U.S. Department of Energy’s Recovery Act Spending

by

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Overview

The American Recovery and Reinvestment Act of 2009 (Pub.L. 111-5, Recovery Act, ARRA) is the economic stimulus package passed by Congress on February 13, 2009 and signed by President Obama four days later. As of February 2011, the package was expected to total $821 billion in costs through 2019 delivered through a combination of federal tax cuts, temporary expansion of economic assistance provisions including unemployment benefits, and domestic spending to advance economic recovery and create new jobs, as well as save existing ones (Rusco, 2011). More than $90 billion from the Recovery Act targets government investment and tax incentives to create the foundation for a clean energy economy (CEA, 2010). This funding provides an unprecedented investment in clean energy in the United States and many of these projects are expected to create new jobs and contribute to economic growth in the future (U.S. Congress, 2009).

Recovery Act money for climate and energy programs is distributed among a handful of federal agencies with jurisdiction over key areas, such as the U.S. Department of Transportation, but most of the energy-related spending is through the U.S. Department of Energy (DOE) (CEA, 2010). The DOE received $41.7 billion in ARRA funds, with approximately $35.2 billion for direct grants and the remaining $6.5 billion in loan authority (Subcommittee on Oversight and Investigations Staff, March 15, 2011).

The Pew Center on Global Climate Change released its first white paper on ARRA in December of 2009. As the majority of clean energy investments are made through grants and contracts that require reviewed proposals, much of the money could not be spent quickly (CEA, 2010). This version of the white paper summarizes the DOE ARRA spending and the Recovery Act’s effects on employment by updating and adding to the original paper. Financial data for project awards are updated with current figures. A new section, Recovery Act Project Highlights, has been added to highlight a number of notable projects.

The following terms found throughout this brief are used by the federal government to describe the status of funds within the process of disbursement and spending. Funds that are ‘authorized’ are made available by Congress for a specific purpose; funds that are ‘awarded’ are committed to a specific project or activity and will likely result in payment; funds that are ‘outlaid’ have been paid to the recipient (DOE, 2011).

As of April 22, 2011, 95 percent of DOE’s total authorized ARRA funds had been awarded and 39 percent of total funds had been outlaid (DOE, 2011).

ARRA Spending by DOE Program Office

Several different offices within the U.S. Department of Energy administer ARRA-funded projects aimed at transforming the way the United States produces and uses energy, including projects aimed at reducing carbon emissions and supporting nascent clean energy industries. As of April 22, 2011, the Recovery Act funds have been authorized, awarded, and outlaid by DOE program offices as follows:
**Table 1: U.S. Department of Energy Recovery Act Funding by Office. Dollars in Billions. (DOE, 2011)**

<table>
<thead>
<tr>
<th>DOE Program Office</th>
<th>Authorized</th>
<th>Awarded (%)</th>
<th>Outlaid (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advanced Research Projects Agency-Energy (ARPA-E)</td>
<td>$0.387</td>
<td>$0.387 (100%)</td>
<td>$0.101 (26.2%)</td>
</tr>
<tr>
<td>Office of Energy Efficiency and Renewable Energy (EERE)</td>
<td>16.7</td>
<td>16.6 (99.9)</td>
<td>6.88 (41.3)</td>
</tr>
<tr>
<td>Office of Environmental Management (EM)</td>
<td>5.99</td>
<td>5.98 (99.9)</td>
<td>4.26 (71.2)</td>
</tr>
<tr>
<td>Office of Electricity Delivery and Energy Reliability (OE)</td>
<td>4.49</td>
<td>4.49 (100)</td>
<td>1.11 (24.8)</td>
</tr>
<tr>
<td>Office of Fossil Energy (FE)</td>
<td>3.38</td>
<td>3.38 (100)</td>
<td>0.213 (6.31)</td>
</tr>
<tr>
<td>Office of Science (SC)</td>
<td>1.67</td>
<td>1.67 (100)</td>
<td>0.963 (57.7)</td>
</tr>
<tr>
<td>Loan Guarantee Program (LGP)</td>
<td>2.47</td>
<td>0.763 (30.9)</td>
<td>0.224 (9.07)</td>
</tr>
<tr>
<td>Western Area Power Administration (WAPA)</td>
<td>0.010</td>
<td>0.008 (76.0)</td>
<td>0.005 (54.5)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>35.2</strong></td>
<td><strong>33.4 (95.0)</strong></td>
<td><strong>13.8 (39.3)</strong></td>
</tr>
</tbody>
</table>

**Advanced Research Projects Agency-Energy (ARPA-E)**

ARPA-E was established under the America COMPETES Act of 2007 as a new agency within the DOE that aims to fund cutting-edge energy research. The Recovery Act gave the agency its initial funding. Awards go to high risk and high payoff energy technologies in all stages of development (ARPA-E). Projects span transformative technologies in energy storage, carbon capture, advanced biofuels, renewable power, and other areas.

ARPA-E has awarded all of its Recovery Act funding, and a portion of its fiscal year 2011 appropriations, to 126 projects totaling $493 million. The projects funded by ARRA in its first year were awarded in 30 states over four different funding rounds announced in October 2009, and April, July, and September 2010. Among the leading recipients for these projects were universities, national labs, and large businesses.

![Figure 1: Lead Recipients for ARPA-E Projects](image)

**Office of Energy Efficiency and Renewable Energy (EERE)**

EERE Recovery Act money supports the office’s wide span of programs and initiatives, including advanced energy-efficient building technologies, advanced biofuels, vehicle, and geothermal research, and spans both development and deployment projects. The EERE projects most heavily funded with Recovery Act money are state and local government programs, including the following:
• **Energy Efficiency Conservation Block Grant (EECBG) Program**, which awards grants to states, territories, and local governments, to implement and manage energy efficiency programs. This program was authorized $3.2 billion. All funds have been awarded and 34 percent have been outlaid.

• **State Energy Program**, which supplements existing funding for state-level energy program grants, for projects such as energy efficiency retrofits and renewable energy installations. This program was authorized $3.1 billion. All funds have been awarded and 39 percent have been outlaid.

• **Weatherization Assistance Program**, which scales up the existing weatherization program in order to provide energy retrofits for 570,000 homes over three years. This represents a fivefold increase from the 104,000 homes weatherized in 2009. This program was authorized $5 billion. All funds have been awarded and 55 percent have been outlaid.

Federal requirements have slowed spending under the major state energy initiatives, the EECBG Program and State Energy Program. Requirements under the [National Environmental Policy Act](#), [Davis-Bacon Wage Determinations](#), ARRA’s [Buy American](#) terms, and the [National Historic Preservation Act](#) have held up spending as the awards are contingent upon meeting these laws’ conditions (Friedman, 2011). For example, spending for the Weatherization Assistance Program was stalled because the Davis-Bacon wage determinations were not established until late summer 2009.

**Office of Environmental Management (EM)**
Aiming to clean up the environmental impact of nuclear waste, the EM ARRA funds accelerate cleanup of soil and groundwater, transportation and disposal of waste, and demolition of former weapons complex facilities.

**Office of Electricity Delivery and Energy Reliability (OE)**
Recovery Act funding for the OE supports smart grid initiatives and provides assistance for state and local governments for electricity policy review, transmission planning and analysis, and workforce development. Funding primarily supports previously unfunded provisions in the [Energy Independence and Security Act (EISA) of 2007](#) that aim to improve electricity transmission and develop the smart grid. Specific EISA provisions receiving ARRA funds are:

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1 The National Environmental Policy Act passed in 1969 set up procedural requirements for all federal government agencies to prepare Environmental Assessments (EAs) and Environmental Impact Statements (EISs) detailing the environmental effects of proposed federal agency actions.

2 Davis-Bacon Wage Determinations ensure that workers on federal government projects must receive prevailing wages, which are the hourly wages and benefits paid to the majority of workers within a particular area.

3 The ‘Buy American’ terms state that none of the Recovery Act funds may be used for projects unless the iron, steel, and manufactured goods are produced in the United States.

4 Federal agencies must fully consider historic preservation issues and the views of the public in their project decision-making.

5 The smart grid refers to the application of digital technology to the electric power sector to improve reliability, reduce cost, increase efficiency, and enable new components and applications. Smart grid technologies—including communication networks, advanced sensors, and monitoring devices—allow utilities to generate and deliver power more efficiently and reliably and to more easily incorporate new clean technologies and enable consumers to better understand and control their electricity consumption.
- **Sec. 1304**, Smart Grid Regional Demonstration Initiative, which solicits and funds projects through competitive funding opportunity announcements for large-scale smart grid demonstration projects that verify technology viability, quantify costs, and validate smart grid business models at scale so they can be replicated. This project was authorized $0.68 billion.

- **Sec. 1305**, Interoperability Standards and Framework, which aims to set development and implementation standards for smart grid technologies to ensure effective and consistent application. This project was authorized $12 million.

- **Sec. 1306**, Smart Grid Investment Matching Grant Program, which creates a competitive, merit-based matching-funds grant program that can cover up to 50 percent of investments planned by electric utilities and other entities for the deployment of smart grid technology. This project was authorized $3.5 billion, by far the most funding out of all OE projects.

**Office of Fossil Energy (FE)**

With the goal of reducing carbon emissions from coal-generated power, FE’s Recovery Act initiatives focus on research, development, and deployment of technologies to use coal more cleanly and efficiently. This includes explorations of coal gasification technology, and improved techniques to capture and store the greenhouse emissions from coal-fired power plants. $1.5 billion of the funds support 25 projects that capture and sequester carbon emissions from industrial facilities, such as cement plants. $1 billion supports the continuation of [FutureGen 2.0](#), a planned advanced coal-fired power plant that will use oxy-combustion technology and capture and sequester 90 percent of its carbon dioxide emissions.

**Office of Science (SC)**

The SC’s Recovery Act funding supports a variety of U.S. laboratory facility upgrades and research projects. Thirty-two percent, or $0.54 billion, of the money is authorized for [Energy Frontier Research Centers](#), Science Laboratories Infrastructure Construction, and [National Synchrotron Light Source II](#). Additionally, 5.8 percent of the SC’s total funds, or $0.097 billion, is authorized for Energy Sciences Fellowships and Early Career Awards to stimulate research careers in energy and environmental sciences. The rest of the awarded money is being distributed among 49 specific lab facilities and project areas.

**Loan Guarantee Program (LGP)**

LGP funding supports advanced technology projects through **Sec. 1705** of the Loan Guarantee Program, which was established by a Recovery Act amendment to the [Energy Policy Act of 2005](#) (EPAct 2005). Sec. 1705 is a temporary program funded by ARRA that authorizes DOE to make loan guarantees to certain renewable energy systems,

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6 The Energy Frontier Research Centers fund university-led basic research for the transformative energy technologies of the future.

7 The National Synchrotron Light Source II is a scientific facility being constructed at Brookhaven National Lab that uses x-rays and other types of light for the purpose of scientific investigation, including energy-related research.
electric transmission systems, and cutting-edge biofuel projects that begin construction no later than September 30, 2011.\textsuperscript{8}

The $2.5 billion from ARRA complements more than $50 billion that the DOE has to advance clean technologies through the EPAct 2005’s other loan programs; these include the Sec. 1703 Loan Program and the Advanced Technology Vehicles Manufacturing Loan Program (DOE, 2009).

As of April 29, 2011, the Sec. 1705 Program had awarded $0.763 billion and outlaid $0.224 billion in order to support $5.9 billion in closed loan guarantees and provide conditional commitments for $4.8 billion worth of loan guarantees (DOE).\textsuperscript{9}

**Western Area Power Administration (WAPA)**

Aiming to increase renewable energy deployment, the Recovery Act authorizes WAPA to borrow up to $3.25 billion from the U.S. Treasury to construct transmission lines to help deliver renewable power in the West, and provides funding to carry out this activity. There are three WAPA projects currently under consideration that would be funded by ARRA and increase renewable energy generation in the United States (WAPA).

**Office of Inspector General**

A support office rather than one administering programs, the DOE Office of Inspector General has audited DOE ARRA spending. The Office received $15 million in Recovery Act funds to pursue, “a strategy designed to present and detect inefficient, ineffective and abusive Recovery Act expenditures.” (Friedman, 2011) As of March 17, 2011, the DOE Office of Inspector General had issued 47 Recovery Act related reports. Only 0.03 percent of the DOE’s Recovery Act spending authority had been called into question by these reports (Isakowitz, 2011).

**Jobs Created or Saved by Recovery Act Spending**

To understand one of the impacts of the Recovery Act, a number of agencies and offices are analyzing its effects on employment. There are two job reports explicitly required by ARRA. First, job reports based on ‘recipient reports’\textsuperscript{10} compile an aggregation of jobs created or saved\textsuperscript{11} as reported by agencies receiving funding (OMB, 2009). Second,

\textsuperscript{8} A loan guarantee is a commitment by the guarantor to cover a debt obligation if a borrower defaults. Through this program, the federal government shares part of the financial risk of projects that make use of new technologies and would not otherwise be funded in the private sector.

\textsuperscript{9} A conditional commitment means a document specifying the terms and conditions required for a loan guarantee agreement has been offered by DOE and accepted by the applicant. A closed loan guarantee means these conditions have been met and financing for the project can begin, with DOE covering the debt obligation if the borrower defaults.

\textsuperscript{10} Section 1512 of the Recovery Act requires funding reports from the recipients. These must include the total amount of funds received, a list of projects funded (including description, completion status, and estimates on jobs created or retained), and details on sub-awards and other payments. Recipients are non-federal entities that receive ARRA funding in the form of grants, loans, or cooperative agreements from the federal government.

\textsuperscript{11} According to the OMB, “a job created is a new position created and filled or an existing unfilled position that is filled as a result of the Recovery Act; a job retained is an existing position that would not have been continued to be filled were it not for Recovery Act funding.” OMB’s Recovery Act memorandum instructs recipients on job calculations provides a basic formula to standardize the calculation process from recipient to recipient: (Cumulative Recovery Act Funded Hours Worked)/(Cumulate Hours in a Full-time Schedule) = Full-time Equivalent Job;
the **Council of Economic Advisers** (CEA), in consultation with the **Office of Management and Budget** (OMB) and **U.S. Treasury**, must submit quarterly reports to Congress that detail the impact of ARRA-funded programs on employment, economic growth, and other key economic indicators (GAO, 2009). A third report, completed by the **Congressional Budget Office** (CBO), is required by the Recovery Act to comment on recipient reports. In doing so, it uses economic models and historical data to estimate the effects on employment (CBO, 2009). This section explores these three reports to provide a comprehensive overview of ARRA’s effects on employment. The most recent data on employment from these sources are displayed in Chart 2.

The first job report, based on the **recipient reports**, estimates that, as of the end of 2010, the total number of jobs created or saved by the Recovery Act was 3.93 million (Recovery.gov). At this time, approximately 80 percent of ARRA funding had been outlaid (CEA, 2011). In the fourth quarter of 2010 alone, ARRA created or saved 582,089 jobs (Recovery.gov). More specifically, DOE’s Recovery Act initiatives created or saved 168,771 jobs through the end of 2010, of which 42,960 were created or saved in the fourth quarter of 2010 (Recovery.gov).

The second required job report analyzes overall economic activity, with particular focus on employment, by using a variety of calculation methods. **The Economic Impact of the American Recovery and Reinvestment Act of 2009 Sixth Quarterly Report**, released by the CEA in March 2011, provides economic analysis of the stimulus package. The CEA estimates that as of the fourth quarter of 2010, the Recovery Act had increased the number of saved or created jobs relative to what it otherwise would have been by between 2.5 and 3.6 million. The CEA’s data represent ARRA

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12 On December 18, 2009, the example and methodology for calculating the jobs created or saved were simplified to what they are today to clarify recipient report calculations (OMB, 2010). Previously, the data on job creation reported by the federal government had been questioned as it relied on recipient estimates of jobs created or saved. While there is a set of reporting requirements and guidance for recipients, a report by the U.S. Government Accountability Office (GAO), “Tracking the Money: How Recovery Act Recipients Account for Their Use of Stimulus Dollars,” indicated that “there are a range of significant reporting and quality issues that need to be addressed.” GAO’s review found errors in data entry, such as recipients failing to indicate the stimulus dollar amount received or expended and incorrectly labeling the Congressional District where the project or activity took place. Additionally, the GAO identified errors made by recipients in calculating full-time equivalent (FTE) positions created or saved. As recipient reports continued to be submitted each quarter, the GAO recommended the OMB clarify its guidance for measuring FTEs and work with federal agencies to examine the procedures for review and quality assurance.
funding for all agencies and are not broken down by agency or office. Throughout the report, the CEA compares its quarterly findings to those of the Congressional Budget Office and a number of other analyses. These analyses, including those done by Goldman Sachs and IHS/Global Insight, are displayed in Table 2. The CEA used two approaches to make its calculations. The quarterly estimates of the first approach use economic modeling, based on existing estimates of the macroeconomic effects of fiscal policy. The quarterly estimates of the second method use statistical projection, which compares “the actual paths of GDP and employment with the predictions of a sensible statistical forecast of what they would have done.”

Table 2: Estimates of the Effects of the Recovery Act on Employment, through Quarters. Jobs in Millions.

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>CEA: Model Approach</td>
<td>+0.400</td>
<td>+1.122</td>
<td>+1.755</td>
<td>+2.227</td>
<td>+2.556</td>
<td>+2.680</td>
<td>+2.513</td>
</tr>
<tr>
<td>CEA: Projection Approach</td>
<td>+0.276</td>
<td>+1.004</td>
<td>+1.811</td>
<td>+2.578</td>
<td>+3.224</td>
<td>+3.512</td>
<td>+3.611</td>
</tr>
<tr>
<td>CBO: Low</td>
<td>+0.300</td>
<td>+0.700</td>
<td>+1.000</td>
<td>+1.200</td>
<td>+1.400</td>
<td>+1.400</td>
<td>+1.300</td>
</tr>
<tr>
<td>CBO: High</td>
<td>+0.500</td>
<td>+1.300</td>
<td>+2.100</td>
<td>+2.800</td>
<td>+3.400</td>
<td>+3.700</td>
<td>+3.600</td>
</tr>
<tr>
<td>IHS/Global Insight</td>
<td>+0.228</td>
<td>+0.689</td>
<td>+1.245</td>
<td>+1.696</td>
<td>+2.107</td>
<td>+2.342</td>
<td>+2.445</td>
</tr>
<tr>
<td>Macroeconomic Advisers</td>
<td>+0.248</td>
<td>+0.623</td>
<td>+1.057</td>
<td>+1.462</td>
<td>+1.847</td>
<td>+2.119</td>
<td>+2.329</td>
</tr>
<tr>
<td>Mark Zandi, Moody's Economy.com</td>
<td>+0.500</td>
<td>+1.008</td>
<td>+1.486</td>
<td>+1.893</td>
<td>+2.249</td>
<td>+2.522</td>
<td>+2.492</td>
</tr>
</tbody>
</table>

A third type of job report is completed by the CBO, which is required by Sec. 1512(e) of the Recovery Act to comment on reports filed by recipients (CBO, 2009; U.S. Congress, 2009). In its comments, the CBO estimates the effects of ARRA on employment. The report, Estimated Impact of the American Recovery and Reinvestment Act on Employment and Economic Output from October 2010 through December 2010, was released in February 2011 and provides estimates considered by the CBO to be more comprehensive than those in recipient reports. The CBO uses economic models and historical data to estimate that, following the fourth quarter of 2010, ARRA increased the number of people employed by between 1.3 and 3.5 million overall (jobs created), and by between 1.8 and 5.0 million compared to what employment figures would have been otherwise (jobs created and saved). The data represent ARRA funding for all agencies and are not broken down by agency or office. Regarding the quality of the recipient reports, the CBO report details factors that affect the accuracy of recipient report data13 and states that “estimating the law’s overall effects on employment requires a more comprehensive analysis than can be achieved by using the recipient reports.”

The percentages for DOE office spending and project category appropriations and awards will continually change as more project solicitations are announced and more money is awarded and outlaid. Jobs data will also fluctuate as submitted reports are verified.

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13 This includes factors that could make reported figures too high, for example that recipient reports may include employment that would have occurred without ARRA, as well as too low, such as that the reporting requirement is limited to primary and secondary recipients of funds and does not account for lower level recipients.
Recovery Act Project Highlights
Out of the Recovery Act’s DOE funds, a number of high-impact projects have come to fruition or are in development. The following is an overview of notable projects funded by the Recovery Act, including funding for smart meter installation, state-level energy programs, and potentially game-changing technology research.

Supporting Electric Vehicle Deployment
One of the largest investments made with Recovery Act funds is the $2.4 billion designated to support rolling out the next generation of electric vehicles and advanced batteries. There are 48 projects in 20 states set to advance the development, manufacturing, and deployment of electric drive vehicle components and lithium-ion batteries. These ARRA funds are expected to be matched by the grant recipients and create or save tens of thousands of jobs. The following awards were made by the DOE as part of its Recovery Act awards for Electric Drive Vehicle Battery and Component Manufacturing Initiative. (DOE, 2009; DOE, 2010; EERE, 2009)

- $1.5 billion authorized to U.S.-based manufacturers to produce lithium-ion batteries and expand battery recycling.
- $500 million authorized to U.S.-based manufacturing for the development and production of electric drive vehicle components, including motors and drive train components.
- $400 million authorized for the demonstration and deployment of plug-in hybrid and all-electric vehicles. This includes installation of charging stations and workforce training to support the transition to electric transportation systems.

Below are highlights of electric vehicle projects expected to have a high impact on electric vehicle deployment, and their projected job impact (ECOtality, 2011; The White House, 2010):

<table>
<thead>
<tr>
<th>Award Recipient, Location, Project Description</th>
<th>ARRA Funding</th>
<th>Expected Total Jobs Created or Saved(^{14,15})</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ECOtality · Phoenix, AZ</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Installation of over 15,000 chargers in 16 cities around the United States</td>
<td>$114 million</td>
<td>125 direct jobs created 750 indirect jobs expected throughout project life (3 years)</td>
</tr>
<tr>
<td>• Deployment of 8,500 electric-drive vehicles, including Nissan Leafs and Chevrolet Volts</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Dow Kokam · Midland, MI</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Construction of battery manufacturing facility</td>
<td>$161 million</td>
<td>1,000 construction jobs 800 permanent jobs expected</td>
</tr>
<tr>
<td>• Eventual production of enough affordable lithium-ion batteries to power 60,000 vehicles per year</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Johnson Controls · Holland, MI</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Construction of lithium-ion battery manufacturing facility previously considered for Asian locations</td>
<td>$299 million</td>
<td>100 jobs created or saved 500 permanent jobs</td>
</tr>
</tbody>
</table>

\(^{14}\) Job descriptors, such as ‘direct’, ‘indirect’, ‘permanent’, and ‘construction’, are included where this information was provided.

\(^{15}\) Direct jobs: created in the actual government-sponsored project. Indirect jobs: created at suppliers who make the materials used in the project (CEA, 2009).
Supply contracts with Ford and Azure Dynamics
*Compact Power, Inc. · Holland, MI*
- Construction of lithium-ion battery manufacturing facility
- Contracts to supply batteries for Chevrolet Volt
  - $151 million
  - 300 construction jobs
  - 300 permanent jobs expected

A123 · Livonia, Romulus, & Brownstown, MI
- Construction of three lithium-ion battery production facilities
- Contracts to supply batteries for Chrysler, Navistar, and Fisker Automotive
  - $249 million
  - 90 jobs created
  - 3,000 jobs expected by 2012

### Reviving American Manufacturing

The Northeastern, Mid-Atlantic, and Midwestern United States have been a historical home to manufacturing, but manufacturing employment decreased there throughout the first decade of the 2000s. With manufacturing plants moving to other countries and increased worker productivity due to improved assembly line automation, the region and the United States had been experiencing net manufacturing job loss. Since 2001, the United States lost an average of 45,000 manufacturing jobs per month (BLS, 2011). The economic recession exacerbated unemployment, and significantly decreased manufacturing output (BLS, 2011; Federal Reserve Bank of Chicago, 2011).

Aiming to help rejuvenate manufacturing, the Recovery Act has funded a number of projects throughout the United States. From December of 2009, when manufacturing employment was at its lowest in the last decade, until February 2011, the sector grew by 199,000 jobs to 11.6 million (BLS, 2011). The following awards are just a few of the nascent manufacturing projects supported with ARRA funds aimed at spurring growth in the clean energy economy (The White House, 2010).

<table>
<thead>
<tr>
<th>Award Recipient, Location, Project Description</th>
<th>ARRA Funding</th>
<th>Expected Total Jobs Created or Saved</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Brevini Wind · Muncie, IN</strong></td>
<td>$12 million</td>
<td>450 expected jobs through 2012¹⁶</td>
</tr>
</tbody>
</table>
| - Will increase wind turbine gearbox production in United States
  - Gearboxes are primarily produced overseas and are one of the most expensive parts of wind turbines |              |                                     |
| **Abound Solar Manufacturing · Tipton, IN**  | $400 million | 2,000 construction jobs              |
| - Increase production, on the order of millions, of solar panels using low cost production technology |              | 1,500 jobs expected                  |
| **EnerDel · Noblesville, Indianapolis, & Mt. Comfort, IN** | $118 million | 80 jobs                             |
| - Expand lithium-ion battery manufacturing in Noblesville and Indianapolis and factory construction in Mt. Comfort |              | 1,400 jobs by 2014                  |
| **General Electric · Louisville, KY**        | $600 million | 800 jobs expected through 2013       |
| - Expand production of energy efficient home appliances
  - Will bring back one of its production lines from China |              |                                     |

¹⁶ Job descriptors, such as ‘direct’, ‘indirect’, ‘permanent’, and ‘construction’, are included where this information was provided.
State Programs: Revolving Loan Funds and Appliance Rebates

A revolving loan fund (RLF) is a supply of money from which funds are borrowed. The loan repayments are then added back into the supply, allowing the loan program to last indefinitely. Multiple RLFs have been created or funded by the Recovery Act (EERE, 2009).

The ‘**Green Bank of Kentucky**’ is a Recovery Act-funded RLF established in late 2009. Kentucky’s low electricity rates, resulting from its historical dependence on coal, are an important reason why the state has one of the highest rates of per capita electricity consumption. The $14 million program finances energy-efficient improvements in state and local government buildings. Loan repayments are limited to the amount of energy savings.

The program was developed as part of a state goal to reduce statewide energy demand 25 percent by 2025. The first loan from the Green Bank, valued at $1.3 million, was made in December 2009 for the Kentucky Department of Education (KDE). The advanced technologies implemented for KDE include lighting system upgrades, equipment control systems, and mechanical system improvements. Once the upgrades are complete, the result will be an estimated $140,000 in annual savings and an annual reduction of 1,383 tons of carbon dioxide over approximately 15 years (State and Local Energy Report, 2010).

Another type of state program receiving funding from the Recovery Act is the energy efficient appliance rebate program. To encourage the purchase of energy-efficient appliances, heating equipment, and weatherization materials, **ENERGY STAR** partners, including businesses, schools, organizations, and governments, sometimes offer rebates or sales tax exemptions or credits for qualified appliances. Through the Recovery Act, the DOE has provided $300 million for U.S. states and territories to set up rebate programs for **ENERGY STAR** qualified appliances. As of the end of March 2011, 1.6 million consumers redeemed $239 million of rebates. The rebates stimulated an estimated $1.8 billion in spending and $102 million in state sales tax. The annual energy savings of these purchases are an estimated 1.5 trillion Btu (British thermal units), or 439 gigawatt hours of electricity, which is enough to power almost 16,000 typical U.S. households for one full year (DOE, 2011; EIA, 2009; ENERGY STAR).

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17 Data partially obtained from City of Naperville website. (City of Naperville, Illinois)
Rebate programs have proven to be an attractive way to stimulate the economy, and often do so quickly. Some programs have been so appealing that they used up all funds within a matter of hours or days. For example, Arizona launched its $6.2 million program on April 12, 2010 and closed it within four hours (NASEO, 2010). The North Carolina Energy Efficient Appliance Replacement and Rebate Program first closed after its planned phases, from April 22 to April 25 and June 1 to June 4, used up its $8.8 million of funds by selling 62,972 appliances worth $64 million. Because of the program’s success, the state transferred $2 million more of its Recovery Act funds to reopen the program for December 2010, after which the total number of appliances sold through the rebate program rose to 89,670, generating more than $89 million in total sales (NC Energy Office, 2011).

**Funding Potential Breakthrough Technology with ARPA-E**

While some clean energy-focused Recovery Act projects are good bets for stimulating job creation and improving local infrastructure, ARPA-E is using its Recovery Act funds to research potential breakthrough energy technologies. Modeled after the successful Defense Advanced Research Projects Agency (DARPA)\(^\text{18}\) with its mandate to support high-risk/high reward projects, ARPA-E’s $386 million funding authority from the Recovery Act supports research that might not receive financial support otherwise. While there are potentially great rewards, the future of ARPA-E beyond 2011 is uncertain as questions loom about funding shortages due to potential budget cuts (Goldfarb, 2011; Leeds, 2010; Hourihan, 2011).

One of the program’s early success stories is the discovery of a more efficient solar panel manufacturing process. A company called ‘1366 Technologies’ received $4 million dollars and, after just eight months, discovered a more cost-efficient way to produce silicon wafers for solar panels. Silicon wafers represent about 50 percent of the cost of making solar panels. The current wafer production process wastes approximately half of the silicon, whereas the newly developed process, “Direct Wafer” technology, reduces silicon waste and cuts the price of solar panels by 40 percent. 1366 Technologies is currently in the process of raising money to commercialize a process that will help lower the cost of solar electricity closer to that of coal and natural gas. The company’s goal is to construct a factory and start producing the new wafers at a commercial scale by 2013 (Wald, 2010).

Other technologies being researched with funding from ARPA-E include electronically tinting energy-efficient windows, low-cost production of light-emitting diodes (LEDs), and advanced vehicle battery technology.

**Conclusion**

The American Recovery and Reinvestment Act provides the unprecedented amount of $90 billion to prepare the country for a clean energy economy, $41.7 billion of which is being spent by the U. S. Department of Energy. According to estimates by several federal agencies, the Recovery Act in total has allowed between 1.3 and 3.93 million Americans to keep or obtain jobs despite the economic recession. ARRA initiatives supporting the development of clean energy technology and energy efficiency programs have resulted in 168,771 jobs according to the DOE. Innovative and previously unfunded programs are now in operation. Rebate programs have helped deploy more than one million ENERGY STAR appliances in a very short period and are expected to result in annual energy savings of 1.5 trillion Btu. Revolving loan funds will also continue to support new projects for many years to

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\(^{18}\) DARPA’s successes include supporting the development of modern computing, the internet, and global positioning system (GPS), among other technologies.
come. $2.4 billion in funding is supporting the next generation of plug-in electric vehicles. These funds and billions of other ARRA DOE dollars are contributing to reinvigorating and refocusing American manufacturing, while supporting research, development and deployment of innovative energy technologies. As the United States recovers from the economic recession, it is important to recognize the effects of the U.S. Department of Energy’s ARRA investments, both economically and with respect to energy security and the development of clean energy technologies. The investments have created immediate job growth and reduced energy use, while laying the foundation for an important U.S. role in the emerging clean energy economy.

References


