UNEP report is among the most explicit in stating its overall anti-trade agenda. It argues:

Companies like Wal-Mart (with its policy of global sourcing and especially its policy of searching for cheap products, with potential negative impacts for labor and the environment) are major drivers and symptoms of [increased global trade] ... Ultimately a more sustainable economic system will have to be based on

*shorter distances and thus reduced transportation needs. This is not so much a technical challenge as a fundamental systemic challenge.*⁶⁰

The report questions whether “a system of unbridled consumption – well entrenched in Western industrialized countries, but spreading rapidly to the growing middle classes of countries” can be sustainable.⁶¹ Having considered the “urbanization, informality, and social and environmental stress across the developing world,” it goes on to urge developing countries to pick a “different” path of development.⁶²

Though UNEP concedes that “the bulk of documented growth of Green Jobs has so far occurred mostly in developed countries, and some rapidly developing countries like Brazil and China”, it then lists anecdotal evidence of green projects in Bangladesh, India and Kenya and appeals for more funding to support the “development of green employment across the developing world.”⁶³

In reality, trade is beneficial to human welfare. The anti-trade position of many studies on green jobs is contradicted by both economic theory and the experience of the world economy. Nor does the green jobs literature acknowledge the world’s baleful experience with trade protectionism. The green jobs literature is, in other words, smuggling in a highly controversial economic policy under the guise of an environmental policy.

B. Ignoring costs to consumers

The green jobs literature asserts benefits of green jobs policies using a flawed conception of improvements in human welfare. Rather than look at both consumer and producer benefits, as is common when evaluating the

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social benefits of a policy,⁶⁴ green job proponents concentrate almost entirely on the producer side. For example, the UNEP report criticizes increased agricultural trade between the United States and Mexico because “cheap corn from the United States has hurt Mexican farmers who grow maize on small- to medium-sized plots in difficult environments using low levels of technology.”⁶⁵ No mention is made of benefits of cheaper corn to Mexican consumers.

The benefits of trade are not just assertions from economic theorizing. Trade has real-life consequences that affect the quality of life, such as by providing more food at lower cost to billions of people.⁶⁶ That is a huge consumer surplus. More generally, the report criticizes expanded trade in foodstuffs because:

*[t]he growth of supermarkets in the global South is having a marked effect on farmers, and some maintain that this effect is bigger than that of trade liberalization. Leading supermarket chains have shifted away from wholesale markets where small farmers make their living, and toward procuring food through a few medium-to-large firms that can deliver a consistent quality product at large volumes.*⁶⁷

As a result, the UNEP report complains that:

*[T]he consolidation of retail has meant that farmers and producers often receive dwindling returns on their produce, as large retailers are in a position to lay down ‘take it or leave it’ conditions. Retailers are also in a position to dictate terms to processors and distributors and even large food manufacturers, which results in manufacturers being more concerned to serve the interests of retailers and less concerned to maintain a good relationship with farmers.*⁶⁸

These passages demonstrate the biased nature of cost/benefit estimates made by proponents of green jobs. In general, economic concepts and technologies that the special interests behind these reports do not like (e.g. fossil fuels, nuclear power, free markets, trade, lower prices for many consumers) are assumed to produce net costs. Those that the advocates prefer (e.g. small farms, local production, solar power) are assumed to produce net benefits. Counting only the benefits from the favored technologies and activities and only the costs from the disfavored ones distorts the outcome. Both

costs and benefits must be taken into account to make an accurate comparison. In particular, the benefits to consumers need to be carefully estimated. This biased calculation is not an accidental oversight – their complete disregard for the benefits of market competition reveal green job sponsors’ rejection of modern economics. It is necessary to address these economic precepts before accepting claims about green jobs and restructuring of the economy.

C. Cost-free mandates and mindless markets

Many green jobs programs rest on government mandates to promote favored technologies over those that would naturally be chosen in a competitive economy. However, in judging the likely efficacy of this approach, the literature tends to ignore the large opportunity costs of such mandates and assumes, incorrectly, that market actors cannot judge their own interests over green technology.

As an example of opportunity costs being disregarded, consider the UNEP study, which refers to the creation of jobs from spending on environmental projects as the “double dividend.”⁶⁹ The report fails to consider what opportunities the government and businesses will forgo since they do not have that money to spend in other ways.⁷⁰ The costs are high: one US study asserts that if \$100 billion is spent on green activities that 935,200 jobs would be directly created,⁷¹ implying a cost of \$107,000 per new job created. Most US citizens could go to a modestly priced private or state university full time for four years for that sum.⁷² Either the funds for these programs were taken from the pockets of people who now have \$100 billion less to spend on other things, causing an economic contraction in those other areas, or it is a bill passed on to the grandchildren of today’s taxpayers in the form of deficit spending. These costs are real and must be considered in any debate. We must ask what we are giving up to fund these programs. Proponents of green jobs ignore these questions.

Most jobs in renewable energy sectors appear to be subsidy driven. A large number of jobs in solar and wind energy rely heavily on taxpayer subsidies or mandates. For example, a study done for the American Wind

Energy Association and the Solar Energy Research and Education Foundation estimated that if the investment tax credit for solar/PV projects and the production tax credit for wind energy were not renewed at the end of 2008, then those industries could lose 77 percent of their jobs.⁷³

Indeed, U.S. subsidies for renewable energy projects are so attractive that in 2008, BP announced that it dropped plans to build wind farms and other renewable projects in Britain. Instead, the company is shifting its renewables programs to the United States, where – as noted by a BP spokesman – government incentives for clean energy projects provide “a convenient tax shelter for oil and gas revenues.”⁷⁴ Royal Dutch Shell also announced it was abandoning wind energy projects in Britain in favor of the U.S.⁷⁵ These developments lend support to the idea that renewable energy is viable only where there is taxpayer support or mandates.

In general, there is no doubt that requiring all public buildings to be retrofitted or offering “strong financial incentives” to private building owners to engage in retrofitting, as some studies suggest, would create jobs.^{76, 77} Of course, requiring all public buildings to be painted purple or offering tax incentives to private building owners to paint their buildings purple would also create jobs. The number of painting jobs would increase, paint manufacturers would increase production of purple paint, paint stores may hire additional delivery help, paint brush manufacturers would increase production, and so forth.

The question is: What would have happened to the resources used to meet the purple paint mandate in the absence of the government program? Those resources would have been put to the building owners’ highest and best use, and those uses would have also created demand for goods and services. The same is true of retrofitting mandates. Meanwhile the implication of the necessity of a mandate is that profit-seeking building owners are too foolish to make investments in energy saving despite the alleged benefits to them.

While costs of alternative energy sources are often unspecified in reports advocating their adoption, advocacy groups believe that the adoption of these alternative energy sources should be required. For

example, the UNEP report argues that “to the extent that government mandates that such alternatives [such as solar power] be given equal access to the [electricity] grid, higher costs will be passed on to the consumers,” but, “as renewables mature technologically ... cost disadvantages disappear and may turn into a cost advantage.”⁷⁸ Consistently throughout the UNEP report, its authors assert that money could be made if only profit seekers were smart enough to recognize the opportunities: “Green innovation helps businesses ... hold down costs by reducing wasteful practices.”⁷⁹ One study cited by the UNEP asserted that “green building” improvements are “paid back over 2–7 years.”⁸⁰ Another claimed that a \$9 billion investment in energy savings would generate \$28 billion in savings over 17 years and generate 58,400 new jobs.⁸¹

In short, the UNEP believes that one wonderful profitable opportunity after another is missed by profit-seeking and short-sighted corporations. That premise is at odds with the desire of a number of utilities to be *allowed* to sink large amounts of capital to build nuclear and coal plants that take up to a decade to build and have a long recoupment period. If the people who make their living in the industry do not see it wise to invest in massive wind and solar farms (unless heavily subsidized), then the economic feasibility of such green projects is dubious.

D. Ignoring incentive effects

The green jobs literature focuses on public policies to induce greater energy efficiency, both to reduce greenhouse gas emissions and because it seeks to shift expenditures away from fossil fuels. However, energy efficiency occurs naturally as a result of market processes even without forced taxpayer support. Because the literature ignores this trend, it overstates the benefits of its conservation measures. Given a trend toward more efficient use of energy even without policy measures, the proposals will induce less net conservation than studies predict because some level of energy conservation would have occurred anyway.

Because energy is costly, the market has an incentive to produce and consume less energy. From the late 1970s to 2000, the amount of energy consumed per dollar of real

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GDP produced fell by 36 percent.⁸² Total energy usage increased because of economic growth over that time, but efficiency increased more than growth in all major energy-using sectors. Using data from the United States and Great Britain, we can compare energy requirements across time. Compared to 1900, each unit of energy input in 2000 could provide four times as much useful heat, move a person 550 times farther, provide 50 times more illumination, and produce 12 times as much electricity.⁸³ One result of this increase in efficiency is that past forecasts of future energy use have *overestimated* future energy demands. For example, estimates done by knowledgeable researchers in the late 1970s for energy use in 2000 proved to be 60 to 80 percent higher than actual use in 2000.⁸⁴ That is, experts who knew efficiency would increase still greatly underestimated technical progress. Given the bias against disfavored technologies in the green jobs literature, we would expect its predictions to be even more off base.

An analysis by the International Energy Agency confirms that greatest improvements in energy efficiency have occurred naturally, rather than through conservation measures:

Analysis ... for 16 IEA countries shows that improved energy efficiency has been the main reason why final energy use has been decoupled from economic growth. Without the energy efficiency improvements that occurred between 1973 and 2005 in 11 of those countries, energy use would have been 58%, or 59 EJ, higher in 2005 than it actually was. However, since 1990 the rate of energy efficiency improvement has been much lower than in previous decades.

These findings provide an important policy conclusion – that the changes caused by the oil price shocks in the 1970s and the resulting energy policies did considerably more to control growth in energy demand and reduce CO₂ emissions than the energy efficiency and climate policies implemented in the 1990s.⁸⁵

Data on energy consumption across both producer and consumer goods (discussed in detail in our longer paper) demonstrates three key lessons relevant to the evaluation of green jobs claims:⁸⁶

- *Market forces provide a powerful incentive that drives greater efficiency with respect to costly inputs.* Net gains

from green jobs policies mandating conservation are likely to produce fewer gains than claimed since some (or even more) efficiency gains would occur in the absence of mandates.

- *Regulatory policies have, at times, slowed or blocked energy efficiency gains through unintended consequences.* Adopting mandates is thus not risk free with respect to energy efficiency.
- *The green jobs literature ignores history and fails to mention the extensive data on increases in energy efficiency over time in the industries they propose to regulate.* The authors of this paper are not experts on technical aspects of energy production or use, yet we were able to find – from widely distributed, credible sources – extensive data on this crucial issue that the green jobs literature ignores. Such gaps suggest a need for great skepticism in evaluating their claims of energy efficiency.

E. Market hostility

Underlying much of the green jobs literature is a deep hostility to free market societies that favor voluntary and decentralized decision making. Instead, the literature shows a clear preference for centrally-directed programs built on government mandates. The unprecedented increase in human welfare resulting from the industrial revolution is dismissed: “The story of economic change is, however, also a story about political choices. More often than not, these choices have put the accumulation of wealth before the needs of the majority.”⁸⁷ For example, the UNEP report insists that there is an:

urgent need to make economies far more sustainable and thus to re-examine the prevailing production and consumption model. Concepts such as dematerialization, remanufacturing, ‘zero-waste’ closed-loop systems, durability, and replacing product purchases with efficient services (such as ‘performance contracting’) have been discussed for some time and tested in some instances, but by and large have yet to be translated into reality.⁸⁸

As a result, the green jobs literature’s answer to a perceived or real problem is almost always massive public expenditure or regulation rather than less intrusive interventions. For example, the UNEP report

claims that the obstacle to greener buildings is due, in large part, to an information problem – people’s overestimation of the additional cost of green techniques. However, the recommendation is government intervention instead of the provision of information.⁸⁹ Nothing better captures the contempt for improving the lives of ordinary people that is rampant in the green jobs literature than the suggestion by the UNEP report that rickshaws could become a significant form of transportation in a green economy.⁹⁰ This contempt for decentralized, free societies leads to a focus on mandates and a wide range of conceptual errors that render the results of these studies untrustworthy.

In summary, green job analyses:

- reject the existence of comparative advantage, suggesting a need to avoid trade.
- ignore harm to consumers, giving misleading estimates of the benefits of the proposed policies.
- ignore the other productive uses of the resources they propose to devote to green jobs programs, thus overestimating net gains in jobs.
- reject the market’s assessment of the potential of green technologies, believing that opportunities for profit and self-sustaining growth will emerge where profit conscious entrepreneurs are unwilling to invest.
- do not take into account how market incentives encourage energy efficiency, instead assuming that energy efficiency results from government policies.
- exhibit a strong hostility to decentralized, market decision making.

That the literature contains so many basic economic errors is not accidental, but reveals that many studies on green jobs are hostile towards free markets. They thus focus on government solutions with no regard for the greater prosperity and higher living standards that have resulted from market incentives. Taken together, these errors reveal fatal flaws in these studies’ analyses of green job policies.

3

Ignoring technical literatures: the case of electricity generation

Proponents of green jobs routinely ignore important technical literature that challenges some of the assumptions underlying green jobs programs. Electricity generation provides a perfect case study of how reports on green jobs ignore facts that contradict their claims and continue to engage in the sort of selective technological optimism described earlier.

The green jobs literature calls for massive shifts in power generation technologies. As noted earlier, the literature is selectively optimistic about favored power generation technologies (e.g. wind, solar, biomass) and selectively pessimistic about disfavored ones (e.g. coal, nuclear). Here we briefly survey claims relating to three power generation technologies: wind, solar, and nuclear, and show how green jobs proponents fail to adequately address the technical issues involved with each.

The UNEP report predicts that, thanks to “rapidly rising interest in energy alternatives”, employment could reach 2.1 million in wind energy and 6.3 million in solar photovoltaics (PVs) by 2030.⁹¹ It argues that wind and solar technology development could help countries that have suffered from de-industrialization and job losses in manufacturing, and countries in development such as China and India.⁹² It is claimed that, in addition to creating jobs, renewables have a host of other benefits, from improving a country’s trade balance and ensuring that money stays in the domestic economy.⁹³

The UNEP report recognizes that these technologies may at first entail higher costs – but it argues that these will disappear as the technology matures, and economies of scale are achieved. In the meantime, their price development should be “determined not only by world market trends, but also by applicable subsidies (and subsidy shifts) and efforts to internalize the social and environmental costs of fossil fuels.”

A. Wind

In the European Union, all member states have agreed to source 20% of energy from renewable sources by 2020. In 2008, just over 4% of the EU’s electricity came from wind power capacity, and for the last few years, wind power has accounted for the majority of new power installations.⁹⁴

Partly because of subsidies, the contribution of wind to *renewable electricity* generation in the United States is expected to increase from 7 percent in 2006 to 16 percent in 2020 and 20 percent in 2030.⁹⁵ However, despite being heavily subsidized, its total contribution to “energy security” is slight, and unlikely to rise to a significant level over the foreseeable future.

The UNEP report advances wind-generated electricity as an example of how a renewable technology can become cost-competitive with gas and coal-fired power plants. But it overlooks a number of concerns.

A report by the UK’s House of Lords Select Committee found that “although declining over time, [the full costs of wind generation] remain significantly higher than those of conventional or nuclear generation (even before allowing for support costs and the environmental impacts of wind farms).”⁹⁶

Wind’s contribution is also diminished by its ability to deliver electricity only intermittently. Wind turbines cannot produce when wind speed is either too low or too high, or if the turbine blades or other critical components are iced up. Since electricity cannot be stored, wind capacity must be backed up by other electric generation sources. All of this increases the cost of wind energy substantially. As the HoL Select Committee reports, “wind generation needs to be viewed largely as additional capacity to that which will need to

be provided, in any event, by more reliable means.”⁹⁷ So while wind is “free”, we must consider construction, installation and transmission costs, and acknowledge that wind turbines alone cannot satisfy consumers’ need for reliability and continuous, round-the-clock availability.

Further, efforts to increase wind generation capacity have run into major hurdles with regulatory laws and opposition by local residents.⁹⁸ Despite these widely known problems, which are never discussed in depth in the green jobs literature, green jobs policy proposals propose enormous increases in wind capacity without detailing a strategy for how these problems will be solved.

B. Solar

Solar power is another technology favored by green jobs advocates. As with wind energy, there are substantial – and largely unacknowledged – hurdles to a significant expansion in solar electric generation.

Solar power in both residences and commercial premises has expanded rapidly around the world, especially in Europe. However this has largely been due to lavish public subsidies. Several countries, including Australia and Germany, have reduced subsidies to solar energy over the past years.

Despite decades of effort and extensive subsidies in the US, the current contribution of solar to meeting the nation’s energy needs is only 0.05%.⁹⁹ The vast majority of this is from solar thermal and hot water production rather than electricity generation. The remainder is from solar photovoltaic (PV).¹⁰⁰

The costs of solar energy continue to be prohibitive. The HoL Select Committee found that solar generation is more costly than most other forms of renewable generation.¹⁰¹ Even the UNEP report concedes that solar photovoltaics (PV) will “remain more expensive for the foreseeable future.”¹⁰² And as with wind, the costs of back-up energy sources are often not included in calculations, meaning that relying on solar energy would entail higher costs than predicted in green jobs reports.

Like wind, solar power suffers from reliability problems as solar radiation changes with different atmospheric

conditions and the changing position through the day, as the Earth changes position relative to the sun.¹⁰³ According to the Institute for Energy Research, solar technologies are improving and are well-suited for small-scale applications, in remote locations. However, meeting current US electricity demand with solar power remains impracticable and extremely costly: the institute estimates that about 10,000 square miles of solar panels – an area the size of New Hampshire and Rhode Island combined – would be required.¹⁰⁴

C. Nuclear

In contrast to its treatment of favored technologies, the green jobs literature almost completely dismisses nuclear power generation. We are not advocating nuclear power generation but are noting the inconsistency of green jobs advocates’ treatment of unproven technologies with serious technical problems, such as solar, compared to its treatment of an existing power-generating technology that emits no greenhouse gases. This difference reveals important embedded assumptions by the green jobs advocates that have little to do with environmental quality or economic impact.

Nuclear power is essentially carbon free to generate, just like solar and wind, and does not require blanketing huge areas of land with wind turbines or solar panels.¹⁰⁵ Currently, its widespread commercial use produces about 20% of U.S. electric power.¹⁰⁶ In Europe, 15 nations produce an even greater share of their electricity from nuclear power. Japan and South Korea also obtain a larger share of electricity from nuclear power than does the United States.¹⁰⁷ The widespread use of nuclear power across nations is likely to increase as European nations formerly skeptical of the environmental impact of nuclear power turn to it to reduce greenhouse gas emissions and to reduce their reliance on shaky Russian natural gas supplies.¹⁰⁸ This is a striking contrast to the tiny shares of electricity generated by wind and solar.

Politically, nuclear power is controversial and a variety of U.S. environmental groups oppose it, as a survey of their websites indicates:

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- *Greenpeace International*: “The only solution is to halt the expansion of all nuclear power, and for the shutdown of existing plants.”¹⁰⁹
- *World Wildlife Fund (WWF)*: “But among currently deployed commercial technologies, scaling up nuclear power is not an effective course to avert carbon emissions.”¹¹⁰
- *Friends of the Earth UK*: “Nuclear Power is dangerous and expensive because:
 - Security threats
Power stations could be terrorist targets.
 - Toxic waste
Pollutes environment. Waste needs careful management for generations.
 - Global proliferation
Availability of deadly materials increased.”¹¹¹

This skepticism is incorporated into reports on green jobs. For example, the UNEP report states that “nuclear power is not considered an environmentally acceptable alternative to fossil fuels, given unresolved safety, health, and environmental issues with regard to the operations of power plants and the dangerous, long-lived waste products that result.”¹¹²

The best technologists cannot predict which technology will dominate years from now, as they know technology changes. A policy that eliminates major possible options, assuming that technologies which exist today will continue to be the only options in decades to come, will have us locked into costly, economically destructive policies.

Conclusion

The costs of the green jobs programs proposed by various interest groups are staggering. For example, the UNEP report concludes that “No one knows how much a full-fledged green transition will cost, but needed investment will likely be in the hundreds of billions, and possibly trillions, of dollars.”¹¹³ The scale of social change that would be imposed is also immense. Green jobs advocates propose dramatic shifts in energy production technologies, building practices, and food production. These calls for radical changes in every aspect of modern life are wrapped in a new package under the guise of “green jobs”. Advocates promise not only a revolution in our relationship with the environment but to employ millions in high paying, satisfying jobs. Unfortunately, the analysis provided in the green jobs literature is deeply flawed, resting on a series of myths about the economy, the environment, and technology.

To attempt to transform modern society on the scale proposed by the green jobs literature is an effort of staggering complexity and scale. To do so based on the wishful thinking and poor economic analysis embodied in many estimates of green jobs would be the height of irresponsibility. We have no doubt that significant opportunities abound to develop new energy sources, new industries, and new jobs in the future. We are equally confident that a market-based discovery process will do a far better job of developing those energy sources, industries, and jobs than could a series of mandates based on flawed data. It is time to bring this debate into the light and dispel the myths so that policies can be based on clear facts and analysis.

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Worldwatch lists its mission statement as 'Worldwatch Institute delivers the insights and ideas that empower decision makers to create an environmentally sustainable society that meets human needs. Worldwatch focuses on the 21st century challenges of climate change, resource degradation, population growth, and poverty by developing and disseminating solid data and innovative strategies for achieving a sustainable society.' *Worldwatch Institute*. "Worldwatch Mission Statement". <http://www.worldwatch.org/node/24> (last visited Feb. 18, 2009). Worldwatch was founded by Lester Brown, author of a number of alarmist books on population. See, e.g. Lester R. Brown. 1995. "Who Will Feed China? Wake-up Call for a Small Planet"; Lester R. Brown. 1998. "Tough Choices: Facing the Challenge of Food Scarcity"; Lester R. Brown, et al. 1999. "Beyond Malthus: Nineteen Dimensions of the Population Challenge". In 1997, *The Economist* summarized Brown's record on population and food issues as follows:

Lester Brown of the Worldwatch Institute began predicting in 1973 that population would soon outstrip food production, and he still does so every time there is a temporary increase in wheat prices. In 1994, after 21 years of being wrong, he said: "After 40 years of record food production gains, output per person has reversed with unanticipated abruptness." Two bumper harvests followed and the price of wheat fell to record lows. Yet Mr. Brown's pessimism remains as impregnable to facts as his views are popular with newspapers. The facts on world food production are truly startling for those who have heard only the doomsayers' views. Since 1961, the population of the world has almost doubled, but food production has more than doubled.

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‘While recycling offers the benefit of recovering resources that otherwise would have to be mined and processed at considerable environmental expense, the procedures prevalent in most of China’s recycling sector themselves impose considerable human and environmental costs. Particularly the manual disassembly jobs cannot be described as green jobs.’ *Ibid.* Page 219.

“... characterized by extremely poor practices, exposing workers to hazardous substances or denying them the freedom of association.” *United Nations Environment Programme*. 2008. “Green Jobs: Towards Decent Work in a Sustainable, Low-Carbon World”. Page 4

http://www.unep.org/labour_environment/PDFs/Greenjobs/UNEP-Green-Jobs-Report.pdf

22. For example, *Occupational Outlook Quarterly* quoted Ann Randazzo of the Center for Energy Workforce Development in Washington, D.C. that ‘jobs in renewable energy are not all that different from jobs in traditional energy sources... . For example, a person who is trained to work on power lines also has many of the skills to work on wind turbines.’ (Phillip Bastian. Fall 2008. “On the Grid: Careers in Energy”. *Occupational Outlook Quarterly*. Pages 33 – 41). Similarly, the United States Conference of Mayors suggests that existing manufacturing operations will simply switch from making other things to making wind turbines. (*United States Conference of Mayors*. 2008. “U.S. Metro Economies: Current and Potential Green Jobs in the U.S. Economy”. Page 13.

<http://www.usmayors.org/pressreleases/uploads/GreenJobsReport.pdf>). The report states

‘The technology of wind electricity is relatively new, but the manufacturing base for its production is very similar to past products. Every state in the country has firms and a labor force with experience making products similar to the blades, gearboxes, brakes, hubs, cooling fans, couplings, drivers, cases, bearings, generators, towers and sensors that make up a wind tower. These jobs fall into the familiar durable manufacturing sectors of plastics and rubber, primary metals, fabricated metal products, machinery, computer and electronic products, and electrical equipment.’

Ibid. Likewise, the CAP report states that ‘the vast majority’ of the green jobs its program would create are ‘in the same areas of employment that people already work in today...’ *Center for American Progress*. 2008. “Green Recovery: A Program to Create Good Jobs and Start Building a Low-Carbon Economy”. Page 5. http://www.americanprogress.org/issues/2008/09/pdf/green_recovery.pdf

And the UNEP study noted that job creation in “sheet metal work, semiconductors, electronic equipment, and others” would be “a welcome antidote to the loss of manufacturing jobs in recent years.” *United Nations Environment Programme*. 2008. “Green Jobs: Towards Decent Work in a Sustainable, Low-Carbon World”. Page 110 http://www.unep.org/labour_environment/PDFs/Greenjobs/UNEP-Green-Jobs-Report.pdf

23. Even the UNEP study conceded that existing green jobs literature is made up of studies using quite different methodologies and assumptions. ‘One problem with the array of existing studies is that they employ a wide range of methodologies, assumptions, and reporting formats, which makes a direct comparison of their job findings – or any aggregation and extrapolation-very difficult or impossible.’ *United Nations Environment Programme*. 2008. “Green Jobs: Towards Decent Work in a Sustainable, Low-Carbon World”. Page 101 http://www.unep.org/labour_environment/PDFs/Greenjobs/UNEP-Green-Jobs-Report.pdf

24. *United Nations Environment Programme*. 2008. “Green Jobs: Towards Decent Work in a Sustainable, Low-Carbon World”. Page 35–36 http://www.unep.org/labour_environment/PDFs/Greenjobs/UNEP-Green-Jobs-Report.pdf

25. Roger H. Bezdek, et al.. 2008. “Environmental protection, the economy, and jobs: National and regional analyses”. *Journal of Environmental Management* Issue 86. <http://www.misi-net.com/publications/JEM-V86-08.pdf>

Bezdek and his associates are primary authors of the ASES report.

26. *United Nations Environment Programme*. 2008. "Green Jobs: Towards Decent Work in a Sustainable, Low-Carbon World". Page 6
http://www.unep.org/labour_environment/PDFs/Greenjobs/UNEP-Green-Jobs-Report.pdf
27. The asserted expansion is in doubt. The largest project, a multi-billion dollar 2,700 wind turbine project in West Texas, had to put plans on hold because of the decline in oil and natural gas prices. AP Article. Nov. 12, 2008. "T. Boone Pickens puts Texas wind farm project on hold". *Dallas Morning News*.
<http://www.dallasnews.com/sharedcontent/dws/bus/stories/111308dnbuspickens.ae1b50.html?npc>
28. *United Nations Environment Programme*. 2008. "Green Jobs: Towards Decent Work in a Sustainable, Low-Carbon World". Page 93 http://www.unep.org/labour_environment/PDFs/Greenjobs/UNEP-Green-Jobs-Report.pdf
29. John Ferak, Ethanol Towns Also on Idle, OMAHA WORLD-HERALD, Jan. 30, 2009, at 01D. Venita Jenkins, Plans for Ethanol Plant Likely to Be Scrapped, FAYETTEVILLE OBSERVER, Jan. 31, 2009.
30. *Ibid*
31. We discuss the current size of several of these sectors below.
32. For example, the *Department of Energy* estimated that if the U.S. attempted to achieve 20 percent wind power by 2030 (which would be an incredible undertaking given the slow rate of growth), there would be 500,000 jobs at that time in the wind-related field, of which 150,000 were manufacturing, construction, and maintenance. *U.S. Department of Energy*. May 13 2008. "20% Wind Energy by 2030".
<http://www1.eere.energy.gov/windandhydro/pdfs/41869.pdf>.
That contrasts to the *ASES* claim that to achieve a goal of 15% renewable energy (wind, solar, etc.) by 2030 would mean 3.1 million jobs by then; a goal of 30% would mean 7.9 million new jobs in that sector of the economy by 2030. Roger H. Bezdek. Jan. 2009. "Green-collar jobs in the US and Colorado". *American Solar Energy Society (ASES)*. Page 7. The *ASES* numbers are not broken down by energy source, but they are vastly higher than the jobs numbers projected by the *Department of Energy*, which only looked at wind.
33. *United Nations Environment Programme*. 2008. "Green Jobs: Towards Decent Work in a Sustainable, Low-Carbon World". Page 295 http://www.unep.org/labour_environment/PDFs/Greenjobs/UNEP-Green-Jobs-Report.pdf
34. *United Nations Environment Programme*. 2008. "Green Jobs: Towards Decent Work in a Sustainable, Low-Carbon World". Pages 94 and 99 http://www.unep.org/labour_environment/PDFs/Greenjobs/UNEP-Green-Jobs-Report.pdf
Ron Pernick and Joel Makower. 2005. "Harnessing San Francisco's Clean-Tech Future: A Progress Report". *Clean Edge, Inc.* http://www.cleantech.com/reports/reports-SF_cleantech2005.php
35. *Ibid.* page 99. The *Renewable Energy Policy Project* published several reports (available at <http://www.repp.org/>) which collectively found that '820,000 new good-paying manufacturing jobs could be created across the country.'
<http://www.sierraclub.org/energy/bluegreenjobs/>
36. The *Apollo Alliance* is 'a coalition of business, labor, environmental, and community leaders working to catalyze a clean energy revolution in America to reduce our nation's dependence on foreign oil, cut the carbon emissions that are destabilizing our climate, and expand opportunities for American businesses and workers.' *Apollo Alliance*. "Our Mission". <http://apolloalliance.org/about/mission/> (last visited Feb. 21, 2009).
37. *United Nations Environment Programme*. 2008. "Green Jobs: Towards Decent Work in a Sustainable, Low-Carbon World". Page 99 http://www.unep.org/labour_environment/PDFs/Greenjobs/UNEP-Green-Jobs-Report.pdf; *Apollo Alliance*. 2004. "New Energy For America: The Apollo Jobs Report: For Good Jobs & Energy Independence". Pages 16–17 (Investment in renewable energy markets and biofuels development yields expected to yield 419,042 jobs over ten years.) http://apolloalliance.org/downloads/resources_ApolloReport_022404_122748.pdf.

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See also: Jay Inslee. 2008. "Apollo's Fire: Igniting America's Clean-Energy Economy". *Apollo Alliance*

38. 'Different methodologies in tallying employment, plus different approaches and diverging labor intensities in materials collection and recovery, make it almost impossible to compare countries across the world or to compute a reliable global total' in recycling. *United Nations Environment Programme*. 2008. "Green Jobs: Towards Decent Work in a Sustainable, Low-Carbon World". Page 17
http://www.unep.org/labour_environment/PDFs/Greenjobs/UNEP-Green-Jobs-Report.pdf; 'Different approaches result in findings that cannot simply be aggregated or extrapolated.' *United Nations Environment Programme*. 2008. "Green Jobs: Towards Decent Work in a Sustainable, Low-Carbon World". Page 36
http://www.unep.org/labour_environment/PDFs/Greenjobs/UNEP-Green-Jobs-Report.pdf;
39. *United Nations Environment Programme*. 2008. "Green Jobs: Towards Decent Work in a Sustainable, Low-Carbon World". Page 8
http://www.unep.org/labour_environment/PDFs/Greenjobs/UNEP-Green-Jobs-Report.pdf
40. Hal R. Varian. Jun 28 2007 "An iPod Has Global Value. Ask the (Many) Countries That Make It". *New York Times*. June 28, 2007. <http://www.nytimes.com/2007/06/28/business/worldbusiness/28scene.html> The same is true of many 'Made in China' products. A Chinese firm captured a trivial fraction of the market value for doing assembly work; the firms do not have the high-value technology.
41. Importing wind turbines is like importing oil; U.S. dollars go overseas. For a discussion of current wind market trends and events, see "The 'Who is Who' of Wind Energy". <http://www.windfair.net/> (last visited Feb. 21, 2009).
42. Lewis Page. Apr. 29 2009. "Jobs bloodbath at Brit, Danish wind turbine factories." *The Register*;
http://www.theregister.co.uk/2009/04/29/wind_turbine_jobs_offshored/
43. *EarthTimes*. Mar. 28, 2008. "Report: Chinese solar cells swamping subsidized German market".
<http://www.earthtimes.org/articles/show/195187,report-chinese-solar-cells-swamping-subsidized-german-market.html>
44. 'The subsidy for new rooftop solar systems will decline by 16% and drop by 15% for ground-mounted solar parks that are constructed after 1 July.' *Renewable Energy Focus*. Mar. 9, 2010. "Germany Reduces Solar Subsidy".
<http://www.renewableenergyfocus.com/view/7865/germany-reduces-solar-subsidy/>
45. Vanessa Fuhrmans. Sep. 28, 2009. "Solar-power Incentives in Germany Draw Fire". *Wall Street Journal*. <http://online.wsj.com/article/SB125383541153239329.html>
46. A critical review of the literature along with case studies of specific cities is provided in "Sports, Jobs, and Taxes: The Economic Impact of Sports Teams and Stadiums" (Roger Noll & Andrew Zimbalist, 1997).
See also John J. Siegfried et al. March/April 2008. "The Economic Impact of Colleges and Universities". *Change*. Page 24. <http://www.vanderbilt.edu/Econ/wparchive/workpaper/vu06-w12.pdf>.

The authors reviewed 138 college economic-impact studies completed since 1992 and concluded that they are 'public-relations documents masquerading as serious economic analysis.'
47. This point is made in Roger Noll & Andrew Zimbalist. 1997. "Sports, Jobs, and Taxes: The Economic Impact of Sports Teams and Stadiums". Page 75. They go on to provide an example of incorrect analysis leading to vast overestimate of impact on pages 497–498.
48. Proponents of stadium projects tout increased employment from tourism, construction jobs and increased localized spending. Richard W. Schwester. Sep. 2007. "An Examination of the Public Good Externalities of Professional

- Athletic Venues: Justifications for Public Financing?'. *Public Budgeting & Finance*. at 89, 90 ('A review of the literature shows that stadiums and arenas are insignificant in terms of creating employment...').
49. Terry Buss. 1999. "The Case Against Targeted Industry Strategies", *Economic Development Quarterly*. 13(4). Page 347. In contrast, a review of 48 studies found that reducing state and local taxes resulted in greater business activity. On average, a ten percent tax cut resulted in a three percent increase in business activity which, of course, included new jobs that were voluntarily created. Timothy J. Bartik. 1994. "Jobs, Productivity, and Local Economic Development", *National Tax Journal*, 47(4). Page 856.
 50. Benoit Mesnil. 2008. "Public-aided crises in the French fishing sector". *Ocean & Coastal Management*. Issue 51. Pages 689 and 697.
 51. That concept was first developed in Bruce Yandle. May-June 1983. "Bootleggers and Baptists: The Education of a Regulatory Economist". *Regulation*. Page 12. It means politicians make for strange bedfellows. Those who wanted prohibition of alcohol (the Baptists) ended up on the same side of the issue as the bootleggers who profited from the existence of prohibition. Those parties have nothing in common but end up, inadvertently, in an alliance. That can be seen in certain environmental issues where environmental groups (the Baptists in this case) champion a policy, such as mass transit construction, that finds a natural alliance in labor unions that will profit from the union-wage construction jobs created.
 52. *United Nations Environment Programme*. 2008. "Green Jobs: Towards Decent Work in a Sustainable, Low-Carbon World". Page 4 http://www.unep.org/labour_environment/PDFs/Greenjobs/UNEP-Green-Jobs-Report.pdf
 53. *Ibid.*
 54. *Ibid.* Pages 228, 184 and 92.
 55. W.G. Hettinga, et al. 2008. "Understanding the reductions in US corn ethanol production costs: An experience curve approach". *Energy Policy*. Issue 27. Pages 190 and 201
 56. The UNEP report argues that comparative advantage should not apply, as '[p]ublic policy can and should seek to minimize disparities among putative winners and losers that arise in the transition to a green economy, and avoid these distinctions becoming permanent features' by protecting workers and communities that are dependent on non-green industries and companies from the consequences.
United Nations Environment Programme. 2008. "Green Jobs: Towards Decent Work in a Sustainable, Low-Carbon World". Page 4 http://www.unep.org/labour_environment/PDFs/Greenjobs/UNEP-Green-Jobs-Report.pdf
 57. *Center for American Progress*. 2008. "Green Recovery: A Program to Create Good Jobs and Start Building a Low-Carbon Economy". Page 5. http://www.americanprogress.org/issues/2008/09/pdf/green_recovery.pdf
 58. *United Nations Environment Programme*. 2008. "Green Jobs: Towards Decent Work in a Sustainable, Low-Carbon World". Page 136 http://www.unep.org/labour_environment/PDFs/Greenjobs/UNEP-Green-Jobs-Report.pdf
 59. *Ibid.* Page 119.
 60. *Ibid.* Page 162.
 61. *Ibid.* Page 73
 62. *Ibid.* Page 19
 63. *Ibid.* Page 47

64. Consumer surplus is the difference between the price that consumers are willing and able to pay for a good and the value they place on a good (the highest price they would be willing to pay). Producer surplus is the difference between the price received by a producer when a good or service is sold and the lowest price the producer would have been willing to accept and still engage in the exchange. The existence of such surpluses is the reason exchange occurs – both parties gain. Roger Miller & Roger Meiners. 3rd Edition, 1986. *Intermediate Microeconomics*. Page 583
65. *United Nations Environment Programme*. 2008. “Green Jobs: Towards Decent Work in a Sustainable, Low-Carbon World”. Page 225 http://www.unep.org/labour_environment/PDFs/Greenjobs/UNEP-Green-Jobs-Report.pdf
66. It also affects the stability of governments as evidenced by the demonstrations in about a dozen countries, including Mexico and Haiti, in the first half of 2008 to protest the escalating food prices. ‘Then there is the elephant in the room: ethanol. Most experts agree that the race among western countries to produce this grain-based alternative fuel is responsible, in significant part, for the rising costs. Their logic is simple: When countries put corn aside for energy, the amount available for food is in greater demand, and prices rise. If demand is already high, the effect is amplified.’
- Kent Garber. “The Growing Food Cost Crisis”. *US News & World Report*. Mar. 17, 2008. Page 33. <http://www.usnews.com/articles/news/2008/03/07/the-growing-food-cost-crisis.html>
- see also* Elisabeth Malkin, Feb. 1, 2007. “Thousands in Mexico City Protest Rising Food Prices”. *New York Times*. Page A6. http://www.nytimes.com/2007/02/01/world/americas/01mexico.html?_r=1&scp=1&sq=Mexico+tortilla+riots&st=nyt&oref=slogin;
- New York Times*. Sept. 19, 2007. “Opinion: The misguided politics of corn ethanol”. Page 8. <http://www.nytimes.com/2007/09/19/opinion/19iht-edethan01.1.7567074.html> The price hike was partly due to the diversion of food crops such as corn, soy and palm oil to meet the demand for ethanol created by subsidies and mandates in developed countries for biofuels to reduce dependence on foreign oil and greenhouse gas emissions. *See* Indur M. Goklany. “Fuels vs. Food”. *New York Post*. Apr. 17, 2008. http://www.cato.org/pub_display.php?pub_id=9337 (‘[F]ood riots resulting partly from the United States’ alternative energy policies have arrived at our front door. Crowds of hungry demonstrators swarmed the presidential palace in Haiti last week to protest skyrocketing food prices.’); “Mexicans Stage Tortilla Protest”. *BBC News*. Feb. 1, 2007. <http://news.bbc.co.uk/2/hi/americas/6319093.stm>.
67. *United Nations Environment Programme*. 2008. “Green Jobs: Towards Decent Work in a Sustainable, Low-Carbon World”. Page 233 http://www.unep.org/labour_environment/PDFs/Greenjobs/UNEP-Green-Jobs-Report.pdf
68. *Ibid*. Page 234. This evinces a lack of understanding that ‘the interests of retailers’ is consistent with that of their customers. Wal-Mart has been a champion at driving down prices by cutting tough bargains with suppliers, thereby allowing consumers, especially lower-income consumers, to enjoy more value for their scarce dollars.
69. *Ibid*. Page 10.
70. The Centre for American Progress does give some consideration to the issue. It asserts that more jobs will be created by the ‘green investment’ program than if the money is used in other ways. The report notes that if \$100 billion was spent on domestic oil industry jobs only 542,000 jobs would be created – far fewer than the 935,200 their proposal would generate. Why? The oil industry would spend a lot of money ‘purchasing machines and supplies.’ *Center for American Progress*. 2008. “Green Recovery: A Program to Create Good Jobs and Start Building a Low-Carbon Economy”. Page 11. http://www.americanprogress.org/issues/2008/09/pdf/green_recovery.pdf. Apparently capital equipment is a bad, as are the jobs creating the equipment, compared to the more labor-intensive green jobs.
71. *Ibid*. Page 9.

72. Full tuition at York College of Pennsylvania in 2008–09 is \$13,680. See <http://ycp.edu/admissions/208.htm>. Full tuition for an in-state student at Penn State in 2008–09 is \$13,014 for a freshman or sophomore and \$14,070 for a junior or senior. See <http://tuition.psu.edu/Rates2008–09/UniversityPark.asp>. We are not arguing that a college education would necessarily be a better use of that much money (despite our self-interest in the growth of the higher-education industry), but the report gives no evidence that their prescription for the expenditure is better than the same amount spent on education or some other area of activity.
73. Navigant Consulting. Feb. 13, 2008. 'Economic Impacts of the Tax Credit Expiration'. Prepared for the *American Wind Energy Association (AWEA)* and the *Solar Energy Research and Education Foundation (SEREF)*.
74. Terry Macalister. Nov. 7, 2008. 'Blow to Brown as BP scraps British renewables plan to focus on US'. *The Guardian*. <http://www.guardian.co.uk/business/2008/nov/07/bp-renewable-energy-oil-wind>
75. Danny Fortson. Dec. 7, 2008. 'Shell to quit wind projects'. *The Sunday Times*.
76. The UNEP report states, "[r]etrofitting buildings directly increases employment because without an attempt to make the building more efficient, the work would not have been done." *United Nations Environment Programme*. 2008. "Green Jobs: Towards Decent Work in a Sustainable, Low-Carbon World". Page 140 http://www.unep.org/labour_environment/PDFs/Greenjobs/UNEP-Green-Jobs-Report.pdf
77. *Center for American Progress*. 2008. "Green Recovery: A Program to Create Good Jobs and Start Building a Low-Carbon Economy". Pages 6–7. http://www.americanprogress.org/issues/2008/09/pdf/green_recovery.pdf
78. *United Nations Environment Programme*. 2008. "Green Jobs: Towards Decent Work in a Sustainable, Low-Carbon World". Page 47 http://www.unep.org/labour_environment/PDFs/Greenjobs/UNEP-Green-Jobs-Report.pdf
79. *Ibid.* Page 24.
80. *Ibid.* Page 139.
81. *Ibid.* Page 134.
82. Paul L. Joskow. 2003. 'Energy Policies and Their Consequences After 25 Years'. *The Energy Journal*. Vol. 24. Page 37.
83. Jesse H. Ausubel. 1995. 'Technological Progress and Climate Change'. *Energy Policy*. Vol. 23. Pages 411–416. http://phe.rockefeller.edu/tech_prog/ and Table 1 in our larger paper.
84. Paul L. Joskow. 2003. 'Energy Policies and Their Consequences After 25 Years'. *The Energy Journal*. Vol. 24. Page 37.
85. *International Energy Agency (IEA)*. 2008. 'Worldwide Trends in Energy Use and Efficiency'. Page 15. http://www.iea.org/papers/2008/Indicators_2008.pdf
86. Long paper available at http://papers.ssrn.com/s013/papers.cfm?abstract_id=1358423
87. *United Nations Environment Programme*. 2008. "Green Jobs: Towards Decent Work in a Sustainable, Low-Carbon World". Page 278. http://www.unep.org/labour_environment/PDFs/Greenjobs/UNEP-Green-Jobs-Report.pdf
88. *Ibid.* Page 6.
89. *Ibid.* Page 139.
90. *Ibid.* Page 14 ('bicycles and modern bicycle rickshaws offer a sustainable alternative and create employment in manufacturing and transportation services.'). The romantic view of happy workers pulling or peddling rickshaws for a joyful life in service to others is provided by wealthy UN employees who may ride in them when visiting poor countries to dispense wisdom.

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91. *Ibid.* Page 8
92. *Ibid.* Page 9
93. *Ibid.* Page 47
94. *The European Wind Energy Association*. 2010. "Count on Wind Energy". Briefing paper. *The European Wind Energy Association*. 2010. "Wind Energy Factsheets". Briefing Paper
http://www.ewea.org/fileadmin/ewea_documents/documents/publications/factsheets/Factsheets.pdf
95. *EIA*. Mar 2009. "Annual Energy Outlook 2009 Early Release", Report #:DOE/EIA-0383(2009). Table 17.
<http://www.eia.doe.gov/oiaf/aeo/pdf/0383%282009%29.pdf> This report, which is issued each year, provides the Department of Energy's best estimate of future supply and demand for the energy sector, based on its judgments about economic growth, labor supply, technological change, and so forth. It 'generally assumes that current laws and regulations affecting the energy sector remain unchanged' throughout the projection period (2030 for this document). See *EIA* (2009) at 2.
96. *House of Lords Economic Affairs Select Committee*. Nov. 12, 2008. "Chapter 7: Recommendations and Conclusions. In: Economic Affairs – Fourth Report, Session 2007–2008. The Economics of Renewable Energy". UK Parliament website. <http://www.publications.parliament.uk/pa/ld200708/ldselect/ldeconaf/195/19510.htm>. Retrieved Sep. 6, 2009.
97. *Ibid*
98. Jonathan H. Adler. "Foul Winds for Renewable Energy". *National Review Online*. Sep. 28, 2007.
<http://article.nationalreview.com/?q=Mjg1YWVjNDZjZTBkNDhlODUzZjVkZThmM2U0YjAwNjE=#more>. The Cape Wind farm has some regulatory approvals after years of planning. Are all such permit requirements to be swept aside from now on? Cape Wind was proposed in 2001; by early 2009 it only had some permits; but was not finished with the permit process. Cape Wind: America's First Wind Farm on Nantucket Sound,
<http://www.capewind.org/> (last visited Feb. 21, 2009). See Wendy Williams & Robert Whitcomb. 2007. 'Cape Wind: Money, Celebrity, Class, Politics and the Battle for Our Energy Future on Nantucket Sound'.
99. *EIA*. Mar 2009. "Annual Energy Outlook 2009 Early Release", Report #:DOE/EIA-0383(2009). Table 1 and 17.
<http://www.eia.doe.gov/oiaf/aeo/pdf/0383%282009%29.pdf>
100. *Ibid*
101. *House of Lords Select Committee on Economic Affairs*. Nov. 25, 2008. "The Economics of Renewable Energy". 4th Report of Session 2007–08. <http://www.publications.parliament.uk/pa/ld200708/ldselect/ldeconaf/195/195i.pdf>
102. *United Nations Environment Programme*. 2008. "Green Jobs: Towards Decent Work in a Sustainable, Low-Carbon World". Page 47. http://www.unep.org/labour_environment/PDFs/Greenjobs/UNEP-Green-Jobs-Report.pdf
103. Institute for Energy Research. "Solar". Available at:
<http://www.instituteforenergyresearch.org/energy-overview/solar/>
104. *Ibid*
105. Jesse H. Ausubel. 2007. "Renewable and Nuclear Heresies". *International Journal Nuclear Governance, Economy & Ecology*. Vol. 1. Pages 229–43. <http://www.inderscience.com/storage/f419103782512116.pdf>.
106. Nuclear is responsible for a little over eight percent of U.S. energy. See *Energy Information Administration of the US Department of Energy*. 2008. "Energy Information Administration/Renewable Energy Consumption and Electricity Preliminary Statistics 2007". Table 1.

- http://www.eia.doe.gov/cneaf/alternate/page/renew_energy_consump/table1.pdf. It produces about 20 percent of electricity. See *Energy Information Administration* of the *US Department of Energy*. Jun 16, 2010. "Total Electric Power Industry Summary Statistics". <http://www.eia.doe.gov/cneaf/electricity/epm/tablees1a.html>
107. World Nuclear Association, *Nuclear Power in the World Today*, (last visited Feb. 19, 2009). <http://www.world-nuclear.org/info/inf01.html>
108. John Deutch & Ernest J. Moniz et al. 2003. "The Future of Nuclear Power: An Interdisciplinary MIT Study". Page 71. <http://web.mit.edu/nuclearpower/pdf/nuclearpower-full.pdf>; Anna Momigliano. Jan. 16 2009. "Russian Gas Cutoff Energizes Nuclear Comeback". *Christian Science Monitor*. Page 6. <http://www.csmonitor.com/2009/0116/p06s01-wogn.html>; Robin Paxton and Amie Ferris-Rotman. Jan. 21 2009. "Gas row shakes Europe's trust in Russian energy". *Reuters*. <http://uk.reuters.com/article/idUKLL33884020090121>
109. *Greenpeace*. "End the Nuclear Age". <http://www.greenpeace.org/international/en/campaigns/nuclear/?tab=0>
110. *World Wildlife Fund (WWF)*. "Climate Solutions: WWF's Vision for 2050". Page 28. <http://www.worldwildlife.org/climate/Publications/WWFBinaryitem4911.pdf> (last visited Nov. 25, 2008). The report calls for a "phase-out of nuclear power," *ibid.* Page 1, "due to its costs, radiotoxic emissions, safety, and proliferation impacts," *ibid.* Page 8.
111. *Friends of the Earth*. May 1, 2005. "Nuclear Power". http://www.foe.co.uk/campaigns/climate/issues/nuclear_index.html
112. *United Nations Environment Programme*. 2008. "Green Jobs: Towards Decent Work in a Sustainable, Low-Carbon World". Page 89 http://www.unep.org/labour_environment/PDFs/Greenjobs/UNEP-Green-Jobs-Report.pdf The report also notes, at that point, that nuclear power is not employment intensive, so would not be a source of many jobs.
113. *Ibid.* Page 306

“Seven Myths about Green Jobs” is published in association with:

Alternate Solutions Institute, Pakistan
 Americans for Tax Reform, USA
 Association for Liberal Thinking, Turkey
 Cathay Institute of Public Affairs, China
 Berlin Manhattan Institute, Germany
 CEDAH, Burkina Faso
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