Job Loss and Infrastructure Job Creation During the Recession

Linda Levine
Specialist in Labor Economics

March 17, 2009

Congressional Research Service
7-5700
www.crs.gov
R40080

CRS Report for Congress
Prepared for Members and Committees of Congress

Summary

After the long economic expansion that characterized much of the current decade, the nation entered its eleventh postwar recession in December 2007. The announcement by the Business Cycle Dating Committee that a recession had begun preceded by one week the monthly *Employment Situation* release for November 2008, in which the U.S. Bureau of Labor Statistics reported the biggest one-month drop in employment in 34 years. This and other news of deteriorating conditions in the labor market at the end of 2008 intensified congressional interest in passage of legislation early in 2009 aimed at encouraging creation of new jobs and warding off further loss of jobs. (For information on the American Recovery and Reinvestment Act, see CRS Report R40104, *Economic Stimulus: Issues and Policies*.)

To mitigate all but one recession since the 1960s, Congress has chosen to increase federal spending on infrastructure. But, there are a number of issues associated with using expenditures on public works to quickly create jobs in times of recession. (See CRS Report R40107, *The Role of Public Works Infrastructure in Economic Stimulus*).

Public works expenditures traditionally have gone chiefly to construction activities (e.g., building highways and bridges, dams and flood control structures) which indirectly increase product demand in industries that supply construction (e.g., manufacturing). Today, the definition of infrastructure has been expanded to include so-called green jobs, which seemingly are those in industries that utilize renewable resources (e.g., electricity generated by wind), produce energy-efficient goods and services (e.g., mass transit), and install energy-conserving products (e.g., retrofitting buildings with thermal-pane windows).

A question that typically arises during congressional consideration of economic stimulus legislation is which approach produces the most bang for the buck. In the instant case, this means how many jobs might be supported by federal expenditures on traditional and green infrastructure projects. After briefly examining the extent of job loss since the recession's onset, the report turns to an in-depth look at job creation estimates, including the limitations of the methodology often used to derive them and the difficulties associated with developing job estimates for green infrastructure in particular. The report will be updated periodically to reflect changes in employment conditions during 2009.

Contents

Tables

Contacts

After the long economic expansion that characterized much of the current decade, the nation entered its eleventh postwar recession in December 2007. The unemployment rate, which is a lagging economic indicator, did not start to rise until May 2008 when it jumped 0.5 percentage points to 5.5%. By November 2008, it rose another 1.2 percentage points to reach 6.7% according to data from the U.S. Bureau of Labor Statistics (BLS). In November 2008 alone, employment at nonfarm businesses fell by almost 600,000—the biggest one-month drop recorded by the BLS Current Employment Statistics program (CES) since December 1974.

The Business Cycle Dating Committee of the National Bureau of Economic Research, the official arbiter of peaks and troughs in the business cycle, announced at the end of November 2008 that a substantial and widespread decline in economic activity had begun a year earlier. December 2007 marks both the end of the 73-month economic expansion that began in March 2001, and the beginning of the latest recession. As part of its announcement, the committee noted that it "views the payroll employment measure, which is based on a large survey of employers, as the most reliable comprehensive estimate of employment. This series [the CES] reached a peak in December 2007 and has declined every month since then."

The committee's announcement, which preceded by one week the monthly BLS *Employment Situation* release containing employment and unemployment data for November 2008, intensified congressional interest in passage of legislation aimed at encouraging creation of new jobs and warding off further loss of jobs. (For information on the American Recovery and Reinvestment Act, see CRS Report R40104, *Economic Stimulus: Issues and Policies*.)

To mitigate all but one recession since the 1960s, Congress has chosen to increase federal expenditures on infrastructure (public works), thereby directly raising demand for goods and services to offset the reduced demand of consumers. (See CRS Report 92-939, *Countercyclical Job Creation Programs*, by Linda Levine). But, there are a number of issues associated with using spending on public works to quickly create jobs during a recession. (See CRS Report R40107, *The Role of Public Works Infrastructure in Economic Stimulus*).

When Congress has considered spending on infrastructure to help stimulate a flagging economy, "how many jobs are created" is a commonly asked question. Although all spending increases labor demand, the number and composition of jobs may vary. After first examining trends in job loss since the latest recession began, this report focuses on job creation estimates associated with increased spending on traditional and "green" infrastructure, placing a heavy emphasis on explaining the methodology often used to derive them and the difficulties associated with developing estimates for green infrastructure in particular. The report will be updated periodically to reflect changes in employment conditions during 2009.

Employment and Unemployment Through Job Loss

As shown in **Table 1**, employment on nonfarm payrolls has steadily declined since December 2007. The number of job cutbacks intensified starting in late 2008. Of the 4.4 million jobs lost since the recession's onset, more than half (2.6 million) disappeared between November 2008 and February 2009.

Table 1. Payroll Jobs at Nonfarm Employers

(seasonally adjusted employment in thousands)

Year by Month	Total Employment	Private Sector Employment
2007		
December	138,152	115,783
2008		
January	138,080	115,689
February	137,936	115,515
March	137,814	115,373
April	137,654	115,203
May	137,517	114,029
June	137,356	114,834
July	137,228	115,691
August	137,053	114,497
September	136,732	114,197
October	136,352	113,813
November	135,755	113,212
December	135,074	112,542
2009		
January	134,419(p)	111,856(p)
February	133,768(p)	111,196(p)

Source: U.S. Bureau of Labor Statistics, data from the Current Employment Statistics program.

Notes: (p) = preliminary.

As is typical during economic downturns, employees in the goods-producing sector have been the most adversely affected. They saw their ranks shrink by almost 2.2 million between December 2007 and February 2009. (See **Table 2**.) Workers in the sector's construction industry began experiencing job losses before the economy-wide downturn began. Nonetheless, between the recession's onset and February 2009, construction firms cut over 900,000 jobs. Across all manufacturing industries, employment fell by 1.3 million over the 14-month period. Although manufacturing job losses have been widespread, two industries that produce durable goods—fabricated metal products (e.g., hardware, wire, and screws) and transportation equipment (e.g., motor vehicles and parts)—have been particularly hard hit.

Table 2. Number of Payroll Jobs by Industry

(seasonally adjusted employment in thousands)

Industry by Sector	Employment, December 2007	Employment, February 2009 (p)
Goods-producing sector	22,043	19,877
Mining and logging	743	781
Construction	7,523	6,619
Manufacturing	13,777	12,477
Service-providing sector	116,109	113,891
Trade, transportation and utilities	26,725	25,615
Wholesale trade	6,045	5,782
Retail trade	15,568	14,960
Transportation and warehousing	4,555	4,302
Utilities	557	570
Information	3,025	2,906
Financial activities	8,243	7,914
Professional and business services	18,109	17,042
Education and health services	18,570	19,149
Leisure and hospitality	13,551	13,242
Other services	5,517	5,451
Government	22,369	22,572

Source: U.S. Bureau of Labor Statistics, data from the Current Employment Statistics program.

Notes: (p)=preliminary.

Employment in the service-providing sector most recently peaked in December 2007, when the recession began. Although some service-providing industries have continued to grow—utilities, education and health services—cutbacks elsewhere have far outweighed their gains. As shown in **Table 2**, the two industries reported higher employment in February 2009 than at the start of the recession. In contrast, the financial activities industry began to lose jobs before the advent of the economy-wide downturn. This mirrors the above-mentioned trend in construction employment in part because real estate is a component of financial activities and it, like construction, has been hurt by the collapse of the housing market. Other components of financial activities, such as brokerage firms that packaged high-risk mortgages and the investors (e.g., banks) that purchased them, have been negatively affected by the housing market downturn as well.

Prospects for job growth resuming in the near-term look dim. Based on information gathered from such sources as newspapers, trade publications, and Securities and Exchange Commission filings, the outplacement firm of Challenger, Gray & Christmas reported that in 2008 companies announced their intention to cut 1.2 million jobs—a level last reached in 2003.[1] In January 2009,

[1] "Employers Announced 1.2 Million Job Cuts in 2008, Most Since 2003, Challenger Says," *Daily Labor Report*, (continued...)

the number of announced layoffs rose to 241,749, the highest level for a January in seven years. Although employers announced fewer job cuts in February (186,350), the total for the first two months of 2009 approached three times the level of January-February 2008.[2] In addition, more workers were let go as part of more extended mass layoffs (those involving at least 50 workers separated for at least 31 days) in the fourth quarter of 2008 than in any quarter since the BLS series began in 1995. Almost 1.4 million workers were separated from employers' payrolls as part of extended mass layoffs in 2008, a level last reached in 2001. And, the 7,818 extended mass layoffs for the year marked a program high.[3]

The Blue Chip Economic Indicators reported the consensus forecast among the nation's leading business economists that the unemployment rate will continue to rise through 2009, and peak at 8.8% in the final quarter of this year or the first quarter of 2010.[4] The unemployment rate in February 2009 rose to 8.1% from 5.0% in December 2007, according to BLS data derived from the Current Population Survey.[5] Workers who lost jobs have been an increasing presence among the unemployed, a group that also includes new entrants, reentrants, and job leavers. Job losers—who numbered 3.8 million in December 2007—accounted for the great majority of workers added to the ranks of the unemployed since the recession's start. Of the 12.5 million workers unemployed in February 2009, 7.7 million were job losers.

Infrastructure Spending and Job Creation Estimates

When in response to a recession Congress has acted to create jobs by raising demand for goods and services through increased federal spending, it often has chosen to direct the funds to infrastructure (public works) activities. Other means of direct countercyclical job creation—employment tax credits, state revenue-sharing, and public service employment—have been relied on much less often.[6]

A more expansive definition of infrastructure than was used in the past is now under consideration. Historically, public works has been synonymous with heavy and civil construction activities (e.g., road and bridge building, flood control structures and dam building). Today, it includes so-called green jobs. Although numerous studies on the emerging green economy have been released in the last several years, no consistent definition of green jobs exists at present. Green jobs seemingly are those in and related to industries that utilize renewable resources to produce their outputs (e.g., energy generated by wind, solar, and geothermal technologies) and jobs in and related to industries that produce energy-efficient goods (e.g., Energy Star appliances and equipment) and services (e.g., intra- and inter-city mass transit).[7] For this reason, the

(...continued)

January 8, 2008.

[2] "Planned Job Cuts Declined 23 Percent but Remain High, Challenger Reports," *Daily Labor Report*, March 3, 2009.

[3] U.S. Bureau of Labor Statistics, "Extended Mass Layoffs in the Fourth Quarter of 2008 and Annual Totals for 2008," press release, February 13, 2009.

[4] "Blue Chip Panel Cuts 2009 GDP Forecast," *Daily Labor Report*, February 11, 2009.

[5] Data from the Current Population Survey of households is available at http://stats.bls.gov/cps.

[6] CRS Report 92-939, *Countercyclical Job Creation Programs*, by Linda Levine.

[7] Related jobs include, for example, those in industries that manufacture wind turbines and install thermal-pane windows.

following discussion focuses on what is known about the job-generating impact of infrastructure spending broadly defined.

The section below begins with an in-depth examination of how job creation estimates usually are developed. The focus then narrows to look at two models that can be used to calculate the number of jobs nationwide dependent upon demand in the construction industry among other industries, and one model that can be used to calculate the number of jobs by state dependent on the construction industry among other industries. The section ends by reviewing the difficulties that researchers encounter in estimating the number of jobs supported by expenditures on green infrastructure and the consequent caution that should be taken when utilizing these estimates in particular.

Job Creation Estimates: What Are They?

Interest in how many jobs are created by a particular type of economic activity has surfaced when the economy is in a downturn and policymakers seek to compare the relative advantages of different stimulus options. It also has arisen when policymakers want to know the impact of shifting expenditures from one federal budget category to another (e.g., away from defense and towards social services programs). Unless there is an *increase in total spending*, however, the number of jobs in the labor market would remain largely unchanged.[8]

Although there are other bases upon which to develop estimates of the number of jobs created by a given economic activity, an input-output (I-O) model of the economy often is utilized due to its cost-effectiveness.[9] An I-O model describes the interrelationships between industries in the production process, showing how the dollar value of a sale is distributed across industries at a particular point in time. It thus reflects how much of the purchased product comes from final and supplier industries. An I-O table might show, for example, the dollar value of roof trusses produced by the veneer, plywood, and engineered wood products manufacturing industry and the dollar value of bricks produced by the clay product and refractory manufacturing industry used by the construction industry to erect residential buildings.

The output requirements from each industry must then be converted to employment requirements. Employment requirements are derived from productivity estimates for each industry at a particular point in time. The total employment requirement associated with a given type of final demand (e.g., a water reuse program) is the employment in the industry producing the final product or service and in the supplier industries. In other words, it is an approximation of both the direct and indirect employment dependent upon/supported by the economic activity. It commonly is expressed as the number of jobs per billion dollars of expenditures valued in a particular year's dollars.

Like an I-O table, an employment requirements table is a matrix of hundreds of columns and rows. Each column displays the number of jobs supported in each of the industry rows by an expenditure of one billion dollars in the column industry. For example, one billion dollars spent in

[8] Small differences in the total number of jobs could occur at the same spending levels if the economic activities to (from) which funds were being shifted were more (less) capital-intensive, for example.

[9] Another basis for estimating the impact of policy and other changes on the economy is conducting surveys. According to the U.S. Bureau of Economic Analysis (BEA), the advantage of the I-O approach to making impact estimates is the accessibility of the data sources required to develop the I-O model.

the construction industry supports (direct) employment in the various components of that industry (e.g., residential and commercial building, highway and bridge building) and (indirect) employment in the many industries that supply their goods and services to the construction industry (e.g., asphalt shingle manufacturing, fabricated metal bridge section manufacturing). An employment requirements table thus permits estimation of the varying impact of an expenditure on different industries and the varying impact of different kinds of expenditures.

Some Caveats

I-O models freeze technology and productivity at a particular point in time. Thus, the job-generating potential of an economic activity undertaken today could differ from that of an earlier period if there were technological and productivity improvements in the intervening years. Similarly, the estimates often are stated in terms of the number of jobs created for every billion dollars of expenditures, but a billion dollars spent in one year could buy less (more) than a billion dollars spent in another year depending on changes in price levels over time.

There also could be differences in estimated versus actual job creation because I-O models assume that resources are unlimited. If, for example, the economy was performing at a fairly high level with plants operating near full capacity and with fairly few workers unemployed, the actual number of new jobs might fall short of the estimate due to capital and labor constraints. This is less likely to matter during a broad-based economic downturn.

Further, I-O tables do not necessarily differentiate between imported and domestically produced goods. As a consequence, the domestic employment impact of expenditures might be overstated to the extent that inputs are imported. Similarly, I-O tables typically do not express employment in terms of full-time equivalents (i.e., both full-time and part-time jobs are counted equally). Thus, programs which draw upon industries that rely relatively more on part-time workers (e.g., retail trade) might appear to create more jobs than programs that draw to a greater extent on industries employing relatively more full-time workers (e.g., manufacturing).

The Multiplier Effect

A complete estimate of the number of jobs created by a particular type of economic activity has three components, namely,

- the number of jobs directly attributable to the activity,
- the number of jobs indirectly attributable to the activity, and
- the number of jobs induced throughout the economy as a result of the activity.

Induced jobs are those dependent upon the purchases of persons in direct and indirect jobs. For example, workers who are directly or indirectly employed as the result of a highway construction program might spend some portion of their wages in their communities at grocery stores, auto repair shops, and movie theaters.

Estimates of induced jobs or the multiplier are considered tenuous. To calculate the multiplier effect, one must estimate how much of the additional money earned by directly and indirectly employed workers will likely be spent versus saved. The actual number of jobs created by this added spending will further depend on economic conditions (e.g., the availability of labor, the

inflation rate). As a result, there are widely varying estimates of the multiplier effect and those job creation studies that include induced employment utilize different multipliers.

Job Estimates and Construction Spending

The Federal Highway Administration

Perhaps the most widely known estimate of the employment impact of federal spending on our nation's roads comes from the Federal Highway Administration (FHWA). Although the FHWA twice updated its 1997 analysis, which estimated that $1 billion of federal-aid highway expenditures plus a $250 million state match supported 47,575 jobs, some proponents of stimulating job growth through increased federal spending on infrastructure continue to use this figure. The most recent update by the FHWA to 2007 indicates that a $1.25 billion expenditure on highway construction consisting of $1 billion from the federal government and $250 million from state government could support 34,779 jobs. If a state match is not required, "then $1 billion in Federal funds supports 27,800 jobs."[10] The jobs number has decreased over time in part because of increases in the price of inputs, such as asphalt and diesel fuel.

The FHWA breaks down the estimate of 27,822 jobs per billion dollars of federal spending on highways as follows:

- 9,536 construction-oriented jobs (i.e., jobs at construction companies working on the projects and at businesses that provide direct inputs to the projects such as asphalt, concrete, and guard rails);
- 4,324 jobs in supporting industries (i.e., employment at firms that provide inputs to the industries directly providing the materials and equipment utilized in highway construction such as producers of sheet metal who supply the manufacturers of guard rails); and
- 13,962 induced jobs (i.e., jobs throughout the economy dependent upon consumer expenditures from the wages of workers in "construction-oriented" and "industry-supporting" jobs).

Thus, the multiplier effect accounts for one-half of the total estimate.

The FHWA notes one caveat about I-O analysis in addition to those mentioned above, that is, the job estimate "utilizes the national average mix of construction materials and labor inputs. Specific projects and local utilization ratios will alter the estimated number of jobs supported."[11] For example, a different combination of materials and number of workers might be required for road resurfacing projects compared to bridge building or commuter rail projects.

The FHWA also states that

[10] U.S. Department of Transportation, Federal Highway Administration, *Employment Impacts of Highway Infrastructure Investment*, pp. 1, http://www.fhwa.dot.gov/policy/otps/publications.htm.

[11] U.S. Department of Transportation, Federal Highway Administration, *Employment Impacts of Highway Infrastructure Investment*, p. 2, http://www.fhwa.dot.gov/policy/otps/publications.htm.

> [t]he employment figures have recently been used as a justification for including highway spending in an economic stimulus package. But with the exception of short-term resurfacing and preservation projects, highway funds spend out slowly, with only 27% of a project, on average, outlaying in the first year.[12]

BLS Employment Requirements Table

In recognition of the fact that "people want to assess the impact on employment of different policies or actions," the U.S. Bureau of Labor Statistics (BLS) makes available electronically free-of-charge to the public the employment requirements tables it develops as part of its employment projections program.[13] I-O and employment requirements tables developed and utilized by others often are proprietary and not made widely available.

The employment requirements tables are based on the official I-O tables for the nation that the U.S. Bureau of Economic Analysis (BEA) develops every five years. BLS takes the latest national I-O table available from BEA – in this case, 1997 – and updates it to reflect more recent production and distribution technologies. It then utilizes the updated I-O table and recent labor productivity data to develop an employment requirements table. Because the base year for the most recently published employment projections is 2006, the latest employment requirements table reflects 2006 technologies of production and distribution as well as labor productivity.

The BLS employment requirements table provides information for the construction industry as a whole. The construction industry, according to the North American Industry Classification System, is composed of three major subdivisions:

- construction of buildings (residential and nonresidential),
- heavy and civil engineering construction (highway, street, and bridge construction; utility system construction; construction of flood control structures, dams, and hydroelectric power generation facilities), and
- specialty trade contractors (foundation, structure, and building exterior contractors; building equipment contractors; building finishing contractors).

The BLS employment requirements table shows 11,768 jobs directly and indirectly dependent upon $1 billion of spending on construction. A majority of the jobs are in the construction industry itself (i.e., 6,925 direct jobs).

The figure from the BLS employment requirements table for construction expenditures (11,768) is somewhat lower than the direct and indirect jobs figure for highway expenditures from the FHWA (13,860). Potential explanations for the disparity include differences in industry definition, data sources, method of updating the model, and time period.

The employment requirements available from BLS do not break out other types of construction that have been discussed as part of a federal job creation package (e.g., public school construction). BLS formerly conducted surveys to estimate full-time year-long employment

[12] U.S., *Employment Impacts of Highway Infrastructure Investment*, U.S. Department of Transportation, Federal Highway Administration, p. 2, http://www.fhwa.dot.gov/policy/otps/publications.htm.

[13] U.S. Bureau of Labor Statistics, *Layout and Description for 201-order Employment Requirements Tables*, Washington, D.C., December 2007, p. 3, http://stats.bls.gov/emp/empind4.htm.

associated with a variety of different construction activities, including new schools, hospitals, water and sewer facilities, roads, mass transit, and maintenance and repair construction. The survey information was last updated a few decades ago, however.

BEA's Regional Input-Output Modeling System (RIMS II)

From its Regional Input-Output Modeling System (RIMS II), the BEA produces estimates by geographic area of the employment, earnings, and output dependent on additional spending in hundreds of different industries.[14] For a fee to most parties, BEA currently utilizes either the 1997 benchmark I-O for the nation or the 2006 annual I-O for the nation adjusted by 2006 data from its regional economic accounts to provide these estimates at the subnational level.[15]

As shown in **Table 3**, the number of jobs directly and indirectly supported by an expenditure of $1 billion in the construction industry in a given state ranges widely. The main reason for the disparity in job creation estimates is that each state has a different mix of industries within its borders. As a consequence, one state varies from the next in its capacity to supply all the intermediate goods needed to carry out construction projects. A secondary explanation is that earnings vary by state.

Table 3. Number of Direct and Indirect Jobs by State Dependent on an Expenditure of $1 Billion in the Construction Industry

State	Number of Jobs	State	Number of Jobs
Alabama	15,851	Montana	16,127
Alaska	11,009	Nebraska	13,946
Arizona	12,238	Nevada	11,459
Arkansas	15,306	New Hampshire	12,374
California	12,289	New Jersey	11,118
Colorado	12,575	New Mexico	14,279
Connecticut	10,709	New York	10,106
Delaware	9,518	North Carolina	15,555
District of Columbia	1,874	North Dakota	13,500
Florida	13,127	Ohio	14,391
Georgia	14,224	Oklahoma	16,232
Hawaii	11,614	Oregon	13,184
Idaho	15,860	Pennsylvania	12,390
Illinois	11,916	Rhode Island	10,767

[14] For additional information on RIMS II see BEA, *Regional Multipliers: A User Handbook for the Regional Input-Output Modeling System*, http://www.bea.gov/scb/pdf/regional/perinc/meth/rims2.pdf.

[15] More specific detail by industry is available from the 1997 benchmark I-O than from the annual I-O. Therefore, Table 1 (Number of Direct and Indirect Jobs Per $1 Million of Output Produced by the Water, Sewage and Other Systems Industry) in CRS Report R40107, *The Role of Public Works Infrastructure in Economic Stimulus*, was drawn from the 1997 benchmark I-O because the 2006 annual I-O provides data only for the utilities industry as a whole.

State	Number of Jobs	State	Number of Jobs
Indiana	13,747	South Carolina	15,319
Iowa	14,330	South Dakota	15,316
Kansas	13,625	Tennessee	14,556
Kentucky	15,039	Texas	12,985
Louisiana	13,731	Utah	14,692
Maine	15,988	Vermont	14,883
Maryland	10,687	Virginia	12,085
Massachusetts	10,714	Washington	12,171
Michigan	13,354	West Virginia	13,834
Minnesota	12,998	Wisconsin	13,673
Mississippi	15,357	Wyoming	13,091
Missouri	13,241	United States	14,315

Source: Prepared by CRS from RIMS II estimates supplied by the BEA Regional Product Division.

Job Estimates and Green Infrastructure Spending

Estimating the number of jobs dependent upon green infrastructure activities presents a greater challenge than estimates related to infrastructure projects as traditionally defined. The basis for most data collection by U.S. statistical agencies is the North American Industry Classification System (NAICS). It currently does not identify separately so-called green industries (e.g., those that utilize renewable resources to produce their outputs, those that manufacture goods which minimize energy use). For example, the NAICS disaggregates the electric utility industry into hydroelectric, fossil fuel, nuclear, and other power generation, transmission, and distribution. Such renewable sources of energy production as wind, solar, and biomass are not uniquely recognized; they are included in the "other" category. If harnessing the wind to produce electricity and plant material to produce biofuel requires a substantially different mix of inputs than relying on coal and gasoline, for example, the conventional I-O model does not seem well-suited as a basis for estimating the number of jobs supported by these green activities. Similarly, within NAICS, the construction industry does not have a unique category for retrofitting (e.g., installing additional insulation, fluorescent lighting, or energy-efficient heating and air-conditioning systems). Retrofitting likely requires a combination of inputs from supplier industries that differs from the mix for the top-to-bottom construction of buildings, once again making use of conventional I-O models problematic.

This recognized difficulty generally is either not mentioned, or how it is dealt with is not described, in the analyses of green job creation. One study, commissioned by the Center for American Progress that is discussed in more detail below, does address the problem. The researchers explain that because "the U.S. government surveys and accounts that are used to construct the input-output tables do not specifically recognize wind, solar, biomass, building retrofitting, or new mass transit as industries in their own right," they created *synthetic industries* by combining parts of industries for which data are available. The researchers provided an example in the case of the biomass "industry:" they constructed it by combining the farming,

forestry, wood products, and refining industries; then they "assigned relative weights to each of these industries in terms of their contributions to producing biomass products."[16]

Further complicating the matter is the context and manner in which estimates of green jobs generally are presented. Studies often develop employment projections based on differing sets of assumptions and time horizons. For example, the number of direct and indirect jobs some 10 or more years in the future supported by an assumed increase in the demand for energy that is met by an assumed shift during the projection period from coal to wind and geothermal power generation. Some reports also include induced employment, but this is not always made clear. In addition, some analyses relate to a particular state. Their results may not be generalizeable to other areas because state economy's have different mixes of industries and may not be able to provide any or all of the inputs for a particular green output. Additionally, the assumptions and methodologies underlying the job creation estimates often are not clearly articulated, which makes thoughtful review of the results very difficult. For these reasons, policymakers considering which if any green infrastructure programs to fund to create and preserve jobs in the near term to mitigate the recession's impact on U.S. workers may not find helpful many green economy studies.

It should be noted that many of the studies by green economy proponents were not conceived for the purpose of quickly stabilizing or increasing the number of jobs in the nation or in industries particularly hard hit by the current recession. Job creation estimates from two organizations that have proposed broad-based green economy strategies intended in part to stimulate the deteriorating labor market are briefly described below.

- The September 2008 report, *Green Recovery: A Program to Create Jobs and Start Building a Low-Carbon Economy*, was commissioned by the Center for American Progress (a research and educational institute). It represents an acceleration of a 10-year program included in a 2007 report (*Capturing the Energy Opportunity: Creating a Low-Carbon Economy*). The 2008 report's authors at the Department of Economics and Political Economy Research Institute (University of Massachusetts – Amherst), who relied on I-O analysis, estimate that almost 2 million jobs (935,200 direct jobs, 586,000 indirect jobs, and 496,000 induced jobs) could be created or preserved by a two-year $100 billion "green economic recovery program." The program involves retrofitting buildings with energy-efficient products and equipment, extending the reach of mass transit and freight rail networks, constructing smart electric-grid transmission systems, increasing the use of wind and solar resources in power generation, and developing next-generation biofuels. Of the $100 billion total, $46 billion would be in the form of federal spending for such activities as public building retrofits, mass transit and freight rail expansion, and smart electrical grid development. Much of the remainder would be in the form of tax credits to encourage businesses and homeowners to retrofit commercial and residential buildings. The authors acknowledge that not all of the green activities

[16] Robert Pollin, Heidi Garrett-Peltier, and James Heintz, et al., *Green Recovery: A Program to Create Good Jobs and Start Building a Low-Carbon Economy*, Center for American Progress, Washington, D.C., September 2008, p. 20, http://www.americanprogress.org.

can contribute equally to a short-term green economic recovery program. Some ... strategies are clearly capable of delivering within a year, while others will require as long as two years to be implemented.[17]

- In December 2008, the Apollo Alliance (a coalition of labor, environmental, business and community leaders) proposed *The Apollo Economic Recovery Act*. It is an initial step toward achievement of a 10-year $500 billion program to create 5 million green-collar jobs, which had been released in September 2008. The new initiative calls for federal spending of about $50 billion to create or maintain more than 650,000 direct jobs and 1.3 million indirect jobs. The derivation of these job creation figures is not always clear, appearing to rely much of the time on spending-to-jobs relationships estimated by other organizations (e.g., Surface Transportation Policy Project, FHWA , and Cambridge Systematics). A selection of the proposed allocation of federal funds and associated job estimates follows.

  1. $6 billion retrofitting buildings: 267,600 direct and indirect jobs
  2. $10 billion to improve the efficiency and reliability of the electric transmission grid: 131,000 direct and indirect jobs
  3. $6 billion on ready-to-go public transit projects: "would create or retain more than 246,000 jobs, including 59,000 direct jobs and more than 162,000 indirect jobs"[18]
  4. $8 billion to repair roads and bridges: 278,000 direct and indirect jobs
  5. $8 billion to encourage localities to replace aging buses and trains with U.S.-made clean-energy vehicles: 37,600 direct jobs in vehicle manufacturing and 167,000 indirect jobs.

Author Contact Information

Linda Levine
Specialist in Labor Economics
llevine@crs.loc.gov, 7-7756

[17] Robert Pollin, Heidi Garrett-Peltier, and James Heintz, et al., *Green Recovery: A Program to Create Good Jobs and Start Building a Low-Carbon Economy*, Center for American Progress, Washington, D.C., September 2008, p. 5, http://www.americanprogress.org.

[18] Apollo Alliance, *Data Points: Economic Outcomes of The Apollo Economic Recovery Act*, 2008, p. 3, http://apolloalliance.org/apollo-14/data-points-the-new-apollo-program-fact-sheet/.