



## GREEN INVESTMENTS AND THE LABOR MARKET

### How many jobs could be generated and what type?

BY JOSH BIVENS, JOHN IRONS, AND ETHAN POLLACK

The budget put forward in March by the Obama administration clearly commits to reducing carbon emissions as a means to fight global climate change. Specifically, the Obama budget advocates on behalf of a “cap-and-trade” policy that would put a price on carbon emissions.

However, to aid the economic transformation that a cap-and-trade system will jumpstart, new federal investments are needed. These new investments carry the potential to provide economic benefits that go beyond the primary one of emissions reduction; they hold out the potential for new jobs in the economy. In the near-term, there is no more pressing need than job creation: the U.S. economy has lost 5.1 million jobs over the past 15 months. In the longer-run, even if the economy approaches full employment, green investments carry the potential to change the *type* of jobs in the U.S. economy in ways that could help push back against the rising inequality that has characterized most of the past three decades.

This Issue Brief draws on the methodology described in an EPI Working Paper (Bivens, Irons, and Pollack 2009) in order to determine the labor market impact of the green investments outlined in Obama’s budget. Our central findings are that a commitment of \$100 billion annually in new public investments over the next decade would yield:

- Approximately \$160 billion in additional output annually for the next two years, which translates into approximately 1.1 million net new jobs created.
- An increase in the relative wages of those 70% of U.S. workers without a four-year college degree by almost 0.5% each year that the increased commitment to green investments persists. While modest, this amount does represent a wage increase for high school graduates that is roughly 40% as large as the entire increase this group has seen since 1979.
- An increase of approximately 100,000 in the number of unionized jobs in the United States (even in the unlikely case that all of the jobs supported through this new spending merely displaced currently existing jobs).

## Green investments and economic stabilization

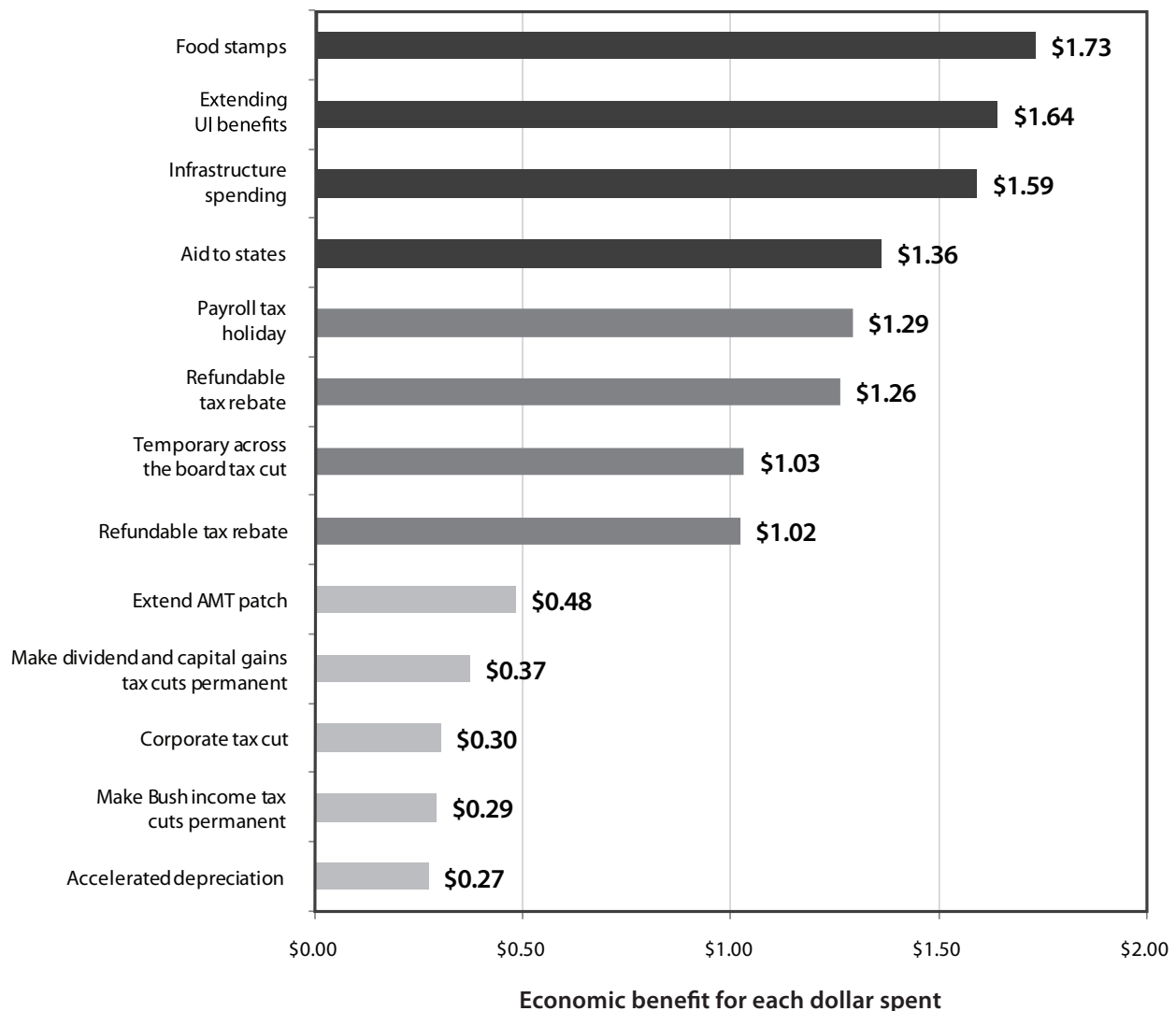
Recessions are often characterized by a self-reinforcing demand slump. The current recession is no exception, but the dual crashes in housing and financial markets have only made this recession more severe and long-lasting relative to other downturns. These crashes led to a sharp reduction in household wealth, which led to a pullback in consumer spending, especially on new homes and durable manufactured goods (autos, in particular).

As workers were laid off in the construction, finance, and durable goods sectors, their spending fell. Employed workers followed by cutting consumption, both to make up for the savings lost as home prices and stocks plummeted and also out of fears that they would be next to lose their job. As businesses lost these consumers, they also lost the incentive to purchase new capital goods (plants and equipment) to expand capacity, which further depresses the economy.

While the last two recessions lasted only eight months, the current recession has already stretched on

**FIGURE A**

### Economic benefits of various stimulus provisions



SOURCE: Mark Zandi from Moody's Economy.com.

for 15 months and is only getting worse. The Congressional Budget Office (CBO) recently projected continued economic contraction and continued layoffs through 2009 (CBO 2009), with unemployment averaging over 9% for the entire year of 2010.<sup>1</sup> The CBO also estimates that the gross domestic product (GDP) gap, which measures the extent to which the economy is underperforming, will total about \$2 trillion over the next two years (CBO 2009). This is a staggering economic loss, equivalent to \$6,600 for every man, woman, and child in the United States.

The most-reliable tool in policy makers' kit for fighting recessions—the Federal Reserve cutting short-term interest rates—has failed to spark any recovery. These short-term rates are essentially zero today.<sup>2</sup>

When an economy is mired in recession even with near-zero interest rates, the case for government directly boosting demand for final production is clear. This can be accomplished either through tax cuts or government purchases—that is, either the government gives money back to households to boost their spending or spends the money itself.<sup>3</sup>

Federal spending on investment projects will boost demand directly as funds are used by contractors to hire construction workers, planners, architects, engineers, project managers, and foremen, who then turn around and use their new income to boost their own spending. A key point is that this effect is not limited to only the industry directly receiving investment funds. For example, every job directly supported in the construction industry supports two additional jobs in supplier industries, such as accounting, office supplies, and construction capital manufacturing (such as Caterpillar, which recently laid off 20,000 workers). Furthermore, additional jobs are created as these workers re-spend their income back into the economy—for example, construction workers newly hired by money from the American Recovery and Reinvestment Act of 2009 (ARRA) will patronize diners and restaurants around the worksite, spurring demand for cooks and waitresses.

Of course, a portion of all these new hires will just pull already-employed resources out of other sectors and industries. However, a portion of these new hires will instead put currently idle resources to work. **Figure A** below shows the net addition to employed resources

resulting from various measures of economic stimulus, ranked by comparative effectiveness.

Each dollar of infrastructure investment—broadly defined—provides on net about \$1.59 in additional economic growth, making it about 33% more effective than generic tax cuts and literally 10-15 times more effective than most business tax cuts. In short, infrastructure spending, including “green” investments, is about as good economic stimulus as there is.

### ***Job impact of green investments***

There is also reason to believe that investments in energy conservation would actually be even more stimulative than suggested by the generic infrastructure numbers discussed above. For example, much of the construction spending undertaken in the name of energy conservation would be mostly directed toward retrofitting existing structures rather than building new ones from scratch. This sort of “fix-it-first” construction typically is more labor-intensive than average and hence would make better economic stimulus.

A new commercial building, for example, requires huge amounts of steel beams, rebar, and concrete, along with heavy machinery. New capacity also often involves land costs, either purchasing the rights-of-way or the land itself. By contrast, renovation and retrofitting do not have costly capital and land expenses, so a larger share of each “fix-it-first” dollar goes more directly toward job creation. Recent studies have found that about 8% to 17% more jobs are created by fix-it-first investments than by investments in new capacity (Mattera and LeRoy 2003; Surface Transportation Policy Project 2004; Bivens, Irons, and Pollack 2009, Appendix A).

This strategy also has the benefit of speedy implementation, a key advantage in a recession economy. New capacity projects must first go through a lengthy planning process, often including cost analysis, environmental impact assessments, engineering, and land acquisition. By contrast, the lead time for maintenance and repair projects is much shorter, often a highly truncated version of the above process and requiring much less land acquisition. An economy in a recession can deteriorate quickly, and often exponentially, so the faster that government can create jobs and boost aggregate demand, the better.

## Long-run structural change and job composition

Public investments in the “green” economy—including energy efficiency, renewable energy, and other areas—can have a more permanent impact on labor markets, most notably on the composition of jobs (including wage levels, educational requirements, union status, etc).

Thus, these investments should be assessed in light of broader economic trends. For example, while the economic downturn is a recent and (hopefully) temporary problem, inequality of hourly wages has been growing for decades. This rising inequality has been the single largest impediment to raising the living standards of typical American workers, even in an era of respectable productivity growth.

Much (though far from all) of this rise in wage inequality is attributable to the rapid increase in the “college premium” since 1979. The college premium refers to the pay advantage enjoyed by workers who have completed a four-year college degree, a premium that persists even after controlling for other relevant labor market characteristics, such as gender, race, ethnicity, experience, region of residence, etc. In 1979 the college premium was approximately 50% (college workers earned wages that

were 50% higher than those of non-graduates), while by 2007 it had risen to approximately 80%.

Another key contributing factor to this rising inequality is the de-unionization of the U.S. workforce over the last few decades (DiNardo, Fortin, and Lemeux 1996). Unions provide bargaining power to many workers who otherwise lack it in the modern U.S. economy. Consequently, the union “wage-and-benefit premium” (an advantage enjoyed by union members that persists even after controlling for other relevant labor market characteristics) is approximately 15%, and is much larger for lower-wage workers. This advantage that unions provide to low-wage workers is a key reason why de-unionization has led to a much less equal U.S. economy. Since 1979, unionization rates have fallen by more than half, from 27% of the workforce to 12% today.

### ***The types and quantity of jobs supported by green investment***

The model developed in the related Working Paper (see the Appendix for a summary) enables us to determine in what direction large scale public infrastructure investments would push the economy’s overall labor demand.

**TABLE 1**

### **Model inputs for receiving industry flows**

<i>Industry</i>	<i>Share</i>	<i>Three scenarios (\$ billions)</i>		
		<i>Scenario 1</i>	<i>Scenario 2</i>	<i>Scenario 3</i>
Construction	40%	40	80	120
Rail transportation	10	10	20	30
Transit and ground psgr	10	10	20	30
Utilities	30	30	60	90
Biofuels	10	10	20	30
<i>Crop production</i>	3	3	7	10
<i>Basic chemical manufacturing</i>	3	3	7	10
<i>Agricultural chemical manufacturing</i>	3	3	7	10
<b>TOTALS</b>	100%	100	200	300

**SOURCE:** Authors’ analysis of BLS and Census data. For more information on methodology, see Bivens, Irons, and Pollack (2009).

To illustrate the impact of undertaking a substantial program of public investments aimed at greening the U.S. economy, we draw on a report, *Green Recovery*, authored for the Center for American Progress by researchers at the Political Economy Research Institute (Pollin et al. 2008). The *Green Recovery* report focuses predominantly on the

short-run macroeconomic benefits of targeted green investments. It recommends \$100 billion in investments spread among a number of categories. We use the *Green Recovery* breakdown of spending shares by industry, but we also score two more-ambitious proposals in terms of the total dollar amount. **Table 1** provides the level and

**TABLE 2**

**Direct and indirect jobs supported through \$100 billion in green investment**

	Direct	Indirect	Total	Direct	Indirect	Total
				(% of total)		
<b>Totals</b>	430,717	315,385	746,102	58%	42%	100%
<b>Gender</b>						
<i>Male</i>	367,666	191,230	558,896	85%	61%	75%
<i>Female</i>	63,051	124,155	187,206	15	39	25
<b>Race</b>						
<i>White</i>	289,519	188,277	477,796	67%	60%	64%
<i>Black</i>	24,523	60,197	84,720	6	19	11
<i>Hispanic</i>	98,228	50,456	148,685	23	16	20
<i>Asian</i>	6,801	15,687	22,487	2	5	3
<i>Other</i>	11,647	939	12,585	3	0	2
<b>Union status</b>						
<i>Covered</i>	51,425	67,144	118,569	12%	21%	16%
<i>Non-covered</i>	379,293	248,288	627,580	88	79	84
<b>Education</b>						
<i>Less than high school</i>	79,623	42,731	122,354	18%	14%	16%
<i>High school only</i>	171,184	118,848	290,032	40	38	39
<i>Some college</i>	111,752	91,345	203,096	26	29	27
<i>BA or greater</i>	68,158	544,356	130,620	16	173	18
<b>Wage quintiles</b>						
<i>First (lowest)</i>	50,163	71,098	121,262	12%	23%	16%
<i>Second</i>	87,382	79,190	166,572	20	25	22
<i>Third</i>	85,131	82,832	167,964	20	26	23
<i>Fourth</i>	104,063	59,821	163,884	24	19	22
<i>Fifth (highest)</i>	103,978	22,518	126,496	24	7	17
<b>Region</b>						
<i>Northeast</i>	48,935	100,087	149,022	11%	32%	20%
<i>Midwest</i>	82,094	77,446	159,540	19	25	21
<i>South</i>	198,561	68,721	267,281	46	22	36
<i>West</i>	101,128	69,130	170,258	23	22	23

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**TABLE 2 (cont.)**

**Direct and indirect jobs supported through \$100 billion in green investment**

	Direct	Indirect	Total	Direct	Indirect	Total
				<i>(% of total)</i>		
<b>Totals</b>	430,717	315,385	746,102	58%	42%	100%
<b>Occupations</b>						
<i>Mgt, bus and fin</i>	55,068	29,692	84,761	13%	9%	11%
<i>Professional</i>	25,646	26,559	52,205	6	8	7
<i>Service</i>	4,023	30,795	34,818	1	10	5
<i>Sales &amp; related</i>	6,808	34,272	41,079	2	11	6
<i>Office &amp; admin support</i>	35,528	43,432	78,960	8	14	11
<i>Farm, fish, forest</i>	0	0	0	0	0	0
<i>Construction &amp; extraction</i>	205,658	1,430	207,088	48	0	28
<i>Install, maintain &amp; repair</i>	25,247	19,000	44,246	6	6	6
<i>Production</i>	30,180	24,092	54,272	7	8	7
<i>Transport</i>	42,399	103,414	145,813	10	33	20
<b>Central city status</b>						
<i>In central city of MSA</i>	101,549	107,292	208,842	24%	34%	28%
<i>In MSA, not central city</i>	181,317	145,914	327,231	42	46	44
<i>Not in MSA</i>	82,648	22,668	105,316	19	7	14
<i>Not identified</i>	65,204	39,510	104,713	15	13	14

\* Estimates do not include spending effects.

**SOURCE:** Authors' analysis of BLS and Census data. For more information on methodology, see Bivens, Irons, and Pollack (2009).

breakdown of spending flows by industry that we use as inputs into the jobs model.

The results presented here assume that the number and kinds of jobs created would be similar to the jobs that already exist in the impacted industries. Also, the job impact assessed here is only that of the construction of the projects (and operation, in the case of transit projects). The projects would likely have broader lasting impacts on the economy as the economy shifts to a low-carbon platform; however, an assessment of those impacts is beyond the scope of this work.

Using these inputs, our analysis finds that such green investments would have many positive impacts on the American jobs market, particularly in pushing back on the trends from recent decades that have resulted in the rising inequality discussed earlier. The highlights are reported in **Table 2**.

The jobs supported by green investments would skew heavily away from workers with a four-year college degree with only 18% of the jobs occupied by workers with a college degree or greater, compared to approximately 28% in the overall economy. These jobs also skew heavily toward workers without a high school degree or those with a high school degree but who have not attended college. Despite having less education on average, the workers' wages are actually concentrated in the middle of the overall wage distribution, with relatively few high-paying jobs (top fifth) but also relatively few low-paying jobs (bottom fifth).

The jobs are also about one-third more likely to be unionized, producing 16% union jobs versus the 12% characterizing the overall economy (see Table 3). Thus, a large-scale and permanent commitment to green infrastructure investment would help reverse the de-unionization trend

over the last few decades and in turn lead to rising median incomes and a reduction in inequality. Greater unionization will also result in more access to job training and mentorship programs that could prove key to expanding job opportunities to high-unemployment communities.

**Table 3** also shows how the jobs created through increased green investments stack up against a number of other benchmarks, including the total economy as well as the direct jobs created in the construction sector alone (the single largest recipient of green investment funds). The

**TABLE 3**

**How do green jobs stack up?**  
*Comparisons with other sectors*

	<b>Total economy</b>	<b>PERI Green Recovery, mid-scenario</b>	<b>Construction only</b>	<b>Rail operations</b>	<b>Rail manufacturing</b>	<b>FIRE</b>
<b>Totals</b>	100%	1%	7%	1%	0.1%	6%
<b>Gender</b>						
<i>Male</i>	60%	75%	90%	70%	68%	80%
<i>Female</i>	40	25	10	30	32	20
<b>Race</b>						
<i>White</i>	67%	64%	63%	72%	70%	78%
<i>Black</i>	11	11	5	9	10v	5
<i>Hispanic</i>	15	20	29	13	13	11
<i>Asian</i>	4	3	1	3	4	1
<i>Other</i>	2	2	2	3	3	5
<b>Union status</b>						
<i>Covered</i>	12%	16%	14%	11%	13%	7%
<i>Non-covered</i>	88	84	86	90	87	93
<b>Education</b>						
<i>Less than high school</i>	11%	16%	25%	8%	5%	7%
<i>High school only</i>	31	39	41	36	40	35
<i>Some college</i>	30	27	24	29	27	32
<i>BA or greater</i>	28	18	10	27	28	27
<b>Wage quintiles</b>						
<i>First (lowest)</i>	19%	16%	13%	13%	16%	6%
<i>Second</i>	21	22	23	17	17	14
<i>Third</i>	20	23	24	17	21	8
<i>Fourth</i>	20	22	23	24	21	29
<i>Fifth (highest)</i>	20	17	16	29	24	44
<b>Region</b>						
<i>Northeast</i>	18%	20%	15%	11%	14%	2%
<i>Midwest</i>	23	21	18	20	7	26
<i>South</i>	35	36	41	48	53	56
<i>West</i>	23	23	26	21	25	16

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**TABLE 3 (cont.)**

**How do green jobs stack up?**  
*Comparisons with other sectors*

	<b>Total economy</b>	<b>PERI Green Recovery, mid-scenario</b>	<b>Construction only</b>	<b>Rail operations</b>	<b>Rail manufacturing</b>	<b>FIRE</b>
<b>Totals</b>	100%	1%	7%	1%	0.1%	6%
<b>Occupations</b>						
<i>Mgt, business and finance</i>	15%	11%	10%	17%	20%	17%
<i>Professional</i>	14	7	2	13	8	16
<i>Service</i>	13	5	1	4	5	0
<i>Sales &amp; related</i>	8	6	1	4	6	1
<i>Office &amp; admin. support</i>	15	11	6	14	17	10
<i>Farm, fish, forest</i>	0	0	0	0	0	0
<i>Construction &amp; extraction</i>	7	28	70	4	0	10
<i>Install, maintain &amp; repair</i>	8	6	5	6	3	8
<i>Production</i>	10	7	2	16	3	21
<i>Transport</i>	10	20	3	21	38	16
<b>Central city status</b>						
<i>In central city of MSA</i>	28%	28%	27%	21%	21%	17%
<i>In MSA, not central city</i>	44	44	45	42	55	29
<i>Not in MSA</i>	14	14	14	22	12	36
<i>Not identified</i>	14	14	14	15	11	19

**SOURCE:** Authors' analysis of BLS and Census data. For more information on methodology, see Bivens, Irons, and Pollack (2009).

table also compares jobs created through green investments to those in the finance, insurance, and real estate sector. Going forward, it is extremely likely that the economic footprint of that sector will shrink considerably. If the jobs shed in this sector are made up for with new jobs created through green investments, then the swap sparked by these investments would help even more in pushing back against wage inequality.

All told, the jobs created by this package of green investments should be expected to raise the wages of non-college workers (both through the impact on relative demands as well as through the union channel) by approximately 0.25% to 0.75% each year that the increased commitment to green investments persist. **Table 4** summarizes the results associated with each of the three scenarios discussed.

These investments will not change the face of American wage inequality on its own, but it is encouraging that truly ambitious green investments would have a visible effect on a couple of the main trends that have reduced the demand for and bargaining power of non-college workers in the United States for decades.

Green investments, however, would not be unequivocally beneficial for the entire labor market: the jobs created by these investments skew heavily in favor of men, with only 26% of the direct and indirect jobs going toward women. (Although the full impact—which would include the jobs created by re-spending—would not be as skewed toward men.) Weighting jobs so heavily toward men could, among other things, exacerbate the gender pay gap, clearly a negative outcome. Furthermore, given that over half the individuals in poverty are in household



**TABLE 4**

**Effect of green investments on relative labor demands**

	<b>\$100 billion</b>	<b>\$200 billion</b>	<b>\$300 billion</b>
<b>Total jobs</b>	746,102	1,492,204	2,238,306
<i>College degree +</i>	130,620	261,239	391,859
<i>High school grads</i>	290,032	580,064	870,096
<b>(% of U.S. labor force)</b>			
<b>Total jobs</b>	0.5%	1.1%	1.6%
<i>College degree +</i>	0.3	0.7	1.0
<i>High school grads</i>	0.7	1.3	2.0
<b>Green jobs replace “typical” jobs</b>			
<i>Relative demand change</i>			
<i>High school grads/college degree</i>	0.3%	0.7%	1.0%
<i>Relative wage change</i>			
<i>High school grads/college degree</i>	0.2%	0.5%	0.7%

**SOURCE:** Authors’ analysis of BLS and Census data. For more information on methodology, see Bivens, Irons, and Pollack (2009).

lacking adult males, a jobs program like this would not be, by itself, an effective anti-poverty tool unless coupled with other policies so that it provides ample job opportunities to women.

A key part of the agenda for policy makers interested in long-run green investments should address this gender imbalance, perhaps by including provisions that set hiring goals or divert a portion of the investment toward job training programs for women.

However, it should also be noted that additional public investments will tighten the labor market more broadly, and the wage and employment gains will not be narrowly limited to just the construction sector. Given the competitive nature of the U.S. labor market, wage gains would likely spill over from the sectors most directly impacted to a broader range of sectors and occupations.

**Conclusion**

Moving the U.S. economy to a lower-carbon future is one of the highest priorities facing the country in coming

decades. This transformation will be made much easier if investments are undertaken to give all American households opportunities to substitute spending away from high-carbon activities toward lower-carbon ones—for example, by providing reasonable public transportation alternatives to single-car commuting.

These green investments are vital, first and foremost because they will help us meet the challenge of global climate change without great loss in living standards. However, if the green investment agenda is ambitious enough to meet its primary goals, it will also change spending flows in the U.S. economy in a significant enough way to have visible impacts on the American job market.

In the short run, any investment that can be done quickly to help meet the challenges of undertaking serious carbon emissions abatement will have welcome near-term macroeconomic impacts. And over the longer-term, these investments will provide a payoff in the form of climate change mitigation, energy independence, and economic gains from energy efficiency.<sup>4</sup>

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In the longer run, dedicating more resources to ameliorating global climate change will actually lead to a mix of industry employment that nudges back against the forces that have generated ever-greater wage inequality for most of the past 30 years. As long as this investment

comes with a policy commitment for ensuring that the groups historically left out of these industries get a fairer shake going forward, green investment has the opportunity to be a success for all stakeholders—a rarity in public policy debates.

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## Appendix: Estimating the number and kind of jobs

To assess the impact of federal investments, we merge industrial data on input-output relationships with household-level data on demographic and labor market variables. This allows us to characterize the job outcomes that would result from the change in industrial mix accompanying increased infrastructure investment. Essentially, input-output data allow us to translate a given amount of industry spending into a total number of jobs supported directly and in supplying industries. The household data then allow us to characterize the demographic and labor-market composition of each industry's workforce. Combining this information allows us to characterize both the total number of jobs supported by a given level of industrial spending as well as the types of jobs and workers that are supported.

Both the direct and indirect jobs associated with a given amount of spending are derived from the employment requirements matrix (ERM) compiled by the Bureau of Labor Statistics (BLS). To estimate the characteristics of jobs created through different kinds of spending, we use data from the Current Population Survey (CPS) to calculate the share of each industry's employment by relevant categories (gender, race, ethnicity, wage levels, etc). To insure we have a large enough sample size, we

pool together data from 2005 to 2007. To match up the CPS data on demographic and labor market variables with the BLS data on industry input-output relationships, we needed to construct a crosswalk between the industry coding schemes used in the respective datasets. This crosswalk matches up both the CPS and the BLS industry codes to a third classification system (the North American Industrial Classification System, or NAICS) that maps cleanly onto both the CPS and BLS data.

It is important to note that these estimates are based on currently existing patterns of employment across sectors. As such, the final results tell us how many and what kinds of jobs would be created with our current economy. However, to the extent that the new investments are aimed at transforming the economy or labor market, our results are not precisely indicative of the true impact. For example, policy restrictions on the kinds or quality of jobs created, and specific policy targeting of job creation, would lead to different outcomes than estimated here. However, the numbers presented here compose an estimated baseline for policy makers to consider.

*Full details can be found in Bivens, Irons, and Pollack (2009).*

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## Endnote

1. Based on data found at <http://www.cbo.gov/ftpdocs/99xx/doc9957/econproj.xls>
2. One reason for the ineffectiveness of monetary policy is the fact that the housing sector is plagued by record levels of inventory. Traditionally, increased home sales were a key “transmission mechanism” through which interest rate cuts sparked economic recovery. Today, as record inventories put relentless downward pressure on home prices, prospective buyers remain on the sidelines even in the face of low interest rates. Without new buyers, builders will stay on the sidelines as well.
3. Generally, tax cuts are much less effective than government spending at boosting domestic demand. During a recession, households save rather than spend much of their tax cuts, thereby providing only a modest boost to demand. With high levels of debt and huge losses in their housing equity, households are today even more likely to save tax cuts than in a normal recession. Tax cuts are also more likely to be spent on imported goods, which do not spur domestic production and employment.
4. According to a UC Berkeley study, California’s energy-efficiency policies created nearly 1.5 million jobs in the last 30 years, while eliminating fewer than 25,000. Households faced lower energy bills, so they shifted that savings toward other goods and services that were more labor-intensive, such as retail (Roland-Holst 2008).

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