



The Role of Public Works Infrastructure in Economic Recovery

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Summary

During the recent recession, policymakers took a number of monetary and fiscal policy actions to stimulate the economy. Notably, Congress enacted the American Recovery and Reinvestment Act (ARRA) that provided increases in federal spending and reduction in taxes in order to increase demand for goods and services. However, as the economy is only slowly emerging from the recession, interest in using federal government spending to boost U.S. economic recovery has again intensified. There is widespread desire to accelerate job creation and economic recovery, although consensus on how to do so is not apparent. Policymakers at all levels of government are debating a range of options to address these problems. This report is an overview of policy issues associated with one approach that also was included in ARRA: using accelerated investments in the nation's public infrastructure as a mechanism to benefit economic recovery.

When most people think about infrastructure, they probably have in mind systems that are publicly provided and are important to the productive capacity of the nation's economy. Today, policymakers define the term more broadly to include both publicly and privately owned systems and facilities and categories that vary considerably in the degree of historic federal investment in building or rebuilding physical structures.

Academics, economists, and policymakers debate two issues concerning the contribution of infrastructure investment to the economy. One issue is the effects of infrastructure investment on productivity and growth. The second related issue is the role of infrastructure spending, which is typically a long-term activity, as a short-term mechanism to invigorate a sluggish economy. Research conducted over time has resulted in a general consensus that there can be positive returns on productivity of investing in infrastructure. Many experts now argue that infrastructure spending could be an important source of stimulating labor demand and enhancing U.S. productivity through investments in roads, bridges, water systems, etc. Still, some analysts are cautious about the effectiveness of this type of fiscal stimulus because of one key issue: timing. By definition, the goal of stimulus spending is to get money into the economy swiftly, but infrastructure spending is different. The reality is that large infrastructure projects typically are multiyear efforts with slow initial spendout that continues over a period of time. Spending advocates contend that to the extent that recovery from a lengthy recession is slow—as it is now—projects with extended timeframes can still contribute to the economy's recovery.

A key question in debating infrastructure as part of job creation to aid economic recovery is, what will the increased spending buy? Two important considerations are, will it produce short-term or long-term benefit, and will it produce a significant economic boost, relative to its budgetary cost. A commonly asked question is, how many jobs will be created?

Setting priorities for infrastructure spending is based on a combination of factors, often including estimates of funding needs. Determining "need" is complicated by differences in purpose, criteria, and timing. In the context of evaluating job creation plans, a further complication is whether funds are targeted to true need, and whether "need" is defined by engineering assessments, by economic measures such as unemployment, or a program's effectiveness in leveraging private capital.

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Policymakers at all levels of government are debating a wide range of options for addressing the nation's faltering economic conditions. One option that is once again receiving attention is accelerated investments in the nation's public infrastructure—that is, highways, mass transit, airports, water supply and wastewater, and other facilities—in order to create jobs while also promoting long-term economic growth.

This report discusses policy issues associated with using infrastructure as a mechanism to benefit economic recovery. It begins with two contextual aspects of this discussion, what is the current economic condition and how to define infrastructure. The report then reviews the role of infrastructure investment in economic growth generally and in contributing to bolstering a faltering economy. It discusses key issues including the potential role of traditional and “green” infrastructure in creating jobs, timing, and setting priorities.

The Context: Current Economic Conditions

Debate about direct government spending to accelerate economic recovery has intensified recently in response to economic indicators showing significant and continuing weakness of the national economy. Although the U.S. economy officially began to emerge in June 2009 from the recession that began in December 2007, the recovery has been sluggish, and the economy has continued to feel the recession's impact in terms of both budget deficits and high unemployment. In August 2011, the nation's unemployment rate was 9.1%, slightly improved from the 2010 average rate of 9.6%, but still stubbornly higher than in 2007 (4.6%) and 2008 (5.6%). Also in August, the Congressional Budget Office (CBO) projected continuing but modest economic growth for the next few years. Under its baseline projections, CBO estimated that deficits will fall from 8.5% of gross domestic product (GDP) in FY2011 to 6.2% in FY2012 and 3.2% in FY2013, although part of the expected change reflects policy changes, such as the expiration of the George W. Bush-era tax cuts in 2013 and expiration of the payroll tax cut in 2012.¹

Fiscal problems are affecting all levels of government. In May, the National Association of State Budget Officers reported that state fiscal conditions in 2011 are somewhat improved from conditions in 2009 and 2010. However, the slow economic recovery and wind down of significant federal funding enacted in 2009 will continue to present states with tight fiscal conditions. State revenue collections continue to be affected by the economic downturn and soft consumer spending, while demand for healthcare and social services remains high. State general fund revenue collections are forecast to increase in 2011 and 2012, but state finances can take many months to recover from recessions. States also face long-term issues such as funding pensions and maintaining and repairing infrastructure.²

Local governments also are dealing with fiscal pressures. In June, the U.S. Conference of Mayors projected that by the end of 2011, 25 metropolitan economies will have unemployment rates higher than 12%, 75 will still be in double digits, and 193 (53% of all such areas) will have rates higher than 8%. The mayors group projected that by the close of 2014, over half of metropolitan areas will have returned to their peak employment levels, but that 48 are not expected to regain

¹ U.S. Congressional Budget Office, *The Budget and Economic Outlook: An Update*, August 2011.

² National Association of State Budget Officers, *Preliminary Summary, NGA/NASBO Spring 2011 Fiscal Survey of States*, May 31, 2011.

jobs lost during the recession in the next decade.³ Similarly, the National League of Cities has observed that state-local fiscal pressures require layoffs and difficult choices about cuts to necessary services like schools, fire, and police.

Much of the public responsibility to build, operate, and maintain infrastructure resides with states and localities. Cities and states normally rely on the bond market to finance long-term projects, meaning that turmoil in financial markets creates concern for financing economic development and infrastructure projects. Virtually all state and local governments have balanced budget requirements and, before undertaking any borrowing, must carefully ensure their ability to repay. Thus, their capacity to self-finance needed projects is more constrained during economic downturns than when the economy is growing rapidly. Facing budgetary pressures and more difficult access to financing, officials may scale back, delay, or cancel projects.

As a result of these conditions, organizations representing states and municipalities have issued agenda documents with both policy and short-term and long-term assistance recommendations for Congress and the Administration, including those in areas of infrastructure, economic development, businesses, manufacturing, and trade.⁴

The concept of countering the effect of economic downturn with legislation to spur job creation through increased spending on public works infrastructure is not new. In recent decades, Congress has done so on several occasions. For example, in 1983 (P.L. 98-8) and 1993 (P.L. 103-50), Congress appropriated funds to a number of existing federal infrastructure and public works programs in hopes that projects and job creation would be stimulated quickly.⁵ During the recent recession, policymakers took a number of monetary and fiscal policy actions to stimulate the economy.⁶ On the monetary policy side, the Federal Reserve has used both conventional tools (lowering short-term interest rates) and unconventional tools (purchasing equity interest in financial firms, long-term Treasury debt, and mortgage-backed securities). On the fiscal policy side, Congress enacted several measures in 2009 and 2010 that were intended to increase demand for goods and services through increases in federal spending and reduction in taxes. The largest of these was the American Recovery and Reinvestment Act of 2009 (ARRA, P.L. 111-5), a \$787 billion package consisting of \$286 billion in tax cuts and the remainder in spending. The spending in ARRA included more than \$62 billion in infrastructure investment.

While the fiscal stimulus from ARRA added to demand over time, this effect diminished as spending authority was spent and tax cuts expired. By CBO's estimate, ARRA funds will continue to be spent out through 2020, but the economic effects of ARRA—including direct and indirect effects—peaked in the first half of 2010. After that, the stimulus still adds to demand but by smaller amounts, and its effect eventually turns negative.⁷

³ U.S. Conference of Mayors, *U.S. Metro Economies: GMP and Employment Forecasts*, June 2011.

⁴ National League of Cities, *Agenda for Economic Growth 2011*, February 2011; U.S. Conference of Mayors, *A Common-Sense Jobs Agenda*, September 2, 2011.

⁵ For information, see CRS Report 92-939, *Countercyclical Job Creation Programs*, by Linda Levine.

⁶ For information, see CRS Report R41578, *Unemployment: Issues in the 112th Congress*, by Jane G. Gravelle, Thomas L. Hungerford, and Linda Levine.

⁷ U.S. Congressional Budget Office, *Policies for Increasing Economic Growth and Employment in 2010 and 2011*, January 2010, p. 4.

At least two factors are bringing renewed attention to these issues, including whether another round of fiscal stimulus—including infrastructure spending—is needed. One is the slow pace of the current recovery. ARRA was controversial when enacted. While most economists believe it was effective, there is dispute among some economists.⁸ Nevertheless, there is widespread desire to accelerate job creation and economic recovery, although consensus on how to do so is not apparent.

Another factor is that debate about additional job-creating programs has merged with discussion among infrastructure advocates that has been ongoing for years about the need for investment to address problems of aging and deteriorating public works. These infrastructure problems have been increasingly recognized by policymakers and the public at large.⁹ It is argued that U.S. investments in public infrastructure have declined significantly in recent decades, to the point that this country is underinvesting in its critical assets, and is failing to construct new facilities or adequately maintain existing systems. The perception that current investment levels are inadequate is in part supported by data which show that, relative to GDP, infrastructure spending has declined about 20%, from 3.0% of GDP in 1960 to 2.4% in 2007. During this same period, spending shifted from predominantly on capital (60% in 1960, compared with 45% in 2007) to operation and maintenance (40% in 1960, compared with 55% in 2007).¹⁰ In a growing economy, infrastructure should hold its own, but other data show that that has not been the case. While total government spending on infrastructure increased from \$92 billion in 1960 to \$161 billion in 2007, it declined from a high of \$1.17 per capita in 1960 to \$0.85 per capita in 2007 (in 2009 dollars).

In response to these multiple concerns, on September 8, 2011, President Obama proposed the American Jobs Act (S. 1549), legislation that includes tax cuts for businesses, extended unemployment insurance, expanded payroll tax cuts, \$80 billion in spending on transportation infrastructure and school repair and modernization, and establishment of a national infrastructure bank to finance large infrastructure projects.¹¹ Congress is to soon consider the President's proposal and possibly others for job creation and economic recovery.

Defining Infrastructure in Today's Context

Most people probably think about roads, airports, or water supply when they refer to infrastructure, having in mind the types of systems or facilities that are publicly provided and are important to the productive capacity of the nation's economy. But some analysts argue that such a conception is too narrow. Accordingly, the term can be defined more broadly to also include spending by the private sector, such as by private utilities that provide electricity or natural gas. In

⁸ See, for example, U.S. Congressional Budget Office, *Estimated Impact of the American Recovery and Reinvestment Act on Employment and Economic Output from April 2011 Through June 2011*, August 2011; Martin Feldstein, "The Economy is Worse Than You Think," *The Wall Street Journal*, June 8, 2011; Ben S. Bernanke, chairman, Federal Reserve System, "The Near- and Longer-Term Prospects for the U.S. Economy," August 26, 2011, and "The U.S. Economic Outlook," September 8, 2011, <http://www.federalreserve.gov/newsevents/default.htm>.

⁹ See Robert L. Reid, "The Infrastructure Crisis Special Report," *Civil Engineering*, January 2008, http://pubs.asce.org/magazines/CEMag/2008/Issue_01-08/article1.htm.

¹⁰ U.S. Congressional Budget Office, *Public Spending on Transportation and Water Infrastructure*, November 2010, Tables A-1, A-3.

¹¹ White House, "Fact Sheet: The American Jobs Act," September 8, 2011, <http://www.whitehouse.gov/the-press-office/2011/09/08/fact-sheet-american-jobs-act>.

addition, other types of public investment, such as public buildings, may not add directly to the productive capacity of the economy but do represent assets in the nation's capital stock.

There is no single definition of infrastructure (see the box "What Is Infrastructure?" below). Today, many policymakers and stakeholder groups define the term broadly to include facilities and categories that vary considerably in the degree of historic federal investment in building or rebuilding physical structures (e.g., highways compared with public schools) and systems that have a long history of combined public and private ownership (water resource projects as well as electric transmission systems, some of which are federally owned, for example). Indeed, today there is considerable blurring between public and private infrastructure, raising more frequent questions about what should be the role of government, including the federal government, in providing infrastructure services. In part, this is due to increasing reliance on the private sector—through contract operations, full ownership and other arrangements—to provide functions and services that typically are thought of as public. Examples include prisons, highways, passenger rail, and postal services and mail delivery. A relatively new dimension in today's context is the notion of coupling public works with investments in environmentally friendly systems that incorporate renewable technologies or energy efficiency—called "green infrastructure" (see discussion below).

What Is Infrastructure?

There is no standard or agreed definition of the term "infrastructure," and the concept in policy terms has been and remains fluid, including both public and private systems, services, and even amenities. Nearly 30 years ago, infrastructure was debated because of concern that the nation's public works infrastructure was believed to be suffering from severe problems of deterioration, technological obsolescence, and insufficient capacity to serve future growth. The focus of debate was on the nature, extent, and severity of poor physical condition, technological adequacy, and capacity of public works systems and about decisions by government at all levels on spending priorities to meet physical and management needs. All of these issues remain relevant and topical today.

Public and private reports at the time analyzed and critiqued the issue, and many sought to define the term "infrastructure." One of these, issued by the Council of State Planning Agencies, defined the term as public service and production facilities, which include "a wide array of public facilities and equipment required to provide social services and support private sector economic activity," commonly roads, bridges, water and sewer systems, airports, ports, and public buildings, and may also include schools, health facilities, jails, recreation facilities, electric power production, fire safety, solid waste disposal, and telecommunications. (Roger Vaughan and Robert Pollard, *Rebuilding America, Vol. I, Planning and Managing Public Works in the 1980s*, Council of State Planning Agencies, 1984, pp. 1-2.)

In a 1983 report to Congress about policies regarding condition of the nation's infrastructure, the Congressional Budget Office (CBO) analyzed seven categories of infrastructure: highways, public transit systems, wastewater treatment works, water resources, air traffic control, airports, and municipal water supply. These seven systems, CBO said, "share the common characteristics of capital intensiveness and high public investment at all levels of government. They are, moreover, directly critical to activity in the nation's economy." CBO noted that "the concept of infrastructure can be applied broadly to include such social facilities as schools, hospitals, and prisons, and it often includes industrial capacity, as well." (U.S. Congressional Budget Office, *Public Works Infrastructure: Policy Considerations for the 1980s*, April 1983, p. 1.)

Five years later, CBO used a similar but consolidated categorization of infrastructure (highways, aviation, mass transit, wastewater treatment, and water transportation) based on a definition that those facilities:

provide a foundation or basic framework for the national economy, and in which federal policy plays a significant role.... This definition excludes some facilities often thought of as infrastructure—such as public housing, government buildings, private rail service, and schools—and some environmental facilities (such as hazardous or toxic waste sites) where the initial onus of responsibility is on private individuals. (CBO, *New Directions for the Nation's Public Works*, September 1988, pp. xi-xii.)

CBO's current infrastructure focus is on highways and roads, mass transit, rail, aviation, water transportation, water resources such as dams and levees, and water supply and wastewater treatment—facilities that "draw heavily on federal resources, share the economic characteristics of being relatively capital intensive and producing services under

public management that facilitate private economic activity.” (CBO, Trends in Public Spending on Transportation and Water Infrastructure, 1956-2004, August 2007, p. 1.)

In 1984, Congress enacted legislation that established a National Council on Public Works Improvement with a mandate to analyze and report to Congress and the President on the state of public works infrastructure systems (P.L. 98-501). The Council provided yet another definition of infrastructure and included nine categories of systems in its analyses: highways, streets, roads, and bridges; airports and airways; public transit; intermodal transportation (the interface between modes); water supply; wastewater treatment; water resources; solid waste; and hazardous waste services. These categories, the Council said, have strong links to economic development and generally have a tradition of public sector involvement. Facilities have high fixed costs and long economic lives. Taken as a whole, the services that they provide “form the underpinnings of the nation’s defense, a strong economy, and our health and safety.” (National Council on Public Works Improvement, *Fragile Foundations: A Report on America’s Public Works*, Final Report to the President and Congress, February 1988, p. 33.)

Following the 2001 terrorist attacks in the United States, policymakers turned attention to protecting the nation’s “critical infrastructure” from physical or cyber attacks. In the context of homeland security, that term is quite broadly defined to encompass certain socioeconomic activities that are vital to the day-to-day functioning and security of the country; for example, transportation of goods and people, communications, banking and finance, and the supply and distribution of electricity and water.

Infrastructure and the Economy

Academics, economists, and policymakers debate two key issues concerning the contribution of infrastructure investment to the economy. One is the issue of the effects of infrastructure spending and investment on productivity and growth. The second related issue is the role of infrastructure spending, including short-term job creation, as a countercyclical tool to support economic recovery.

Productivity and Output

The question of whether or how the availability of public infrastructure, and investments in public infrastructure, influence productivity and growth has long interested academics. One economist describes the issue as follows:

The argument is simple. Infrastructure is a public good that produces positive externalities for production. The provision of adequate infrastructure is a necessary condition for private firms to be productive. Even if infrastructure is also provided for its amenity value (i.e. for its direct utility value to individuals) it is obvious that it plays a central role in generating external effects that fundamentally alter the capacity of the economy to produce goods and services. Just imagine an economy without roads or telephones to think about the impact that infrastructure has on productivity.¹²

Few would argue that infrastructure isn’t important to economic activity. A Mercatus Center researcher observed that “economists have long recognized the value of infrastructure. Roads, bridges, airports, and canals are conduits through which goods are exchanged.”¹³ But the precise

¹² Francisco Rodriguez, *Have Collapses in Infrastructure Spending Led to Cross-Country Divergence in per Capita GDP?*, Wesleyan University Department of Economics, Wesleyan Economics Working Papers No. 2006-013, April 2006, p. 3.

¹³ Veronique de Rugy, “Infrastructure Spending Increase in the last 10 Years,” September 12, 2011, <http://mercatus.org/publication/infrastructure-spending-increase-last-10-years>.

ways in which infrastructure is important, and to what degree (e.g., new construction or maintenance of existing systems), are questions that have interested researchers. Thus, public roads are important, but by themselves, they don't produce anything. Yet they are linked in complex ways to economic growth. Economically, what is important are the services that roads provide in transporting goods and people, mitigating congestion, etc.

Academic interest in the issue of economic payoff associated with public infrastructure spending was motivated in part by recognition of declines in public investment in the early 1970s and declines in economic productivity growth at about the same time. The question for researchers was whether there was linkage, or causality, between public investments and economic productivity and, consequently, whether underinvestment in infrastructure helped to explain the slowdown in productivity growth. Research reported in the late 1980s found that there are very large returns on investment from infrastructure spending and, by implication, argued that part of the U.S. productivity slump in the 1970s and 1980s was due to a shortfall of investing in infrastructure. Some of this early work found that a 10% rise in the public capital stock would raise multifactor productivity (meaning, changes in economic output resulting from the combination of labor, capital, materials, fuels, and purchased services) by almost 4%.¹⁴ This was a very high estimate and, as such, was very controversial. Subsequent investigations by others found that the initial results were highly sensitive to numerous factors, such as minor changes in data, or time period, or sectors of the economy that were analyzed.

During the 1990s, further research on this issue modified the methodology used to analyze the economic effects of investing in public infrastructure and either affirmed or challenged the findings of the initial work. Although not all subsequent studies found a growth-enhancing effect of public capital, a general consensus has developed over time that there are positive returns on investment in public infrastructure, but that the impact is less than was first reported. Some of this research suggests that investments in energy infrastructure have the greatest impact on long-term wages and investment, followed by mass transit, and water and sewer.¹⁵

Another aspect of the issue is the interconnected nature of multiple infrastructure systems and the argument that being competitive in a global economy requires investment in what some refer to as "supply chain infrastructure," that is, ports and associated road, rail, and air connections that facilitate manufacturing, transport, and export. According to this view, inefficient connections and capacity limitations lead to delays that raise the price of a company's product and make it harder to compete globally, especially if global competitors out-perform the United States in this regard.¹⁶

¹⁴ David Alan Aschauer, "Is Public Expenditure Productive?," *Journal of Monetary Economics*, vol. 23, no. 2 (March 1989), pp. 177-200. This research was reviewed and expanded in Alicia H. Munnell, "Infrastructure Investment and Economic Growth," *Journal of Economic Perspectives*, vol. 6, no. 4 (Fall 1992), pp. 189-198.

¹⁵ For review of the economic literature on this issue, see U.S. Congressional Budget Office, *Trends in Public Spending on Transportation and Water Infrastructure, 1956 to 2004*, August 2007, pp. 6-9; Richard A. Krop, Charles Hernick, and Christopher Frantz, *Local Government Investment in Municipal Water and Sewer Infrastructure: Adding Value to the National Economy*, U.S. Conference of Mayors, Washington, DC, August 14, 2008, <http://www.usmayors.org/pressreleases/uploads/LocalGovtInvInMunicipalWaterandSewerInfrastructure.pdf>; and Becky Thiess and Andrew Fieldhouse, *Investing in America's Economy, A Budget Blueprint for Economic Recovery and Fiscal Responsibility*, November 2010, pp. 66-68, http://www.ourfiscalsecurity.org/storage/Blueprint_OFS.pdf.

¹⁶ Nicole Y. Lamb-Hale, Assistant Secretary for Manufacturing and Services, International Trade Administration, U.S. Department of Commerce, "Doubling U.S. Exports: Are U.S. Sea Ports Ready for the Challenge?" Testimony Before the Senate Committee on Finance, Subcommittee on International Trade, customs and Global Competitiveness, April 29, 2010.

One conclusion of more recent research is that both the average return and range of return to the economy vary, based on the type of infrastructure and the amount of infrastructure already in place. In other words, the larger the existing stock and the better its efficient use and current quality, the lower will be the impact of new infrastructure. Also, the effect of new public investment will crucially depend on the extent to which spending aims to alleviate bottlenecks in the existing network of infrastructure systems and facilities.¹⁷

The Contribution of Infrastructure to Economic Recovery

Since mid-2008, Congress and the Administration have attempted to address the nation's significant economic difficulties through a variety of policy approaches. Policymakers have debated a range of options for doing so and, as noted previously, have used a combination of tools to stimulate the economy.¹⁸ Under discussion now is the need for additional actions.

Throughout these debates, some have argued that economic stabilization can best be achieved through monetary policy (i.e., the Federal Reserve's ability to adjust interest rates), coupled with automatic fiscal stabilizers.¹⁹ CBO and others contend that the conventional policy tools available to the Federal Reserve for additional monetary stimulus currently are limited, since the Fed announced that it will continue to hold short-term interest rates near zero at least through mid-2013.²⁰ The Fed could again use unconventional monetary policy tools, such as purchasing Treasury securities, as it has done since 2008.

Others have argued for governmental policy to provide fiscal stimulus, which can involve tax cuts, government spending increases, or both. During debates that preceded enactment of ARRA in February 2009, a wide range of experts—including economists who generally differ in their economic policy views, such as Martin Feldstein²¹ and Paul Krugman²²—contended that, in times when neither consumers nor businesses are spending, a massive infusion of government spending is needed quickly to energize economic activity. Infrastructure investment, they argued, can be an important source of stimulating labor demand when the labor market is underutilized, and enhancing U.S. productivity through long-neglected investments in roads, bridges, water systems, ports, etc.²³ Again today, some advocate using direct fiscal stimulus through a combination of

¹⁷ Ward Romp and Jakob de Haan, "Public Capital and Economic Growth: A Critical Survey," *European Investment Bank Papers*, vol. 10, no. 1 (2005), pp. 40-70.

¹⁸ For additional information, see CRS Report R41578, *Unemployment: Issues in the 112th Congress*, by Jane G. Gravelle, Thomas L. Hungerford, and Linda Levine.

¹⁹ Automatic stabilizers are built-in changes in government spending and taxation, such as income taxes and unemployment compensation that increase and decrease automatically to dampen economic cycle fluctuations. For example, in recessionary times, payment of unemployment benefits injects more money into the system and stimulates demand.

²⁰ Binyamin Applebaum, "Its Forecast Dim, Fed Vows to Keep Rates Near Zero," *The New York Times*, August 9, 2011, <http://www.nytimes.com/2011/08/10/business/economy/fed-to-hold-rates-exceptionally-low-through-mid-2013.html?pagewanted=all>.

²¹ Martin Feldstein, "The Stimulus Plan We Need Now: The President-Elect Won't Have to Wait Till January to Act," *The Washington Post*, October 30, 2008, p. A23.

²² Paul Krugman, "Let's Get Fiscal," *The New York Times*, October 16, 2008.

²³ Jared Bernstein, Senior Economist, Economic Policy Institute, Testimony before the U.S. House Committee on Ways and Means, Hearing on Economic Recovery, Job Creation and Investment in America, October 29, 2008, <http://waysandmeans.house.gov/hearings.asp?formmode=view&id=7463>.

measures such as infrastructure investments, state fiscal relief, employer tax benefits, and expanded unemployment insurance to provide a needed boost for the economy.

The economic value of infrastructure investments follows from the cumulative, or multiplier effect, which is described by CBO.

Infrastructure spending directly increases employment because workers are hired to undertake construction projects. It also adds to demand for goods and services through purchases of material and equipment and through additional spending by the extra workers who are hired ... that increase in demand leads to further hiring.²⁴

According to this view, spending on projects to address unmet infrastructure needs presents an opportunity to contribute significantly to economic recovery. During recessionary periods and the beginning of recovery, the state of the U.S. economy is such that there is excess capacity of both labor and materials for infrastructure projects. Large number of workers are unemployed, especially in the construction sector, which reported a 13.5% unemployment rate in August 2011.²⁵ It is widely believed that a large number of those workers (many of whom had been employed in residential construction) could be employed on infrastructure construction projects. This same argument was raised during debate that preceded enactment of ARRA, when similarly high unemployment prevailed among construction workers.

Proponents argue that the cumulative, or multiplier, effect of infrastructure spending on the economy, discussed previously, makes it especially beneficial to economic recovery. CBO recently estimated the multiplier effect of major provisions of ARRA and concluded that each dollar transferred to state and local governments for infrastructure raised GDP above what it would have been otherwise by a total of \$1 to \$2.50 over several quarters. In CBO's analysis, the output multiplier of infrastructure spending was the same as ARRA provisions for purchases of goods and services by the federal government, and both were greater than impacts of other ARRA provisions such as tax cuts for individuals.²⁶ However, some critics of using public spending to create jobs argue that the costs far exceed the benefits.²⁷

Issues

Public infrastructure's potential role in contributing to job creation at a time when the economy continues to sputter raises several questions, including does infrastructure spending really create jobs, does it invest in assets with long-term value, and how are needs and priorities determined? These issues, along with the potential contribution of investments in "green" infrastructure, are explored in the remainder of this report.²⁸

²⁴ U.S. Congressional Budget Office, *Policies for Increasing Economic Growth and Employment in 2010 and 2011*, January 2010, p. 23.

²⁵ U.S. Department of Labor, Bureau of Labor Statistics, "Employed and unemployed persons by occupation, not seasonally adjusted," September 2, 2011.

²⁶ U.S. Congressional Budget Office, *Estimated Impact of the American Recovery and Reinvestment Act on Employment and Economic Output from April 2011 Through June 2011*, August 2011, pp. 5-6.

²⁷ Daniel Mitchell, "The Impact of Government Spending on Economic Growth," March 15, 2005, <http://www.heritage.org/research/reports/2005/03/the-impact-of-government-spending-on-economic-growth>.

²⁸ The focus of this report is on one set of issues presented by policy proposals for job creation and economic recovery. Such proposals raise many other issues, including how to pay for new or expanded programs, that are beyond the scope (continued...)

Job Creation Estimates

One of the ways in which Congress has tried to spur job growth and stem job losses to mitigate the impact of recessions is by directly raising demand for (i.e., increasing spending on) goods and services. That is to say, Congress has increased federal spending to counteract the labor market effects of decreased consumer purchases. Most often in the postwar period, Congress has engaged in direct job creation by increasing federal expenditures on public works.²⁹

When Congress has considered raising spending on infrastructure or other federally funded activities to help stimulate a flagging economy, a commonly asked question is “how many jobs will be created?” 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 used due to its cost-effectiveness.³⁰ 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 concrete produced by the nonmetallic minerals product manufacturing industry and of steel produced by the primary metals manufacturing industry that the construction industry uses to produce its various final outputs (e.g., buildings, roads, and dams).

The output requirements from each intermediate and final goods industry are then converted to employment requirements. Employment requirements are derived from productivity estimates for each industry at a particular point in time. The employment requirement associated with a given type of final demand is the employment in the industry producing the final product or service plus the employment in 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.³¹

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 an industry as defined in the North American Industry Classification System (NAICS).³² For example, one billion dollars spent in the construction industry supports direct employment in the industry’s various components (e.g., bridge construction) and indirect employment in the many industries that supply goods and services to the construction industry (e.g., fabricated metal bridge section manufacturing).

(...continued)
of this report.

²⁹ For more information, see CRS Report 92-939, *Countercyclical Job Creation Programs*, by Linda Levine.

³⁰ Data from specially conducted surveys are another basis for estimating the impact of policy and other changes on the economy. A key advantage of the I-O approach is the accessibility of data sources required to develop the I-O model.

³¹ Two caveats pertaining to job estimates based on I-O models concern changes in productivity and prices over time. I-O models freeze technology, productivity and prices at a particular point in time, so the job-generating potential of an economic activity undertaken today could differ from that of an earlier period if there were technological, productivity or price changes in the intervening years.

³² Statistical agencies use the NAICS to categorize firms for the purpose of data collection. The NAICS does not have unique classifications for so-called “green economic activities” such as renewable energy production or retrofitting buildings to conserve energy.

Actual job creation may differ from estimated job creation, however, because I-O models assume that resources are unlimited. If, for example, the economy were performing at a fairly high level (i.e., plants operating near full capacity and few workers unemployed), the actual number of new jobs might fall short of the estimate due to capital and labor constraints. In addition, I-O tables may not 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. Employment requirements tables also do not distinguish between jobs by number of hours worked (part- or full-time) or length of employment (short- or long-term).

Induced jobs, that is, the number of jobs resulting from purchases of goods and services by those in first-round (direct and indirect) jobs, may be included in job creation estimates as well. For example, workers who are directly or indirectly employed as the result of a highway construction program might spend some of their wages in grocery stores, at auto repair shops, etc. Estimates of induced jobs (i.e., the multiplier) are considered tenuous in part because their calculation relies on estimates of how much of the additional money earned by first-round workers will be spent versus saved. The jobs multiplier will further depend on economic conditions (e.g., the availability of labor, the inflation rate).

Job creation estimates vary from one source to another depending on such factors as industry definition and time period. The Federal Highway Administration (FHWA) provides the most widely cited estimate of jobs supported by federal highway investments. The latest iteration of the FHWA model indicates that a \$1 billion expenditure on highway construction in 2007 supported a total of 30,000 jobs:³³

- 10,300 construction-oriented jobs (i.e., jobs at construction firms working on the projects and at firms providing direct inputs to the projects, such as guard rails);
- 4,675 jobs in supporting industries (i.e., jobs at companies providing inputs to the firms directly supplying materials and equipment used in highway construction, such as sheet metal producers who supply guard rail manufacturers); and
- 15,094 induced jobs (i.e., jobs dependent on consumer expenditures from the wages of workers in “construction-oriented” and “industry-supporting” jobs).

The FHWA noted two caveats about I-O analysis in addition to those mentioned above. First, the job estimate “utilizes the national average mix of construction materials and labor inputs. Specific projects and local utilization ratios will alter the actual employment supported.” For example, a different combination of materials and number of workers might be required for road resurfacing compared to bridge construction projects. Second, the 30,000 jobs estimate “includes ‘new jobs’ to the extent unemployed labor is hired; ... and ‘sustained jobs’ as current employees are retained with the expenditure.”³⁴

Another source of job creation estimates is the employment requirements table of the U.S. Bureau of Labor Statistics (BLS).³⁵ Its most recent employment requirements table is based on the 2002

³³ The estimated number of jobs per \$1 billion dollars of federal-aid highway expenditures has decreased over time partly because of increases in the price of inputs (e.g., asphalt and diesel fuel). U.S. Department of Transportation, Federal Highway Administration, *Employment Impacts of Highway Infrastructure Investment*, <http://www.fhwa.dot.gov/policy/otps/pubs/impacts/index.htm>.

³⁴ Ibid.

³⁵ BLS makes available free-of-charge to the public, the employment requirements tables developed every two years as (continued...)

national I-O table developed by the U.S. Bureau of Economic Analysis (BEA), which BLS updated to reflect 2008 production and distribution technologies. The updated I-O table and 2008 labor productivity data were then used to develop an employment requirements table for 2008. The BLS employment requirements table indicates that 11,265 jobs were directly or indirectly dependent upon \$1 billion of spending on construction activities in 2008.³⁶ A majority of the jobs were in the construction industry itself (7,174 direct jobs). The 2008 figure from the BLS employment requirements table for construction expenditures (11,265) is lower than the 2007 direct and indirect jobs figure for highway expenditures from the FHWA (14,975).

Another example of an infrastructure job creation estimate is provided by the BEA's Regional Input-Output Modeling System (RIMS II).³⁷ Currently, the BEA uses either the 2002 benchmark I-O for the nation or the 2008 annual I-O for the nation adjusted by 2008 data from its regional economic accounts to provide subnational estimates.³⁸ As shown in **Table 1**, the number of jobs directly and indirectly supported by an expenditure of \$1 billion in the construction industry in a given state in 2008 ranged widely. The main reason for the disparity in estimates is that each state has a different mix of industries within its borders. As a result, 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 1. Number of Direct and Indirect Jobs by State Dependent on an Expenditure of \$1 Billion in the Construction Industry, 2008

State	Number of Jobs	State	Number of Jobs
Alabama	14,674	Montana	14,328
Alaska	9,169	Nebraska	11,929
Arizona	11,718	Nevada	9,727
Arkansas	13,662	New Hampshire	10,914
California	10,185	New Jersey	9,263
Colorado	11,643	New Mexico	12,908
Connecticut	8,929	New York	8,804
Delaware	9,102	North Carolina	14,181
District of Columbia	1,562	North Dakota	10,880
Florida	12,889	Ohio	12,971
Georgia	13,857	Oklahoma	14,704
Hawaii	9,762	Oregon	12,200

(...continued)

part of its employment projections program (http://stats.bls.gov/emp/ep_data_emp_requirements.htm).

³⁶ The table provides an estimate for the construction industry as a whole. As defined by the NAICS, the industry is composed of three major subdivisions: construction of residential and nonresidential buildings, heavy and civil engineering construction (e.g., roads, utility systems, levees, and hydroelectric power facilities), and specialty trade contractors (e.g., building foundation, equipment, and finishing contractors).

³⁷ Usually for a fee, the BEA produces estimates by geographic area of the employment, earnings, and output dependent on additional spending in hundreds of different industries.

³⁸ BEA cautions that state estimates should not be added or averaged to create a U.S. estimate.

State	Number of Jobs	State	Number of Jobs
Idaho	13,956	Pennsylvania	11,663
Illinois	10,257	Rhode Island	10,036
Indiana	12,477	South Carolina	14,550
Iowa	12,373	South Dakota	13,110
Kansas	11,589	Tennessee	13,340
Kentucky	13,605	Texas	12,692
Louisiana	12,229	Utah	14,018
Maine	14,427	Vermont	13,579
Maryland	9,526	Virginia	11,385
Massachusetts	9,057	Washington	11,015
Michigan	12,416	West Virginia	12,061
Minnesota	11,549	Wisconsin	12,108
Mississippi	13,904	Wyoming	10,773
Missouri	11,780		

Source: Prepared by CRS from RIMS II estimates supplied by the BEA Regional Product Division, September 2011.

Short-Term Economic Stimulus vs. Long-Term Investment

Funding infrastructure is a long-term investment, not quick-fix spending, that should lead to something durable, useful, and financially productive. The long-term nature of such investments can be at odds with the goal of quickly injecting money into the economy. Thus, the overriding question in debating infrastructure spending as part of a job creation package is, what will the increased spending buy? Two important considerations regarding any such proposal are, will the proposal produce short-term or long-term benefit, and will it produce a significant amount of incentive for the economy, relative to its budgetary cost.

Some analysts are cautious about the effectiveness of infrastructure spending in this regard because of one key issue: timing. This concern was described in testimony by the Director of the Congressional Budget Office in 2008.

The timing of fiscal stimulus is critical. If the policies do not generate additional spending when the economy is in a phase of very slow growth or a recession, they will provide little help to the economy when it is needed.... Poorly timed policies may do harm by aggravating inflationary pressures and needlessly increasing federal debt if they stimulate the economy after it has already started to recover.

For federal purchases [of goods and services, such as infrastructure spending], the primary issue in targeting the spending is that of timing ... because many infrastructure projects may

take years to complete, spending on those projects cannot easily be timed to provide stimulus during recessions, which are typically relatively short lived.³⁹

By definition, the goal of stimulus spending is to get money into the economy swiftly. But that objective conflicts with the reality of building infrastructure projects that typically are multiyear efforts with slow initial spendout. Public works projects are likely to involve expenditures that take a long time to get underway and also are spread out over a long time. Large-scale construction projects generally require years of planning and preparation, including cost analysis, land acquisition, engineering, environmental review, and securing financing. For major infrastructure, such as highway construction and water resource projects, the initial rate of spending can be 25% or less of the funding provided in a given year.⁴⁰ Based on CBO information, the National Governors Association reported spendout rates for several infrastructure categories:

- About 68% of highway and 45% of transit obligations spend out over the first two years of a project.
- About 19% of airport obligations spend out in the first year and another 42% in year two.
- About 24% of drinking water and wastewater obligations are expended over two years, and 54% over three years.⁴¹

Economist Mark Zandi, who has been an advocate of infrastructure spending to stimulate economic recovery, acknowledged that it does take a substantial amount of time for funds to flow to builders, contractors, and the broader economy. “Even if the funds are only used to finance projects that are well along in their planning, it is very difficult to know just when the projects will get underway and the money spent.”⁴²

However, advocates of infrastructure spending have two responses to this concern. First, to the extent that recovery from a lengthy recession is slow—as it is now—projects with extended timeframes can still contribute to recovery. Thus, the general concern about timing is less relevant, they say. Second, because every major infrastructure category has significant backlogs of projects that could proceed except for funding, advocates are confident that large amounts of actual construction work can be undertaken with increased financial assistance.

In 2009, policymakers concerned about these timing issues included requirements in ARRA that stimulus funds be awarded to “shovel ready” or “ready to go” infrastructure projects that could proceed to construction and contribute to economic output quickly. ARRA’s effectiveness in meeting that challenge is not fully known, but may be less than was hoped for, at least according to CBO: “As a practical matter, the experience with ARRA suggests that fewer projects are ‘shovel ready’ than one might expect: By the end of fiscal year 2009, outlays for infrastructure

³⁹ Peter R. Orzag, Director, Congressional Budget Office, Testimony before the U.S. Senate Committee on Finance, Hearing on Options for Responding to Short-Term Economic Weakness, January 22, 2008, pp. 5, 8.

⁴⁰ Ibid., pp. 19, 22.

⁴¹ National Governors Association, *Economic Recovery: A Federal-State Partnership*, November 13, 2008, pp. 11-12.

⁴² Mark Zandi, Chief Economist, Moody’s Economy.com, Testimony before the House Committee on Small Business, Hearing on “Economic Stimulus for Small Business: A Look Back and Assessing Need for Additional Relief,” July 24, 2008, p. 7.

spending from ARRA made up less than 10 percent of the budget authority granted for infrastructure in that year.”⁴³

A related concern raised by some is whether spending that is undertaken in efforts to stimulate economic recovery will represent investment in long-term assets for society. Critics contend that emphasizing “ready to go” projects is likely to result in spending on many with marginal value, such as projects with plans that have been backlogged for some time because they lack sufficient merits. Critics contend that most projects are small and do not solve long-term problems or have strategic value. Infrastructure projects should be justified on the merits, not as job-creating instruments. One such critic of additional infrastructure spending noted, “If additional infrastructure is worthwhile, it should be constructed. Such determinations are most likely to be accurate, however, when they are made without the haste associated with an attempt to respond to economic weakness.”⁴⁴

Undoubtedly, some types of public jobs programs support jobs that have little long-term impact, such as hiring workers to sweep streets or rake leaves, sometimes called “make work.” Projects that involve substantial new construction are slower to complete and to impact jobs, but often have a political appeal because of high visibility to the public. Some infrastructure, such as highway resurfacing and minor road repairs or replacement of pumps and compressors at water facilities, does benefit the value of the nation’s capital assets and can be done more quickly than new construction. Likewise, acquiring new clean fuel buses or rehabilitating transit stations can occur more rapidly than extending collector sewer lines into unsewered communities. Many public officials believe that it is possible to balance both short-term and long-term goals through infrastructure projects.

Some economists contend that public infrastructure investments benefit economic growth only if the impact of the infrastructure outweighs the adverse effects of higher taxes that are needed to finance the investment, or if it outweighs the adverse effects of spending cuts in other areas, such as properly maintaining existing public works systems. Higher deficits that result from stimulus spending slow economic growth in the long run, it is sometimes said, because government borrowing crowds out private investment.⁴⁵ Critics of this view say that this concern is valid in times when the economy is working at full capacity, because under those circumstances, government spending just changes the mix of jobs with no change in the overall quantity or quality of labor. According to this alternative view, government spending in a severe and lingering economic slowdown affects resources and labor that are idle, and it does not fully displace private investment.

Other economists say that if federal assistance merely provides fiscal relief by paying for spending that would have occurred anyway—that is, if federal dollars merely substitute for or

⁴³ U.S. Congressional Budget Office, *Policies for Increasing Economic Growth and Employment in 2010 and 2011*, January 2010, p. 23.

⁴⁴ Alan Viard, Resident Scholar, American Enterprise Institute, Testimony before the U.S. House Committee on Ways and Means, Hearing on Economic Recovery, Job Creation and Investment in America, October 29, 2008, <http://waysandmeans.house.gov/hearings.asp?formmode=view&id=7468>.

⁴⁵ According to this argument, by issuing large amounts of debt to finance spending, government drives up interest rates. In turn, businesses are unwilling to spend on new plants and equipment. Thus, government’s actions crowd out private investment and reduce the economy’s long-run growth rate. See, for example, Ronald D. Utt, *More Transportation Spending: False Promises of Prosperity and Job Creation*, The Heritage Foundation, Backgrounder No. 2121, April 2, 2008, http://www.heritage.org/Research/budget/upload/bg_2121.pdf.

replace local dollars invested in the same activity—it provides no economic boost. In response, state and local public officials say that that is not the case in today’s economy. Because of the pressures that they continue to face, states and cities have been cancelling and delaying infrastructure projects. Another way of describing this situation could be to say that what is under discussion is in reality about holding state and local governments harmless in order to encourage them to carry out projects that they could not otherwise do, because of budget shortfalls.

Setting Priorities and Determining Funding Needs

Traditionally, setting priorities for infrastructure spending is based on a combination of factors. Estimates of funding needs are one factor that is commonly used as a measure of the dimension of a problem and to support spending on some activities relative to others, as in: funding needs for X are much greater than for Y, therefore, society should spend more heavily on X.

One widely cited estimate of the nation’s infrastructure needs is presented in the finding of the American Society of Civil Engineers (ASCE) that the condition of the nation’s infrastructure merits a letter grade of “D.” According to ASCE, five-year funding needs total \$2.2 trillion, while the “gap” between estimated investment needs and estimated spending is \$1.8 trillion. ASCE reported the condition of a dozen categories of infrastructure, including roads (“Poor road conditions cost U.S. motorists \$67 billion a year in repairs and operating costs—\$333 per motorist”), dams (“The gap between dams needing repair and those actually repaired is growing significantly”), wastewater (“Aging, underdesigned, or inadequately maintained systems discharge billions of gallons of untreated wastewater into U.S. surface waters each year”), and schools (“No comprehensive, authoritative nationwide data on the condition of America’s school buildings has been collected in a decade. The National Education Association’s best estimate to bring the nation’s schools into good repair is \$322 billion.”).⁴⁶ However, assessing “need” is complicated by differences in purpose, criteria, and timing, among other issues.

In the infrastructure context, funding needs estimates try to identify the level of investment that is required to meet a defined level of quality or service. Essentially, this depiction of need is an engineering concept. It differs from economists’ conception that the appropriate level of new infrastructure investment, or the optimal stock of public capital (infrastructure) for society, is determined by calculating the amount of infrastructure for which social marginal benefits just equal marginal costs.

The last comprehensive national infrastructure needs assessment was conducted by the National Council on Public Works Improvement that was created by the Public Works Improvement Act of 1984 (P.L. 98-501). The Council reported in 1988 that government outlays for public works capital totaled about \$45 billion in 1985 and that a commitment to improve the nation’s infrastructure “could require an increase of up to 100 percent in the amount of capital the nation invests each year.”⁴⁷ This estimate of future needs by the Council may have been imprecise because of the inherent difficulties of needs assessments, something its report discusses in

⁴⁶ American Society of Civil Engineers, *Report Card for America’s Infrastructure, 2009*, <http://www.asce.org/reportcard/>.

⁴⁷ National Council on Public Works Improvement, *Fragile Foundations, A Report on America’s Public Works: Final Report to the President and the Congress*, Washington, 1988, p. 2.

detail.⁴⁸ It is worth highlighting a few of these key difficulties as a cautionary note when attempting to interpret infrastructure needs assessments.

One of the major difficulties in any needs assessment is defining what constitutes a “need,” a relative concept that is likely to generate a good deal of disagreement. For this reason, some needs assessments are anchored to a benchmark, such as current provision in terms of physical condition and/or performance. This current level of provision may be judged to be too high by some and too low by others, but nonetheless it provides a basis for comparison as future spending needs can be estimated in terms of maintaining or improving the current condition and performance of the infrastructure system. Needs estimates in highway and public transit are calculated in this way by the U.S. Department of Transportation (DOT). The Environmental Protection Agency (EPA) similarly estimates total U.S. funding needs for wastewater treatment facilities. EPA defines a “need” as the unfunded capital costs of projects that address a water quality or water quality-related public health problem existing as of January 1, 2008, or expected to occur within the next 20 years.⁴⁹

In some cases, estimates are intended to identify needs for categories of projects that are eligible for assistance under various federal programs. By being defined in that manner, assessments based solely on funding eligibility may not take into consideration needs for non-eligible categories, such as replacement of aging infrastructure or projects to enhance security.

Some federal agencies estimate the funding necessary to bring the current infrastructure system to a state of good repair. The resulting funding estimate is sometimes referred to as the infrastructure “backlog.” Again, among other problems, such as inventorying the current condition of infrastructure and calculating repair costs, the needs estimate is affected by judgments about what constitutes a state of good repair. It is worth noting, too, that needs assessment are often conducted by organizations with a vested interest in the outcome. This is most obviously a concern when a needs assessment is conducted by an advocacy group, but may also occur with government agencies.

A second major difficulty with needs assessments is estimating future conditions, especially consumer demand for services that infrastructure provides. To begin with, estimating demand is difficult because it is based on a host of assumptions such as the rate of population and economic growth. Typically, the longer the time period over which conditions are forecast, the harder it is to accurately predict them. Particularly hard to predict, and, thus, the effect they have on infrastructure needs, are structural changes in the economy and technological change. In addition, however, consumer demand can vary enormously depending on how a service is financed and priced, as well as other public policy decisions including regulation and conservation. For example, highway infrastructure is primarily financed by fuels and other taxes that provide a vague signal or no signal at all about the total cost of driving, particularly the external costs such as the fuel and time wasted in congested conditions. Highway tolls, on the other hand, particularly those that fluctuate in line with congestion, provide a direct price signal for a trip on a certain facility at a certain time of the day. Pricing highway infrastructure in this way has been found to reduce travel demand, thereby affecting infrastructure need.⁵⁰ Consumer demand can sometimes

⁴⁸ Ibid., chapter 2.

⁴⁹ U.S. Environmental Protection Agency, Office of Water, Office of Wastewater Management, *Clean Watersheds Needs Survey 2008, Report to Congress*, May 2010.

⁵⁰ See U.S. Department of Transportation, Federal Highway Administration and Federal Transit Administration, *2006 Status of the Nation’s Highways, Bridges, and Transit: Conditions and Performance*, Washington, DC, 2007, chapter (continued...)

be met without infrastructure spending. For example, water supply needs can be reduced by employing water conservation methods.

Finally, it is worth mentioning that the need for public funding to supply infrastructure, including federal support, may often be an open question because the roles of the public and private sector can and do shift over time. Even within the public sector, the roles of federal, state, and local governments change and these shifting intergovernmental relationships may even affect the assessments of infrastructure needs.

A third major difficulty with infrastructure needs assessments is that needs estimates for individual elements of public infrastructure are rarely comparable. Some assessments include only capital spending, others include both capital and operation and maintenance (O&M) spending. Some estimates of need are developed for the purposes of short-term, fiscally constrained spending plans, while others are developed to assess long-term needs based on current system condition and performance, future demand, and the effects of pursuing different policy options. Some needs assessments are for public sector spending by all levels of government, while others focus only on federal spending. Furthermore, needs estimates are rarely directly comparable because of differing underlying assumptions, such as those about economic and population growth, based on when the assessment is being done and for what purpose. Even comparing assessments for the same category over time can be difficult, if criteria of what gets counted change.

Needs surveys are likely to be conducted at different times, and thus will be expressed in different years' dollars. Comparing dollar estimates of infrastructure needs from different assessments is difficult. Many estimates are prepared in nominal dollars for the reference year, while others, particularly multi-year estimates, are sometimes prepared in constant dollars for a base year. Because there are different ways to inflate and deflate nominal dollar estimates, it should not be assumed that dollar estimates for the same year are necessarily comparable.

Because of major differences in coverage and methodology, individual needs assessments cannot be added together to provide a single estimate of future public infrastructure needs, despite the political desire to do so. Moreover, as needs assessments are typically prepared separately, there may be instances where a need for a type of infrastructure is included in more than one estimate, resulting in double counting, and other instances of omission, resulting in undercounting. As separately estimated, these assessments also ignore competitive and complementary situations in which spending levels in one area may affect needs in another. For example, in the case of transportation infrastructure, an improved freight rail line might reduce the need to improve the highway system to accommodate truck traffic.

A further complication arises in the context of evaluating job creation plans—whether infrastructure funds are targeted to true need, and whether “need” is defined by engineering assessments and established distribution methods, or by economic measures such as unemployment or the effectiveness of programs to pull in or leverage private capital.

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10, <http://www.fhwa.dot.gov/policy/2006cpr/index.htm>.

Is There a Role for “Green Infrastructure” in Creating Jobs and Aiding Economic Recovery?

A relatively recent addition to debate over the issues discussed in this report is the concept of growing the economy and creating jobs with investments that will promote clean energy and environmental protection. In the current context of economic recovery, consideration of “green” projects is less prominent than it was preceding enactment of ARRA in 2009,⁵¹ but the concept continues to have advocates who contend that investments in technologies with improved energy efficiency, energy security, or environmental protection will benefit the economy. Several interest groups have advocated these types of proposals. Among these, the Center for American Progress (CAP), a public policy and research think tank, recommended green investment projects totaling \$100 billion as part of “A Strategy for Green Recovery” and also has advocated on behalf of the economic benefits of investing in clean energy.⁵² Also, a February 2011 report by the BlueGreen Alliance and the Economic Policy Institute argues that investments in the green economy can address near-term economic challenges of creating jobs and the long-run challenge of helping global economies transition to less carbon-intensive forms of economic activity.⁵³

Several questions arise concerning such proposals. First, what, exactly, is “green infrastructure?” The term is less precisely defined than is traditional infrastructure (see page 4), which some “green” advocates now refer to as “gray infrastructure.” In the context of benefitting economic activity, green infrastructure has been broadly defined to include support for constructing the manufacturing infrastructure to develop and commercialize various technologies that are more energy efficient (e.g., advanced vehicle batteries) or more environmentally friendly (e.g., investments in renewable energy sources and the electricity grid to transmit and distribute clean energy). Renewable energy technologies generate electricity from resources such as the sun or wind, or produce transportation fuels from biomass, with essentially no net greenhouse gas emissions. Most of the future growth in green jobs is generally envisioned as coming from the growth in deployment of renewable energy technologies. Attention also has been given to mass transit projects that can decrease energy consumption and reduce global warming pollution. Similarly, many advocates favor such other technologies or techniques to retrofit schools and public buildings for greater energy efficiency.⁵⁴

⁵¹ ARRA provided more than \$21 billion in tax incentives for energy efficiency and renewable energy projects. Also, some programs that received ARRA funds were required to reserve a portion for “green” projects. For information, see CRS Report R40412, *Energy Provisions in the American Recovery and Reinvestment Act of 2009 (P.L. 111-5)*.

⁵² Will Straw and Michael Ettlinger, *How to Spend \$350 Billion in a First Year of Stimulus and Recovery*, Center for American Progress, December 5, 2008, pp. 12-14, http://www.americanprogress.org/issues/2008/12/pdf/second_stimulus.pdf; and Richard W. Caperton and Adam Hersh, *Putting America Back to Work with Clean Energy*, March 17, 2011, http://www.americanprogress.org/issues/2011/03/pdf/green_jobs.pdf.

⁵³ Jason Walsh, Josh Bivens and Ethan Pollack, BlueGreen Alliance and Economic Policy Institute, *Rebuilding Green, The American Recovery and Reinvestment Act and the Green Economy*, February 2011, <http://www.bluegreenalliance.org/admin/publications/files/BGA-EPI-Report-vFINAL-MEDIA.pdf>. The BlueGreen Alliance is a coalition of labor and environmental advocacy groups, and the Economic Policy Institute conducts research on economic conditions and policies affecting middle- and low-income workers.

⁵⁴ In the context of environmental protection, there is another aspect of “green infrastructure.” In that context, it has been defined as “strategically planned and managed networks of natural lands, working landscapes and other open spaces that conserve ecosystem values and functions and provide associated benefits to human populations,” including natural elements such as wetlands and grasslands.” (<http://www.greeninfrastructure.net/content/definition-green-infrastructure>) For example, it describes the management of stormwater runoff through the use of natural systems, or engineered systems that mimic natural systems, to treat polluted runoff before it reaches streams or lakes.

A second question is, can investment in “green” projects create jobs that benefit the economy’s recovery? One aspect of this is, are there “ready to go” “green” projects that could create jobs quickly? As previously discussed, the key to stimulus spending is to get funds moving quickly into the economy. However, many of the proposals 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 recession. Studies like CAP’s 2008 report recommend categories of projects to create green jobs, such as full funding of federal energy-efficiency programs, which “can start stimulating the economy relatively rapidly” and others, such as new authorization for grants to states to support manufacturing plant retooling to produce clean and energy-efficient technologies, that are “less fast-acting.” Eighty percent of CAP’s recommended funding would have been for “less fast-acting” programs.⁵⁵ Critics say that many types of “green” projects are pricey, are subsidized through tax expenditures, and would do little to benefit the economy rapidly, but proponents contend that “green” investments represent a downpayment on long-term economic growth and should be done even over a somewhat longer time period.

One environmental advocacy group, the Alliance for Water Efficiency, estimated that investments in water efficiency programs could increase GDP by \$1.3-1.5 million per million dollars of direct investment. The types of projects include installing green roofs, raingardens, and permeable pavement that can reduce the need for new wastewater treatment plants and stormwater and sewer pipes; restoring wetlands and natural floodplains; and residential and commercial water efficiency projects.⁵⁶

A final question is, what is the job creation potential of “green infrastructure” investments? Estimating the number of jobs dependent upon green infrastructure activities presents a greater challenge than estimates related to infrastructure projects as traditionally defined. As mentioned previously, 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, or those that manufacture goods which minimize energy use). Within NAICS, the electric utility industry is disaggregated 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 input-output (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 building construction industry does not have a unique category for “green” 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 analyses of green job creation. The 2008 CAP study, mentioned above, does address

⁵⁵ Will Straw and Michael Ettlinger, *How to Spend \$350 Billion in a First Year of Stimulus and Recovery*, Center for American Progress, December 5, 2008, pp. 12-14, http://www.americanprogress.org/issues/2008/12/pdf/second_stimulus.pdf.

⁵⁶ Alliance for Water Efficiency, *Transforming Water: Water Efficiency as Stimulus and Long-Term Investment*, December 4, 2008, <http://www.allianceforwaterefficiency.org/WorkArea/linkit.aspx?LinkIdIdentifier=id&ItemID=2638..>

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.”⁵⁷

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, with the resulting analyses producing wide-ranging estimates of the number of green jobs. For example, some attempt to estimate the number of direct and indirect jobs 10 or more years in the future that are 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 generalizable to other areas, because state economies have different mixes of industries and may not be able to provide any or all of the inputs for a particular green output. The analyses also may express job estimates per unit of power generated by renewable resources and saved by increased demand for energy-efficient products and equipment, rather than per dollar of investment in green activities. And, 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 may not find helpful many green economy studies.

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⁵⁷ 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, DC, September 2008, p. 20, <http://www.americanprogress.org>.