



NATIONAL ENERGY TECHNOLOGY LABORATORY



NETL 2009 Economic Impacts Methodology Report

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NETL 2009 Economic Impacts Methodology Report

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Acronyms and Abbreviations

BEA	Bureau of Economic Analysis, U.S. Department of Commerce
DOE	Department of Energy
IMPLAN	IMpact analysis for PLANning, an economic modeling software program
IO	Input-Output
NETL	National Energy Technology Laboratory
NSS	Non-site support
O&M	Operations and maintenance
OR	Oregon
PA	Pennsylvania
R&D	Research and development
RPC	Regional purchase coefficient
WV	West Virginia

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Executive Summary

The U.S. Department of Energy's (DOE) National Energy Technology Laboratory (NETL) supports energy-related research and development (R&D) activities and science education programs throughout Oregon (OR), Pennsylvania (PA), West Virginia (WV), and the United States. Through these actions NETL serves as an economic catalyst for the states and the nation.

This report documents NETL's 2009 economic impacts in OR, PA, and WV, as well as the nation as a whole. NETL's previous work in this area laid the groundwork for this study and is available on the NETL website (NETL, 2009); however, direct comparisons with results from previous NETL economic impact reports are not feasible due to improvements that have been made in the methodology for collecting IMPLAN and NETL data.

The input-output (IO) models developed for this study assess the direct economic impacts of NETL wages and salaries, Federal operational expenditures, and R&D awards and grants. The analysis also estimates the economic "ripple effects" of NETL activities, which are measured through a series of multipliers in the IO models that provide estimates of the number of times each dollar of direct spending cycles through the economy in the form of additional (indirect and induced) spending, personal income, and employment. In addition, the study estimates the jobs created or retained as a result of funds awarded through NETL in 2009 from the American Recovery and Reinvestment Act (the Recovery Act).

The data presented in Table 1 include the wages and salaries of the 689 U.S. residents employed at NETL in 2009, as well as direct operational expenditures (e.g., hand tools, copier paper, laboratory supplies), R&D awards, and grant monies spent within the United States, as a whole, and in OR, PA, and WV, in particular. The analysis indicates that through these activities NETL injected \$1.2 billion directly into the national economy in 2009, and \$17 million in OR, \$132 million in PA, and \$94 million in WV (see Table 2).

The impact of NETL on the national economy is greater than the total of the laboratory's direct spending because money spent by NETL is spent again by the recipient employees and U.S. businesses. This "ripple effect" resulted in NETL's total economic impact in the U.S. being approximately \$5.5 billion (see Table 3 below for the indirect and induced employment and expenditure impacts in the U.S., as well as in OR, PA, and WV).

In 2009 NETL received Recovery Act funding to make public investments that save and create jobs, and cushion the impacts of the economic downturn.¹ NETL followed guidance provided by the Executive Office of the President (Council of Economic Advisors, 2009) to estimate the national and state job creation and retention impacts from the \$7.7 billion in NETL Recovery Act funding and determined that 83,958 jobs were created or retained in the nation, while the job impacts in the three states with NETL research campuses were: OR = 877, PA = 3,832, and WV = 779 (see Table 11 for more details).

¹ Note that the employment impacts of the Recovery Act funding are not factored into NETL's economic impacts presented in Tables 2 and 3.

Table 1 Direct Economic Impact of NETL by Region, 2009

Input Category	Oregon	Pennsylvania	West Virginia	United States
Federal Employment (jobs)	57	322	305	689
Federal Wages and Salaries	\$7 M	\$39 M	\$35 M	\$81 M
Federal Operational Expenditures and Federal R&D Awards and Grants	\$11 M	\$94 M	\$59 M	\$1,152 M

Table 2 Total Direct Economic Impact of NETL by Region, 2009

Input Category	Oregon	Pennsylvania	West Virginia	United States
Total Direct Impact on the U.S. ^a	\$17 M	\$132 M	\$94 M	\$1,234 M

^aInputs may not sum to total due to rounding

Table 3 Total Economic Impact of NETL by Region, 2009

Impact Category ^a	Oregon	Pennsylvania	West Virginia	United States
Employment (jobs)	364	2,461	1,749	26,327
Expenditures (including wages, salaries, operational, and R&D spending)	\$72 M	\$513 M	\$282 M	\$5,457 M

^a Monetary data adjusted to millions of dollars (\$2009)

Introduction

The National Energy Technology Laboratory (NETL) conducted an analysis of its economic impacts using input-output (IO) models in the summer of 2010 to quantify the laboratory's direct, indirect, and induced economic impacts in Oregon (OR), Pennsylvania (PA), and West Virginia (WV), and the nation as a whole. This document presents the study's methodology and key economic impact findings, as well as an estimate of employment impacts related to NETL funding appropriated in the American Recovery and Reinvestment Act (the Recovery Act).

NETL is a federally owned and operated Department of Energy (DOE) laboratory dedicated to the research, development, and demonstration of domestic energy resources. NETL has three major research campuses in the United States, located in Albany, OR, Pittsburgh, PA, and Morgantown, WV, and other locations.² The campuses include 14 major research facilities on nearly 200 acres of land. NETL employs more than 1,100 people at its facilities, with roughly half being Federal employees and half being site support contractors.³ The NETL workforce is primarily composed of scientists and engineers, who are augmented by technical, professional, and administrative staff that provide a variety of specialized services (see labor breakout box for more details) (DOE, 2011).

NETL devotes the majority of its funding to research and development (R&D) partnerships with industry, university, and other government entities. This work augments NETL's onsite research in the areas of computational and basic sciences, energy system dynamics, geological and environmental systems, and materials science. (NETL, 2011)

Composition of NETL Workforce

Federal Employees

Scientists = 23%
 Engineers = 36%
 Technical = 9%
 Professional = 10%
 Administration = 19%
 Other = 3%

Site Contractors

Scientists = 9%
 Engineers = 23%
 Technical = 22%
 Professional = 14%
 Administration = 15%
 Other = 17%

Source: NETL <http://fossil.energy.gov/facilities/netl/index.html>

In addition to conducting cutting-edge research and technology development on site, NETL shapes, funds, and manages contracted research in the United States and more than 40 foreign countries. The laboratory's research portfolio includes more than 1,800 projects that are carried out through various contracting arrangements with corporations, small businesses, universities, non-profit organizations, and other national laboratories and government agencies (NETL, 2011).

² NETL also has sites in Houston, Texas, and Fairbanks, Alaska.

³ The site support contractors are selected through competitive solicitations and provide expert services that complement and support the efforts of Federal staff at the NETL facilities.

In 2009 the Federal government enacted the Recovery Act to foster “job preservation and creation, infrastructure investment, energy efficiency and science, assistance to the unemployed, and State and local fiscal stabilization” (Public Law 111-5, 2009). The Recovery Act appropriated over \$43 billion for energy-related activities such as fossil energy R&D and the demonstration of advanced energy technologies. NETL provided technical expertise and contract management services to assist in the implementation of the energy provisions in the Recovery Act. All totaled, NETL was involved in the distribution of \$8.9 billion in Recovery Act funding in 2009.

The next section of this report reviews the data collection methodology used for this analysis and then goes on to describe the input-output model that was used to estimate the direct, indirect, and induced economic impacts of NETL in 2009. The document concludes with a review of the study’s key findings.

Modeling Approach

The IO modeling approach used for this report is the same approach used by NETL last year to estimate its economic impacts and is documented in a report entitled *National and State Economic Impact of NETL* (NETL, 2009). The IO modeling approach was developed by Wassily Leontief in the late 1930s. It is based on the inter-industry sales and purchase relationships that exist in every economy. IO analysis characterizes an economy by describing these flows of goods and services between industries, institutions, and the final market. It has been extended to deal with such things as energy consumption, environmental factors, and employment impacts. It can now also be extended to consider interregional and multiregional analyses. More background, foundation, and strengths and weaknesses of IO analysis are available in *National and State Economic Impact of NETL*.

Data Collection Methodology⁴

IMPLAN Data Sources

Software and data purchased from the Minnesota IMPLAN Group, Inc., form the foundation for the regional IO models and for the national IO model used in this analysis. All of the models have been constructed with the IMPLAN software, using 2008 structural and region-specific data.

Within each of the state models (OR, PA, and WV), trade flows—the transfer of goods and services between and within counties, selected region(s), or within the U.S.—are estimated using

⁴ The data collection methodology used in this study is similar to the approach used the previous year and documented in Section 6 - Data Collection of *National and State Economic Impact of NETL*. The text in the “Data Collection Methodology” section of this report is an update of the data collection section contained in the previous year’s report to enable the reader to easily compare the two studies.

the IMPLAN national trade flows method. This method estimates import and export flows between counties' economies based on size or mass and is inversely related to the distance or cost to move goods and services from one county's economy to another. This method results in regional purchase coefficients (RPCs)—the proportion of local supply satisfying local demand—for the specified state model.

Trade flows for the national model, however, are estimated using the supply/demand method. This method captures only imports and exports from foreign countries. All trade used for domestic imports and exports (i.e., between areas of the US) is already accounted for in the IMPLAN data.

The RPCs used in this report have changed from the ones used in the 2009 analysis. The RPC trade flows used in the 2009 analysis were based on econometric equations internal to IMPLAN for all the models. The equations were based upon a number of regional-to-national variables, including the wage ratio, "other costs" ratios, output ratios, the commodity weight/value ratio, the ratio of the number of users of a good, the ratio of the number of producers of a good, and the land area ratio. The new trade flow RPCs are believed to more accurately model the transfer of goods and services between and within counties, selected region(s), or within the U.S. The following data were extracted from IMPLAN and saved in spreadsheet form for use in the impacts assessment model:

- Regional Use Table—contains information on the use of commodities by industry (the dollar value of purchases of goods and services by each industry for use in the production process).
- Regional Make Table—contains the information on the output distribution of commodities by industry (the dollar value of each good and service produced by each industry).
- Total Commodity Imports—sum of intermediate and institutional imports of commodities (goods and services). These commodity trade data are obtainable from IMPLAN's social accounts.
- Total Commodity Final Demand—institutional demand for the final use of commodities (includes the household consumption portion of final demand). These institutional commodity demand data are obtainable from IMPLAN's study area.
- Employment by Industry—total employment (number of jobs) for each industry. These industry detail data are obtainable from IMPLAN's study area.
- Tax Multipliers—multipliers for all tax variables, including business taxes (expressed in dollars by type per dollar of industry output). Tax data are obtainable from IMPLAN's industry by commodity social accounting matrix.

To capture direct, indirect, and induced impacts on various economic parameters, industry-level data (i.e., production, operational expenditures, employment, awards, etc.) were collected, processed and analyzed. An important consideration in determining the level of industry detail to incorporate into this study was the relevance of a given industry in the scope of the project. The industry schema used in this study is shown in Table 4. The schema was derived by aggregating IMPLAN industries and is largely consistent with industry schemas used by the Bureau of Economic Analysis,⁵ but was altered slightly to provide granularity in sectors relevant to NETL, such as coal mining, architectural and engineering services, and scientific R&D services.

NETL Data Sources

As indicated above, the goal of this project was to develop a means to estimate national and state-level (OR, PA, and WV,) economic impacts derived from NETL employment and activity. The most current (2009) NETL data served as the inputs for the model. IMPLAN data were adjusted using Office of Management and Budget historical deflators to 2009 dollars for consistency with the NETL data. Results are represented in 2009 dollars.

Specifically, some of the NETL data categories and sources are summarized as follows:

- NETL (Federal Wages/Salaries)

The source of the NETL Federal wages and salaries data (calendar year 2009) was obtained from NETL's Human Resources Division. For each federal employee at NETL, the data required include the assigned work site (e.g., Albany, Pittsburgh, or Morgantown), the state of residence, the annual unburdened salary, a multiplier for benefits, and the total burdened salary (salary plus benefits).

- NETL (Operational Expenditures)

The Operational Expenditures Data for FY2009 were obtained from NETL's Information Technology Division. As used in this context, operational expenditures constitute materials purchased— everything from paper towels to computers to complex laboratory equipment. The purchasing site and home state for each vendor were recorded to enable an accounting of purchases by geographic origin. The impacts of the operational expenditures were determined by the state location of the vendor. In addition, operational expenditures from Recovery Act funding are differentiated from other funding.

⁵ Being largely consistent with the BEA schema helps ensure the models' data follow a standardized schema, facilitates validation with a federally approved source for economic accounts data, and aids understanding of the analysis results.

Table 4 Industry Schema Used in Project Models

IMPLAN Codes	Industry Description	IMPLAN Codes	Industry Description	IMPLAN Codes	Industry Description
1 - 14	Farms	259 - 275	Electrical equipment, appliances, and components	368, 370, 374, 377 - 380	Miscellaneous professional, scientific, and technical services
15 - 19	Forestry, fishing and related activities	276 - 283	Motor vehicle, bodies and trailers, and parts	371 - 373	Computer systems design and related services
20	Oil and gas extraction	284 - 294	Other transportation equipment	375	Environmental and other technical consulting services
21	Coal mining	295 - 304	Furniture and related products	376	Scientific research and development services
22 - 27	Mining, except coal, oil and gas	305 - 318	Miscellaneous manufacturing	381	Management of companies and enterprises
28	Drilling oil and gas wells	319	Wholesale trade	382 - 389	Administrative and support services
29	Support activities for oil and gas operations	320 - 331	Retail trade	390	Waste management and remediation services
30	Support activities for other mining	332	Air transportation	391	Elementary and secondary schools
31	Electric power generation, transmission, and distribution	333	Rail transportation	392	Junior colleges, colleges, universities, and professional schools
32	Natural gas distribution	334	Water transportation	393	Other educational services
33	Water, sewerage and other systems	335	Truck transportation	394 - 396	Ambulatory health care services
34 - 35, 37 - 40	Construction, all other and maintenance and repair	336	Transit and ground passenger transportation	397 - 398	Hospitals and nursing and residential care facilities
36	Miscellaneous new construction, including power plants	337	Pipeline transportation	399 - 401	Social assistance
41 - 74	Food and beverage and tobacco products	338 - 339	Other transportation and support activities	402 - 406	Performing arts, spectator sports, museums, and related activities
75 - 85	Textile mills and textile product mills	340	Warehousing and storage	407 - 410	Amusements, gambling, and recreation industries
86 - 94	Apparel and leather and allied products	341 - 345	Publishing industries (includes software)	411 - 412	Accommodation
95 - 103	Wood products	346 - 347	Motion picture and sound recording industries	413	Food services and drinking places
104 - 112	Paper products	348, 349, 351	Broadcasting and telecommunications	414 - 426	Other services, except government
113 - 114	Printing and related support activities	350, 352, 353	Information and data processing services	427, 429, 439, 440	Federal, other, including Postal Service
115 - 119	Petroleum and coal products	354 - 355	Federal Reserve banks, credit intermediation, etc.	428	Federal electric utilities
120 - 141	Chemical products	356	Securities, commodity contracts, and investments	430, 432, 437, 438	State & Local, other
142 - 151	Plastics and rubber products	357 - 358	Insurance carriers and related activities	431	State and local government electric utilities
153 - 169	Nonmetallic mineral products	359	Funds, trusts, and other financial vehicles	433	Used and secondhand goods
170 - 180	Primary metals	360	Real estate	434	Scrap
181 - 202	Fabricated metal products	361	Imputed rental activity for owner-occupied dwellings	435	Rest of the world adjustment to final uses
203 - 233	Machinery	362 - 366	Rental/leasing services/lessors of intangible assets		
234 - 258	Computer and electronic products	367	Legal services		

- R&D Non-Site Support (NSS) Awards— 2009 fiscal year (October 1, 2008–September 30, 2009)

The data regarding Awards to Contractors that are not Site-Support Contractors for FY 2009 were obtained from NETL’s ProMIS database. Data collected include:

- Award type
- Performer name
- Home state of awardee
- Award value (government + awardee shares)
- FY09 actual costs
- Value by prime contractors
- Project duration
- Activity title

Typically, “awards” are not attributed to a particular NETL site, but include all awards made at all sites. Regardless, award data provided by the NETL project tracking system do provide information assumed to be sufficient to model award impacts in the state where the awardee is located. Once the data were collected, the performers were mapped to industries listed in Table 4.

- Site Support Contractor (Wages/Salaries and Expenditures)

The Site Supported Contractor data were obtained from the Office of Systems, Analyses, and Planning (OSAP). The following information was gathered:

- Home state and work location of the contractor
- FY2009 total value, including broken out value of the Recovery Act

- Weatherization and State Energy Awards

The sources for weatherization and state energy awards data were obtained from the Office of Crosscutting Functions. The following information was gathered:

- State weatherization and energy awards occurred
- FY 2009 total value, including broken out value of the Recovery Act
- Grant name
- Grant type (weatherization or state energy formula)

Project personnel interacted closely with individuals from the above organizations who provided all of the data necessary for model development and application. Based upon the data formats provided by the various NETL groups and organizations, standardized data collection vehicles were developed that can be used to collect the data in future years. These data collection vehicles were developed to make future data collection efforts seamless from the standpoint of both those collecting the data and for those executing the models.

Input-Output Model⁶

The models developed for this project are Excel-based applications that include regional and national models that achieve the stated project objectives. The models include an interactive user interface with the following features:

- Provides flexibility to the user, enabling a high level of user control (The user can enter values for operational expenditures, wages and salaries, and awards.)
- Easily allows for multiple runs against a range of scenarios
- Facilitates annual IMPLAN updates
- Facilitates flexible industry sector assignments for research awards
- Produces results that can easily be incorporated into reports

This analysis uses IMPLAN data and NETL information to create Excel spreadsheet IO models of NETL's 2009 economic impacts. NETL Operational Expenditure data augmented the IMPLAN MAKE and USE tables, effectively forming a separate "NETL O&M" sector. NETL Federal Employee wage data were also used as the O&M value added in the USE table. Non-Site Support (NSS) and Site-Support Contractor award expenditures were combined and formed the basis of the final demand vectors that drive the models. The final demand entry for the NETL O&M sector corresponds to the sum of vendor data and federal employee wage estimates. Final demands then drive the respective models and generate results in the form of a total output vector. The relationships between output and employment, employment compensation, and the remainder of value added are used to calculate impact for these categories, and for taxes.

The Non-Site Support (NSS) Awards are subject to a "translator" process designed to provide a more detailed description and allocation of award expenditures. The NSS awards are initially assigned a sector based on the facility/operator sector category of the recipient. The translator process allows a single award to be allocated to multiple sectors through a sector weighting process. These weights allow for a more refined distribution of expenditures across the assigned sectors for each award, and were assigned based on extensive knowledge of each awardee's activity by sector. The translator process is implemented by a user exercising professional judgment based on the comprehensive description of the award in the database provided. A user can manually change and/or distribute the weighting of a single award into one to three different sectors. If the weighting is changed, a user is required to select an associated NETL industry description from an assigned drop-down menu. This process is beneficial in accounting for awards expenditures that may impact multiple sectors. For example, awards initially allocated solely to the IMPLAN sector Junior Colleges, Colleges, Universities, and Professional schools are typically used to conduct scientific research and development. As such, the award activities

⁶ The Input-Output Model used in this study is similar to the model used by NETL the previous year and documented in Section 7 – Model Construction of *National and State Economic Impact of NETL*. The text in the "Input-Output Model" section of this report is an update of the model section contained in the previous year's report to enable the reader to easily compare the two studies.

more closely resemble the scientific research and development services sector than the education sector. The scientific research and development services is an IMPLAN designated sector; therefore, funds awarded by NETL to the Junior Colleges, Colleges, Universities, and Professional schools sector should also reflect the scientific research and development services sector. Using the translator process described above provides a means for designating more appropriate award allocations by sector (see Table 5 for an illustration of this process).

Table 5 Award Translator Example

FY09 Costed Dollars	Translated? (Yes/No)	Key NETL Industry Code	Key NETL Industry Description	KEY \$	NETL Industry Code	NETL Industry Description	Weights	\$	NETL Industry Code	NETL Industry Description	Weights	\$
\$276,835.00	Yes	392	Junior colleges, colleges, universities, and professional schools	\$276,835.00	392	Junior colleges, colleges, universities, and professional schools	0.8	\$221,468.00	376	Scientific research and development services	0.20	\$55,367.00

This project incorporates several assumptions into the study design. These assumptions impact the results and should be taken into consideration when analyzing, interpreting, and applying the results generated from the project model.

Since this study uses the economic IO modeling framework, all of the assumptions underlying IO are relevant. Among those assumptions are the following:

- The economy can be represented by a set of linear equations with parameters derived primarily from data developed by the Bureau of Economic Analysis. Production is represented as a linear function.
- The 2009 NETL data and 2008 IMPLAN data upon which the economic model is based are the most recent data available. These data are assumed to be representative of the current economic structure.
- Impact estimates are interpreted as average impacts, such as average employment per economic sector.
- Recovery Act spending of \$92,000 creates one job-year per guidance provided by the Executive Office of the President–Council of Economic Advisers from their May 2009 report titled *Estimates of Job Creation From the American Recovery and Reinvestment Act of 2009* (Council of Economic Advisors, 2009).

For a given set of inputs, such as operational expenditures, salary and benefits, and award information from NETL OR, PA, and WV facilities, the outputs include information regarding the impact of these facilities on the regional and national economies as well as job creation. Impact results include industry-specific numbers of full-time equivalents (jobs), income, output, and value added by component. Value added components include household compensation, proprietors' income, other property type income, and indirect business taxes, all of which follow standard national accounting convention definitions. The model also generates an array of estimated tax impacts. In addition, estimates of job creation and retention impacts from FY 2009 NETL Recovery Act awards are provided.

Findings

The table below presents NETL's direct impact on the nation's economy during 2009. Data include employment, wages, and salaries of the 689 federal employees working at NETL. It also includes NETL's direct operational expenditures (e.g., hand tools, copier paper, laboratory supplies), as well as R&D award and grant monies spent within the country. The analysis indicates that through these activities, NETL injected \$17 million directly into Oregon, \$132 million directly into Pennsylvania, \$94 million directly into West Virginia, and \$1.2 billion directly into the national economy in 2009 (all dollar figures in the tables are in millions).

Table 6 Direct Economic Impact of NETL by Region, 2009

Input Category	Oregon	Pennsylvania	West Virginia	United States
Federal Employment (jobs)	57	322	305	689
Federal Wages and Salaries	\$7 M	\$39 M	\$35 M	\$81 M
Federal Operational Expenditures and Federal R&D Awards & Grants	\$11 M	\$94 M	\$59 M	\$1,152 M
Total Direct Impact on the U.S.^a	\$17 M	\$132 M	\$94 M	\$1,234M

^aInputs may not sum to total due to rounding

The impact of NETL on the national economy is greater than the total of the laboratory's direct spending because money spent by NETL is spent again by the recipient employees and U.S. businesses. This "ripple effect" resulted in NETL's total economic impact in the U.S. being approximately \$5.5 billion (see Table 7 below for the indirect and induced employment and expenditure impacts in the US, as well as OR, PA, and WV).

Table 7 Total Economic Impact of NETL by Region, 2009

Impact Category ^a	Oregon	Pennsylvania	West Virginia	United States
Employment (jobs)	364	2,461	1,749	26,327
Expenditures (including wages, salaries, operational, and R&D spending)	\$72 M	\$513 M	\$282 M	\$5,457 M

^a Monetary data adjusted to millions of dollars (\$2009)

The top ten sectors impacted by NETL activities are ranked below by the change in industry total value added. While there is variation across regions, there are some sectors that are present in the top ten for all of the geographic areas. The Operations and Maintenance sector representing NETL operational expenditures, which was expected to be heavily impacted by NETL activities, was one of the top industries for all three states, as well as the nation. Also present in the top ten impacted sectors for all of the models is the State, Local, and Other sector. This sector contains the State Energy and Weatherization grants programs and funding associated with this type of award. The retail trade sector is also heavily impacted by NETL activities, as a consequence of its role in all final consumption. The state and national model impacts to the top ten industries per region are shown in Table 8.

Table 8 Top Ten Industry Impacts per Region

OR Top 10 Industry Impacts

Industry Names	Output(\$M)	Employment (FTEs)	Value Added				Total (\$M)
			Employee Compensation (\$M)	Proprietors Income (\$M)	Property Type Income (\$M)	Indirect Business Tax(\$M)	
O&M	\$11.08	57	\$6.54	\$0.00	\$0.00	\$0.00	\$6.54
State & Local, other	\$5.37	59	\$4.49	\$0.00	\$0.48	\$0.00	\$4.98
Construction, all other and maintenance and repair	\$4.36	40	\$1.75	\$0.36	\$0.20	\$0.03	\$2.35
Retail trade	\$2.36	34	\$0.99	\$0.09	\$0.30	\$0.38	\$1.76
Imputed rental activity for owner-occupied dwellings	\$2.15	0	\$0.00	\$0.00	\$1.34	\$0.27	\$1.60
Wholesale trade	\$1.85	9	\$0.72	\$0.06	\$0.28	\$0.28	\$1.34
Real estate	\$1.55	10	\$0.13	\$0.14	\$0.81	\$0.19	\$1.27
Ambulatory health care services	\$1.40	10	\$0.66	\$0.18	\$0.22	\$0.01	\$1.07
Hospitals (private) and nursing and residential care facilities	\$1.20	13	\$0.76	\$0.03	\$0.02	\$0.02	\$0.83
Miscellaneous professional, scientific, and technical services	\$1.11	9	\$0.31	\$0.14	\$0.22	\$0.01	\$0.68
Sum of the Top 10 Industries	\$32.43	241	\$16.35	\$1.00	\$3.88	\$1.19	\$22.42
Percent of All Industries	45%	66%	76%	58%	60%	72%	71%

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PA Top 10 Industry Impacts

Industry Names	Output(\$M)	Employment (FTEs)	Value Added				Total (\$M)
			Employee Compensation (\$M)	Proprietors Income (\$M)	Property Type Income (\$M)	Indirect Business Tax(\$M)	
O&M	\$48.15	322	\$38.64	\$0.00	\$0.00	\$0.00	\$38.64
State & Local, other	\$35.61	410	\$27.99	\$0.00	\$4.02	\$0.00	\$32.01
Imputed rental activity for owner-occupied dwellings	\$16.84	0	\$0.00	\$0.00	\$16.60	\$2.11	\$12.72
Retail trade	\$16.27	216	\$6.40	\$0.71	\$2.34	\$2.59	\$12.05
Wholesale trade	\$13.36	62	\$5.18	\$0.41	\$1.97	\$2.02	\$9.59
Ambulatory health care services	\$11.35	85	\$5.65	\$1.13	\$1.77	\$0.10	\$8.64
Real estate	\$9.86	53	\$0.79	\$0.95	\$5.25	\$1.21	\$8.20
Colleges, universities, and junior (private) colleges	\$12.02	138	\$7.41	\$0.17	\$0.40	\$0.13	\$8.11
Miscellaneous professional, scientific, and technical services	\$12.32	75	\$4.12	\$1.30	\$2.43	\$0.12	\$7.96
Hospitals (private) and nursing and residential care facilities	\$10.35	113	\$6.48	\$0.31	\$0.18	\$0.14	\$7.10
Sum of the Top 10 Industries	\$186.12	1,475	\$102.65	\$4.99	\$28.97	\$8.41	\$145.02
Percent of All Industries	36%	60%	66%	35%	54%	65%	61%

WV Top 10 Industry Impacts

Industry Names	Output(\$M)	Employment (FTEs)	Value Added				Total (\$M)
			Employee Compensation (\$M)	Proprietors Income (\$M)	Property Type Income (\$M)	Indirect Business Tax(\$M)	
O&M	\$38.89	305	\$35.46	\$0.00	\$0.00	\$0.00	\$35.46
Imputed rental activity for owner-occupied dwellings	\$9.62	0	\$0.00	\$0.00	\$6.75	\$1.35	\$8.10
Retail trade	\$8.78	154	\$3.95	\$0.49	\$1.23	\$1.55	\$7.22
State & Local, other	\$7.00	90	\$5.93	\$0.00	\$0.81	\$0.00	\$6.74
Ambulatory health care services	\$6.07	64	\$3.04	\$1.04	\$0.96	\$0.05	\$5.09
Construction, all other and maintenance and repair	\$7.22	90	\$3.81	\$0.67	\$0.42	\$0.06	\$4.95
Miscellaneous professional, scientific, and technical services	\$6.25	71	\$2.35	\$1.17	\$1.03	\$0.07	\$4.62
Hospitals (private) and nursing and residential care facilities	\$5.98	83	\$4.33	\$0.06	\$0.13	\$0.08	\$4.59
Architectural and engineering services	\$5.54	59	\$2.67	\$1.29	\$0.02	\$0.03	\$4.02
Wholesale trade	\$4.59	33	\$2.04	\$0.10	\$0.76	\$0.78	\$3.69
Sum of the Top 10 Industries	\$99.95	950	\$63.57	\$4.82	\$12.10	\$3.98	\$84.48
Percent of All Industries	35%	54%	72%	51%	50%	57%	65%

National Top 10 Industry Impacts

Industry Names	Output(\$M)	Employment (FTEs)	Value Added				Total (\$M)
			Employee Compensation (\$M)	Proprietors Income (\$M)	Property Type Income (\$M)	Indirect Business Tax(\$M)	
State & Local, other	\$542.62	6,278	\$436.57	\$0.00	\$54.72	\$0.00	\$491.28
Real estate	\$151.44	859	\$11.84	\$13.46	\$76.87	\$17.71	\$119.88
Retail trade	\$160.74	2,002	\$61.25	\$6.19	\$19.71	\$23.90	\$111.05
Imputed rental activity for owner-occupied dwellings	\$153.29	0	\$0.00	\$0.00	\$88.90	\$17.73	\$106.63
Wholesale trade	\$137.24	685	\$48.78	\$4.14	\$18.80	\$19.24	\$90.96
Miscellaneous professional, scientific, and technical services	\$146.46	894	\$45.09	\$14.47	\$23.89	\$1.33	\$84.77
O&M	\$150.52	689	\$81.50	\$0.00	\$0.00	\$0.00	\$81.50
Scientific research and development services	\$119.19	753	\$59.21	\$18.85	(\$9.65)	\$0.50	\$68.91
Ambulatory health care services	\$99.63	774	\$44.05	\$10.42	\$13.47	\$0.75	\$68.70
Federal Reserve banks, credit intermediation, and related activities	\$94.84	385	\$28.03	\$2.31	\$33.44	\$2.35	\$66.13
Sum of the Top 10 Industries	\$1,755.97	13,321	\$816.32	\$69.83	\$320.16	\$83.51	\$1,289.81
Percent of All Industries	32%	51%	56%	40%	54%	60%	55%

In addition, the IO regional and national models developed for this project provide information on the economic impact of NETL activities specific to universities, colleges, and other schools, and small businesses at regional and national levels. The economic impacts of these activities are shown below in Tables 9 and 10, respectively.

Table 9 Economic Impact of NETL Activities to Universities, Colleges, Other Schools, and Other Educational Activities

Impact Category ^a	Oregon	Pennsylvania	West Virginia	United States
Direct Impact of NETL by Region				
Federal Operational Expenditures and Federal R&D Awards & Grants	\$0.3M	\$15M	\$3M	\$87M
Total Economic Impact of NETL by Region				
Employment (jobs)	5	293	33	1,372
Expenditures ^a (including wages, salaries, operational, and R&D spending)	\$1M	\$53M	\$4M	\$246M

^aMonetary data adjusted to millions of dollars (\$2009)

Table 10 Economic Impact of NETL Activities to Small Businesses

Impact Category ^a	Oregon	Pennsylvania	West Virginia	United States
Direct Impact of NETL by Region				
Federal Operational Expenditures and Federal R&D Awards & Grants	\$4M	\$13M	\$3M	\$110M
Total Economic Impact of NETL by Region				
Employment (jobs)	92	228	60	2,123
Expenditures ^a (including wages, salaries, operational, and R&D spending)	\$20M	\$52M	\$12M	\$502M

^aMonetary data adjusted to millions of dollars (\$2009)

NETL also received Recovery Act funding in 2009 to make public investments that save and create jobs, and cushion the impacts of the economic downturn. The state and national Recovery Act funding and employment impacts are shown in Table 11. The \$7.7 billion in NETL Recovery Act funding is not factored into the economic impacts above; this study followed the guidance provided by the Executive Office of the President–Council of Economic Advisers to estimate the job creation and retention impacts from NETL Recovery Act funding, not the IO models described in the methodology section. In addition, the methodology applied to the

Recovery Act funding measures the employment impact over the entirety of the project life; therefore, the Recovery Act results are not comparable to employment impacts presented above that reflect single-year funding and employment.

Table 11 Recovery Act Economic Impact of NETL by Region, 2009

Region	Recovery Act Funding	Employment (Job Years Created or Retained)^a
Oregon	\$81	877
Pennsylvania	\$353	3,832
West Virginia	\$72	779
United States	\$7,724	83,958

^aNot comparable to estimates in other tables due to different job impact methodologies

In closing, NETL conducted this study to document the laboratory's 2009 direct, indirect, and induced economic impacts in OR, PA, WV, and the United States. The findings presented in this report are based on input-output models that used IMPLAN and NETL data, and it is anticipated that the data collection and modeling insights gained from this effort will help guide future economic impact analysis work at the laboratory. In addition to this document, fact sheets that summarize NETL's economic impacts in OR, PA, WV, and the US and are available on NETL's website.

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