NATIONAL RENEWABLE ENERGY LABORATORY

Economic Impact of NREL on Colorado, FY2012

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EXECUTIVE SUMMARY

The U.S. Department of Energy's National Renewable Energy Laboratory (NREL) continues to have a multimillion dollar economic impact on Colorado's economy.

NREL – the nation's primary laboratory for renewable energy and energy efficiency research and development – celebrated its 35th anniversary in 2012. Scientists, researchers, analysts, and other staff at NREL develop renewable energy and energy efficiency technologies and practices, advance related science and engineering, and transfer knowledge and innovations to address the nation's energy and environmental goals. Commercialization and deployment activities engage private- and public-sector organizations to successfully transfer technologies into commercially viable products and businesses for the marketplace.

NREL is a primary employer in the state of Colorado, attracting outside investment and paying higher-than-average wages in the state. The laboratory is one of 10 largest employers in Jefferson County, contributing scientific research and business services jobs to a robust, diversified local economy. Given the nature of the research and development conducted at the NREL, employment and expenditures represent only a fraction of the benefits to the state, which range from university-laboratory-business collaborations, to spinoff technologies that are commercialized, to the development of localized business clusters.

This study quantifies the economic impacts of NREL on Jefferson County and the state of Colorado. The report details the direct, indirect, and induced economic impacts in terms of output, employment, and income. Primary data were collected from multiple departments within NREL. Data responses were verified and supplemented with interviews with facility administrators.

The total economic impact of NREL on the state of Colorado was $814.8 million in FY 2012, with employment impacts of 6,150 and wage impacts of $403.4 million. This level of activity is driven off the $405.5 million in direct facility expenditures in the state and the 2,118 full-time, part-time, and contract workers earning and spending in Colorado. NREL sources a majority of supplies and equipment from companies with operations in Colorado, boosting the overall impact on the state.

Previously conducted studies of NREL pegged the economic impact on the state of Colorado at $588.3 million in 2009, growing to $742 million in FY 2010. This study estimates an economic impact of $814.8 million in FY 2012, 2.4% below $834.8 million in FY 2011, with declines in employment, leases, subcontracted research and development, and other operating expenditures. Total (direct, indirect, and induced) employment impacts were 6,150 in FY 2012 and 6,430 in FY 2011. The majority of economic benefits are derived from operations, including employment.

More than 68% of workers contribute to core research and development at NREL (e.g., engineers, postdoctoral researchers, IT professionals, and research analysts), while 32% are in business support roles (e.g., attorneys, human resources, budgeting, administration, and communications, etc.). The educational foundation of these workers far exceeds the national average—30.6% have a doctorate; 32.4% have a master's; 32.8%, a bachelor's; and 4.2%, an associate's.

Awarded research contracts, one-time construction expenditures, and visitor impacts provide economic benefit to numerous industries across the state, including the ailing construction industry. Construction projects have been significant over the past four years, with expenditures totaling approximately $47.4 million in FY 2009, $97.4 million in FY 2010, $105.2 million in FY 2011, and $113 million in FY 2012. Much of this spending remained in Colorado as the two largest contractors were Colorado companies. The accommodation and food services industry also received a boost via visitors to NREL, with visitor spending ranging between $900,000 and $1.1 million per year.

PURPOSE OF THE STUDY

The Business Research Division (BRD) at the Leeds School of Business was asked by the Alliance for Sustainable Energy, LLC (Alliance) to objectively measure the economic and fiscal impacts of the National Renewable Energy Laboratory (NREL) located in Golden, Colorado, for fiscal 2012. This report also includes an update to the preliminary FY 2011 impacts based on final FY 2011 data.

The Alliance for Sustainable Energy, LLC manages and operates the National Renewable Energy Laboratory (NREL) for the U.S. Department of Energy (DOE). NREL is the DOE's primary national laboratory for renewable energy and energy efficiency research and development. It develops renewable energy and energy efficiency technologies and practices, advances related science and engineering, and transfers knowledge and innovations to address the nation's energy and environmental goals.

METHODOLOGY

This study was conducted in cooperation with the NREL organization. In 2008, 2010, and 2011, similar studies with a comparable methodology were conducted of CO-LABS, a consortium of Colorado-based federally funded scientific laboratories, universities, businesses, local governments, and community leaders. CO-LABS was organized to establish Colorado as a global leader in research and technology, and to facilitate the interaction between the labs and the business community to help develop commercialization.

The research team queried NREL about facility, employment, operating, and capital expenditures (including construction) for fiscal years 2011 and 2012. Data were reorganized by function and applied to a 440-sector IMPLAN input-output model. This model quantified the economic and fiscal impacts of NREL. This study employs the same methodology used to examine FY2009 and FY2010 data in the previous study.

Economic benefits refer to dollars generated and distributed throughout the economy due to the existence of an establishment. *Public revenues* indicate state, county, and local (nonfederal) tax revenues generated due to the existence of an establishment via income taxes, sales taxes, property taxes, and special taxes. *Public costs* refer to the cost of proving government services to the establishment and its employees, both on-site and off-site. Public revenues are included in economic benefits; thus, the net economic benefits are the economic benefits minus public costs.

The sources of impacts that sum to economic benefits, public costs, and public revenues include capital expenditures, operating expenditures, off-site employee effects, and secondary effects.

Capital expenditures refer to the purchase or upgrade of equipment, land, or buildings. For this study, capital expenditures are primarily captured through construction, which includes new construction, tenant improvements, and additions. Economic benefits arise from expenditures on materials, architectural and engineering services, and construction labor. The projects inherently generate tax revenues, including sales taxes on materials, impact fees, and property taxes. Public costs derive from providing government services to the property development and construction workers.

Operating expenditures include ongoing costs for materials, maintenance costs, utilities, and salaries and benefits. Direct public revenues are scarce in relation to operations of federal facilities due to their tax-

exempt status; however, public costs still exist when government services are provided to the establishment (i.e., fire and police protection).

Off-site employee effects take into account the impact of employees' spending incurred outside the workplace. Effects encompass employee spending, including expenditures on housing (rent or own), retail purchases, transportation, entertainment, and other disposable income expenditures. Public revenues include sales taxes and property taxes, while public costs include services to respective households. The off-site impacts rest primarily in the county of employee residence rather than in the locale of the facility.

Multiplier effect estimates the indirect employment and earnings generated in the study area due to the interindustry relationships between the facility and other industries. As an example, consider a manufacturing company operating in Jefferson County. The firm employs managers, engineers, and support staff for its direct manufacturing operations. In addition, the company spends on goods and services to support its manufacturing operations, leading to auxiliary jobs in the community in transportation, accounting, utilities, retail goods, and so on—the *indirect impact*. Furthermore, employees spend earnings on goods and services in the community, leading to jobs in retail, accounting, entertainment, and so forth—the *induced impact*.

Conceptually, multipliers quantify the number of jobs. Multipliers are static and do not account for disruptive shifts in infrastructure without specifically addressing infrastructure changes. This model uses IMPLAN multipliers aggregated specifically for Jefferson County and for the state of Colorado. Public revenues and public costs are not tabulated due to the unknown residence dispersion of secondary employees.

LITERATURE REVIEW

A review of studies conducted on research laboratories in the United States reveals the industry's strong and lasting economic impact on the country as a whole. While all of these reports do not focus on renewable energy, they unveil the concrete benefits of research in general on the economy.

A significant impact of energy-centered labs lies in their diffusion of benefits throughout state economies. For example, in 2009, the National Energy Technology Laboratory (NETL) paid $81 million in federal wages and salaries to citizens of the United States, including more than $35 million in both Pennsylvania and West Virginia.

Across the country, in 2010, $50 million of $81 million in business expenditures were paid directly to Hawai'i entities by the National Energy Laboratory of Hawai'i Authority (NEHLA). NELHA also provides an innovative framework in energy research as the world's only facility that continually brings ashore pristine supplies of both warm surface and cold deep seawater 24 hours a day, while offering opportunity for precommercial, commercial, research, and educational tenancy of the park. The park serves as the largest diversified economic development project in the state of Hawai'i.

A driver in the positive influence of research laboratories lies specifically in their capacity for employment. In Albuquerque, a total of 584 of 1,658 new hires at Sandia National Laboratory in New Mexico in 2011 were from a New Mexico university. As well, 457 students from schools in New Mexico had year-round internships in the facility that same year. In Illinois, Argonne National Laboratories contributed more than 5,000 new jobs in the state alone in FY 2010, and just a year before, the Brookhaven National Laboratory in New York generated 5,400 jobs in the state. The average annual

employee salary in the Sandia National Laboratory is $90,000, and within Sandia's Science and Technology Park, the average annual employee salary is more than $30,000 greater than the average annual salary—$39,000 for a full-time job—in the Albuquerque metropolitan area.

A review of federal labs illustrates the role they play in supporting local and state business. Of $921 million paid in contract-related payments in 2011, Sandia National Lab paid approximately half to New Mexico businesses. Moreover, about 80% of that amount went directly to small businesses in the state. An intangible but nonetheless significant impact noted by Argonne National Lab is its support of U.S. science and future scientists and engineers. Since 1999, these researchers have produced more than 11,000 scientific publications across many disciplines, and they continue to reach thousands of K−12 students each year through tours, science fairs, competitions, and open houses. Furthermore, the lab contributes to the early research careers of visiting scholars, postdoctoral researchers, and graduate students. This helps foster the development of an increased number of research positions available to scientists and engineers in the nation, and thus provides the potential for overall economic growth because of the high salaries in these fields. While Brookhaven National Lab paid $45 million to New York state contractors, $34.9 million stayed in the lab's hometown of Long Island with Long Island-based contractors.

Lastly, the Business Research Division conducted a study of NREL in 2011 based on final FY 2009 and FY 2010 expenditures, and based on preliminary FY 2011 expenditures. This study estimated total economic impacts of $588.3 million in FY 2009, growing to $742 million in FY 2010, based on growing employment, operating expenditures, and construction outlays.

ECONOMIC OVERVIEW

Data from the Bureau of Economic Analysis show that the economy grew at a real rate of 2% in Q1 2012, and continued at a rate of 1.3% in Q2 and 2.7% in Q3. According to Consensus Forecasts, full-year growth expectations are 2.2% for 2012, with slower growth projected in Q1 2013 but accelerating 2.1% for the full year in 2013. The newest available data for Colorado indicate the state economy grew at a rate of 1.9% in 2011, the 15th-fastest rate in the country—faster than most peer states in the Rocky Mountain region, which increased at a rate of 1.4%.

Nationally, total nonfarm employment fell 6.4% in 25 months, according to data from the Bureau of Labor Statistics. The nation has now spent the last 32 months rebuilding jobs, but the current employment deficit remains at 3%. The United States added on average 156,000 jobs per month in 2012. This number is expected to be marginally higher in 2013. In contrast, the nation was losing in excess of 800,000 jobs per month at the depth of the recession. Colorado, like the nation, lost 6.4% during the recession, and the employment deficit stood at 2.6% in October 2012. The jobs deficit was just over 1% for the combined Denver and Boulder metropolitan region, demonstrating a comparatively strong local economy.

Labor force and employment growth leads to a volatile unemployment rate. Unemployment has been falling nonetheless, with the national rate improving from 10% in October 2009 to 7.9% in October 2012. Colorado peaked at 9% in November 2009, dipping to 7.9% in October 2012. U6 unemployment (which includes underemployment, a measure of labor underutilization) improved to 14.6% in October 2012 (seasonally adjusted), compared to 16 % a year ago and 17.4% at its peak.

Incomes are also demonstrating improvement. In November 2012, the Bureau of Economic Analysis reported that personal income rose 5.2% nationally in 2011 and increased in all of the nation's 366 metropolitan statistical areas. Personal income, disposable personal income, and personal consumption expenditures all increased in nominal terms in October 2012. Nonfarm salary and wages climbed 4.2% in 2011 and were up 7.7% in Q1 2012. Average wages increased 2.5% in 2011.

OUTREACH AND EDUCATION ACTIVITIES

NREL primarily hosts workshops and meetings. The majority of attendance comes from forums (1,949 attendees) and workshops (1,091 attendees). The largest event in terms of attendance was the World Renewable Energy Forum (WREF). NREL fully sponsored 20 events attended by 2,069 attendees and cosponsored an additional 6 attended by 2,003 attendees. NREL also hosted 4 school-oriented events attended by nearly 800 attendees.

The WREF, supported by NREL, was held in Denver May 13-17, 2012. Attendees totaled 1,380, and a keynote speech given by U.S. Secretary of Energy Steven Chu. Jointly sponsored by the American Solar Energy Society (ASES) and the World Renewable Energy Network (WREN), the WREF is the "the longest-running educational event for renewable energy professionals in North America." The next solar conference will be held in Baltimore April 2013. The Colorado Renewable Energy Forum (CREF), which was held alongside the WREF in Denver in 2012, had 520 attendees.

The 24th annual NREL Industry Growth Forum, held in Denver in November 2011, was attended by 425 attendees and featured presentations from more than 200 cleantech startup companies. Since 2003, presenting startups have raised over $4 billion in financing.

The NREL workshops focus on technical topics. One of the school-oriented events was a competition, attended by 390 attendees, in which middle-school teams built and raced solar, hydrogen, and battery powered model cars.

MODEL INPUT DATA AND ASSUMPTIONS

Construction

NREL reported $105.2 million in construction expenditures in FY 2011, growing 7.4% to $113 million in FY 2012. The construction budget was categorized by hard costs, soft costs (e.g., professional fees, engineering and design fees, environmental testing, and nondirect costs), and labor. NREL estimates 62% of materials and 85% of architectural and engineering services were sourced within the state of Colorado. The two primary general contractors on construction projects were JE Dunn Construction and Hasleden Construction, which both have a large presence in the state.

Construction included Phase II of NREL's Research Support Facility, which has approximately 540 staff in 150,000 square feet of space. Construction continued on the Energy Systems Infrastructure Facility, with offices and laboratories for 200−250 staff in approximately 175,000 square feet of space, and on the Ingress/Egress and traffic capacity projects with five-story covered parking for 1,800 cars.

The commercial and institutional buildings multiplier was applied to construction costs.

Operations and Capital Equipment

Operating expenses and capital purchases were provided for supplies, materials, equipment, computers, software, training, services, maintenance, printing, and shipping costs. These estimates excluded labor and benefits, awards, travel, rent, utilities, maintenance, contracted services, and/or construction costs. NREL's operating expenditures totaled $64 million in FY 2011 and remained nearly flat at $63.7 million in FY 2012. Approximately 90% of these expenditures remained within the state of Colorado and 30% stayed in Jefferson County. The federal nonmilitary multiplier was applied to facility expenditures.

Lease payments totaled declined 20.5% to $5.8 million in FY 2011 as NREL reduced its portfolio of rented buildings. Lease payments declined another 15.5% in FY 2012 to $4.9 million. Utilities were estimated at $3 million in FY 2011 and $3.2 million in FY 2012, while maintenance costs were estimated at $2.9 million for both years.

Employment

NREL reported a total of 2,145 full-time equivalent employees (FTEs) in FY 2011.[1] (See Table 1.) The total number of FTEs fell to 2,057 in FY 2012, a decline of 4.1% compared to the prior year. Salary and benefits averaged $92,739 in FY 2011. While total compensation fell 3.1% with employment declines, FY 2012 average wages increased 1%. Salaries are commensurate with educational level—the highest degrees for employees as of 2010 were doctorate's/PhDs (31.5%), master's (32.3%), bachelor's (31.6%), and associate's (4.6%).

TABLE 1: NREL TOTAL EMPLOYMENT, FY 2009-FY 2012

	FY 2011		FY 2012	
Status	**Employment**	**Compensation (Millions)**	**Employment**	**Compensation (Millions)**
Full-Time	1,624	$191.1	1,509	$184.1
Part-Time	113	6.7	122	7.6
Contract	464	1.0	487	1.0
Total[b]	**2,145**	**$198.9**	**2,057**	**$192.7**

[a]Compensation includes salary and benefits.
[b]FTEs include full-time, one-half part-time employees, and contract workers.

Occupations

NREL's operations are the work of scientific and support staff. Positions were segmented by the 36 business units within NREL (e.g., National Wind Technology Center, Renewable Fuels and Vehicle Systems, Finance, Market Transformation Center, etc.). Of the full-time, part-time, and temporary positions working within these units in 2012, approximately 68% were in core research and development, while 32% were employed in business support operations. Core positions include engineers, postdoctoral researchers, IT professionals, and research analysts. Support positions include attorneys, human resources, budgeting, administration, and communications.

Expenditures

Operating and capital expenditures were detailed by expenditure type, including general operating costs, lease payments, supplies, compensation, construction, and subcontracted research and development. Facility expenditures reported from NREL totaled $412 million in Colorado in FY 2011 (Table 2). Expenditures decreased $6.5 million, or by 1.6%, in FY 2012 to total $405.5 million.

[1]Part-time workers were counted as one-half FTE.

TABLE 2: NREL'S COLORADO EXPENDITURES, IN MILLIONS

Expenditures	FY 2011	FY 2012
Labor	$196.2	$189.9
Operating Expenditures	$55.0	$54.7
Lease Payments	$5.8	$4.9
Maintenance and Utilities	$5.9	$6.1
Total Direct Colorado Operations	$262.9	$255.6
Construction	$65.4	$70.7
Subcontracted Research and Development	$83.7	$79.2
Total Colorado Direct Expenditures	**$412.0**	**$405.5**

Data provided by NREL indicate roughly 28% of NREL's FY 2012 Colorado nonlabor operating, capital, and contracted research expenditures are spent within Jefferson County (Table 3).

TABLE 3: NREL'S JEFFERSON COUNTY EXPENDITURES, IN MILLIONS

Expenditures	FY 2011	FY 2012
Labor	$101.6	$96.2
Operating Expenditures	$18.3	$18.2
Lease Payments	$5.8	$4.9
Maintenance and Utilities	$4.3	$4.5
Total Direct Colorado Operations	$130.0	$123.8
Construction	$6.1	$6.6
Subcontracted Research and Development	$27.9	$26.4
Total Jefferson County Direct Expenditures	**$164.0**	**$156.8**

Off-site employee effects

NREL provided the total number of employees living in each ZIP code in Colorado in order to assign off-site economic benefits to their respective counties. More than 98.5% of the employees reside in Colorado, 95% live in the Denver and Boulder metropolitan statistical areas,[2] and 50% live in Jefferson County (Table 4).

TABLE 4: COUNTY RESIDENCES OF NREL EMPLOYEES, 2012

County	Employees	Percentage
Adams	86	5.3%
Arapahoe	48	2.9
Boulder	205	12.6
Broomfield	70	4.3
Denver	269	16.5
Douglas	46	2.8
Jefferson	813	49.9
Other	68	4.2
Colorado	1,605	98.5
Total	**1,629**	**100.0%**

[a]For this calculation, part-time employees are counted as 1.

[2]Including Adams, Arapahoe, Boulder, Broomfield, Clear Creek, Denver, Douglas, Gilpin, Elbert, Jefferson, and Park counties.

Housing statistics were gathered from the U.S. Census Bureau's 2009−2011 American Community Survey[3] for use in the impact model. Data include average household size, percentage of single-family and multifamily units, median home prices, and median rents (Table 5)

TABLE 5: HOUSING DATA, 2009-2011

County	Average Household Size (People)	Single Family[a] (% of Units)	Multi-family (% of Units)	Median Owner-Occupied Unit Value	Median Monthly Rent
Jefferson	2.46	74.5%	25.5%	$259,400	$920
Colorado	2.58	74.0%	26.0%	$235,800	$893

[a]Single family includes mobile homes. Source: American Community Survey 2009-2011, retrieved November 28, 2012

Pupil counts, funding, and taxes were obtained from the Colorado Department of Education, and the number of occupied households was obtained from the 2010 U.S. Census to correspond with the data. Jefferson County property taxes per pupil totaled $2,363—the second highest in the Denver MSA. Statewide, this figure was $2,378. Funding per pupil totaled $6,370 per pupil in Jefferson County and $6,606 statewide (Table 6).

TABLE 6: PUBLIC SCHOOL FUNDING FY 2010-2011

County	Enrollment	Total Program Funding	Funding per Pupil	Taxes	Taxes per Pupil	Households	Pupils per Households
Adams	80,162	545,610,638	$6,806	$111,762,126	$1,394	153,764	0.52
Arapahoe	105,175	692,696,762	$6,586	$214,992,485	$2,044	224,011	0.47
Boulder	53,642	344,482,309	$6,422	$180,206,554	$3,359	119,300	0.45
Broomfield	NA	NA	NA	NA	NA	21,414	NA
Denver	72,770	505,129,562	$6,941	$285,169,022	$3,919	263,107	0.28
Douglas	57,946	363,795,969	$6,278	$125,871,583	$2,172	102,018	0.57
Jefferson	81,192	517,205,296	$6,370	$191,890,325	$2,363	218,160	0.37
Colorado	**791,000**	**5,225,244,885**	**$6,606**	**$1,881,028,126**	**$2,378**	**1,972,868**	**0.40**

Sources: Colorado Department of Education, 2010 Fall Pupil Membership by District, www.cde.state.co.us, retrieved November 28, 2012, and the U.S. Census Bureau.

Consumer spending data were obtained from the Bureau of Labor Statistics's 2011 Consumer Expenditure Survey for MSAs in western states.[4] It is estimated that 25.7% of consumers' income after taxes is spent on taxable retail goods and services in Colorado. This assumes the following taxable goods and services: food away from home; alcoholic beverages; housekeeping supplies; household furnishings and equipment; apparel and services; vehicle purchases; gasoline and motor oil; personal care products and services; audio and visual equipment and services; pets, toys, hobbies, and playground equipment; reading, and tobacco products and smoking supplies. Food for home consumption accounts for 6.4% of taxable income and is not taxed by the state; however, many local areas tax this food.

Indirect Effects

Multipliers were selected based on the published North American Industrial Classification System (NAICS) codes. IMPLAN multipliers were obtained from MIG by matching the NAICS description to IMPLAN's corresponding unaggregated sectors. Employment, earnings, and output multipliers were based on NAICS sector Public Administration (92), and corresponded to "federal, nonmilitary" in

[3]www.Census.gov, retrieved November 28, 2012.
[4]http://www.bls.gov/cex/2011/Standard/region.pdf, retrieved December 4, 2012.

IMPLAN. Other multipliers were selected based on the specified expenditures, including maintenance, construction, operations, and utilities.

Income Taxes

The state income tax rate is 4.63%. However, the effective tax rate is below 3%. (See Table 7.)

TABLE 7: COLORADO INDIVIDUAL STATISTICS OF INCOME, ADJUSTED GROSS INCOME TAX, 2009

Minimum	Maximum	Midpoint	Number of Returns	Colorado Gross Tax (Millions)	Colorado Net Tax (Millions)	Colorado Gross Tax per Return	Colorado Net Tax per Return	Estimated Colorado Gross Tax Rate	Estimated Colorado Net Tax Rate
(Negative Income)		NA	33,536	$0.35	$0.69	$10.29	$20.44	NA	NA
$0	$5,000	$2,500	82,340	$0.36	$0.36	$4.35	$2.77	0.17%	0.11%
$5,001	$10,000	$7,501	119,531	$0.54	$0.55	$4.50	$5.25	0.06%	0.07%
$10,001	$15,000	$12,501	139,504	$9.76	$9.70	$69.95	$77.99	0.56%	0.62%
$15,001	$20,000	$17,501	143,006	$26.29	$26.12	$183.84	$197.51	1.05%	1.13%
$20,001	$25,000	$22,501	139,626	$44.87	$44.57	$321.33	$344.36	1.43%	1.53%
$25,001	$35,000	$30,001	245,832	$137.91	$137.11	$561.00	$583.73	1.87%	1.95%
$35,001	$50,000	$42,501	278,767	$269.18	$266.90	$965.61	$978.80	2.27%	2.30%
$50,001	$75,000	$62,501	311,321	$496.14	$489.77	$1,593.66	$1,580.76	2.55%	2.53%
$75,001	$100,000	$87,501	199,941	$499.73	$491.69	$2,499.37	$2,459.06	2.86%	2.81%
$100,000	$250,000	$175,000	278,924	$1,328.31	$1,296.23	$4,762.27	$4,593.61	2.72%	2.62%
$250,000	> $250,000	$250,000	40,897	$1,035.75	$920.63	$25,325.84	$19,913.01	NA	NA
Total			**2,013,225**	**$3,849.17**	**$3,684.31**	**$1,911.94**	**$1,799.96**	**NA**	**NA**

Source: Colorado Department of Revenue, Office of Research and Analysis, Federal AGI and Tax, All Full-Year Resident Returns.

Property Taxes

Given the tax exempt status of federal properties, the property taxes captured in this study are derived from employees' home property taxes. The Colorado Department of Local Affairs, Division of Property Taxation's *2011 Annual Report,*[5] provides a summary of county, average municipal, average school, and average special property levies in *Section XI: Assessed Valuation, Revenue, and Average Levies by County* (Table 8). Taking the weighted average of property tax by the stated residences of NREL employees provided weighted average mill levies for the state.

TABLE 8: PROPERTY TAX LEVIES, 2011

County	Assessed Valuation 2011	Total Revenue	County Mill Levy	Average Municipal Levy[a]	Average School Levy	Average Special Levy[b]	Total Average County Levy[c]
Adams	$4,572,463,290	$486,881,412	26.806	7.259	56.272	3.598	106.481
Arapahoe	7,428,089,170	745,516,612	17.316	8.001	53.817	3.311	100.365
Boulder	5,627,815,998	485,032,312	24.645	12.057	45.521	1.651	86.185
Broomfield	1,057,183,430	114,594,120	17.511	11.457	52.466	6.696	108.396
Denver	10,937,453,830	819,805,987	28.419	0.000	42.265	1.968	74.954
Douglas	4,504,735,760	475,795,574	19.774	1.854	48.788	4.882	105.621
Jefferson	6,997,605,972	672,425,610	24.346	4.992	48.721	3.659	96.094
Colorado	87,817,088,245	6,612,073,967	18.947	7.745	37.627	2.918	75.294
NREL Weighted Average			23.181	5.172	45.212	3.072	87.401

[a]Municipal revenues are divided by the sum of municipal assessed valuation. [b]Special district revenues are divided by the sum of special district assessed valuation. [c]Average will not add to the total average county levy because denominators (assessed valuation) are not common to all. [d]NREL weighted average weighted by stated 90.9% residence of employees in the Denver MSA. *These figures include tax increment valuation, and all tax revenues attributable to the increment are allocated to the increment financing authority.
Source: http://www.colorado.gov/cs/Satellite/DOLA-Main/CBON/1251590806884, retrieved November 26, 2012.

[5]http://www.colorado.gov/cs/Satellite/DOLA-Main/CBON/1251590806884, retrieved November 26, 2012.

Sales Taxes

State, city, and county tax rates are published by the Colorado Department of Revenue (Table 9 and Table 10). The Colorado state sales tax rate is 2.9%.

TABLE 9: COUNTY SALES TAX RATES

County	County Rate	RTD	Scientific and Cultural Facilities	Total County
Adams	0.75%	1.00%	0.10%	1.85%
Arapahoe	0.25	1.00	0.10	1.35
Boulder	0.80	1.00	0.10	1.90
Broomfield[a]	4.15	1.00	0.10	5.25
Denver[a]	3.62	1.00	0.10	4.72
Douglas	1.00	1.00	0.10	2.10
Jefferson	0.50	1.00	0.10	1.60

Note: Does not include local improvement districts in dispersed areas of the counties.
[a]County and city tax rates are combined in Broomfield and Denver.
Source: https://www.colorado.gov/revenueonline/#2, retrieved November 26, 2012.

TABLE 10: CITY TAX RATES

City	City Rate
Arvada	3.46%
Aurora	3.75
Boulder[a]	3.41
Brighton	3.75
Broomfield	4.15
Denver[a]	3.62
Erie	3.50
Golden	3.00
Lafayette	3.50
Lakewood	3.00
Littleton	3.00
Longmont	3.28
Louisville	3.50
Westminster	3.85

[a]Boulder and Denver have an alternative tax on food and liquor for immediate consumption (3.56% and 4%); Fort Collins has an alternative tax on food for home consumption (2.25%).
Source: https://www.colorado.gov/revenueonline/#2, retrieved November 26, 2012.

Cost of Government

NREL undoubtedly provides economic benefits and public revenues to Colorado through operations and employees' off-site impacts. However, costs exist in providing state, county, and local government services to the facilities and their employees, including general government administration, public works (e.g., roads, utilities), public safety (e.g., fire protection, police protection), parks and recreation, and so forth. Comprehensive annual financial reports (CAFRs) were used as resources to identify these costs at state, county, and city levels. Costs were assigned to residents and businesses based on government function, and per capita expenses were derived using total business employment and residential population as denominators. The cost of providing state government services was estimated at $1,223

per resident and $1,151 per employee. The average cost of providing city and county government services totaled $498 per resident and $428 per employee.

Visitor Effects

Visitor effects primarily result from out-of-town visitors to the study area due to the existence of the facility. This typically includes management, employees, and scientists visiting the facility for operational meetings, training, or research. Benefits sum from the visitors' expenditures on hotels and motels, vehicle rentals, dining, and other miscellaneous expenditures. Public revenues derive from sales and accommodation taxes paid on the visit. Given the relatively small number of visitors in comparison to local business activity and visitation, additional public costs, such as additional police and fire protection, are considered marginal.

NREL reported 13,730 visitors in FY 2012. Overnight visitors to NREL were estimated at more than 2,400 in FY 2012. Visitors attended conferences, presentations, meetings, tours, fact-finding missions, and partnership meetings, and participated in focus groups. These individuals stayed an average of 1.9 nights. Day visitors totaled 13,730.

TABLE 11: NREL VISITORS

Fiscal Year	Allowable Lodging Rate	Per Diem	Travel Day Per Diem
2011	$141	$66	$50
2012	$149	$66	$50

Source: Lodging and per diem obtained from the U.S. General Services Administration, http://www.gsa.gov/portal/category/100120, retrieved December 4, 2012.

Federal allowable lodging expenses in Jefferson County in FY 2012 were $149 per night (excluding taxes), and per diem for meals and expenses totaled $66. Based on the overnight visitation numbers, visitor spending totaled nearly $1 million in FY 2012.

ECONOMIC IMPACT

Impact on Colorado

The net economic benefit of NREL on the state of Colorado totaled $834.8 million in FY 2011 (Table 12). Total impacts fell 2.4% in FY 2012, to $814.8 million. Total (direct, indirect, and induced) employment impacts totaled 6,428 in FY 2011 and declined to 6,151 in FY 2012. The majority of economic benefits derived from operations, including employment. Awarded research contracts, one-time expenditures on construction, and visitor impacts provided economic benefit to numerous industries across the state, including the ailing construction industry.

Given the tax-exempt status of the federal facilities, public revenues (city, county, school, and special) are largely derived from employee income taxes, off-site sales, and property taxes. While federal facilities are tax exempt, they do receive government services, including police and fire protection and the benefits of parks and roads. The costs of providing government services (state, city, county, school, and special) to the facilities, employees, and Colorado residents nearly equaled collected revenues.

TABLE 12: NREL IMPACT ON COLORADO

	Impact Type	Employment	Labor Income, Millions	Output, Millions
2011	Direct Effect	3,138	$271.0	$412.8
	Indirect Effect	1,078	$53.5	$142.8
	Induced Effect	2,212	$90.9	$279.1
	Total Effect	6,428	$415.3	$834.8
2012	Direct Effect	3,021	$263.1	$406.1
	Indirect Effect	1,024	$52.0	$139.4
	Induced Effect	2,106	$88.3	$269.4
	Total Effect	6,151	$403.4	$814.8

Impact on Jefferson County

The net economic benefit of NREL on Jefferson County totaled $288.7 million in FY 2011, before slipping 4.9% to $274.6 million in FY 2012 (Table 13). The majority of economic benefits were derived from operations, including employment. Awarded research contracts, one-time expenditures on construction, and visitor impacts provided economic benefit to numerous industries in Jefferson County, including the ailing construction industry.

TABLE 13: NREL IMPACT ON JEFFERSON COUNTY

	Impact Type	Employment	Labor Income, Millions	Output, Millions
2011	Direct Effect	1,436	$122.4	$164.7
	Indirect Effect	334	$16.9	$40.9
	Induced Effect	707	$27.6	$83.0
	Total Effect	2,476	$166.9	$288.7
2012	Direct Effect	1,371	$115.9	$157.5
	Indirect Effect	309	$16.0	$38.9
	Induced Effect	656	$26.1	$78.1
	Total Effect	2,336	$158.1	$274.6

CONCLUSION

NREL provided significant economic benefits to Colorado and Jefferson County in FY 2011 and FY 2012. Statewide economic impacts were estimated at $835 million in FY 2011 and $815 million in FY 2012. Direct and indirect employment totaled an estimated 6,430 and 6,150 jobs in FY 2011 and FY 2012 statewide.

While quantifying the laboratory's benefits to the state and the county presents important economic metrics, further research may be done to capture the downstream benefits of tech transfer, commercialization, and enterprise creation.

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APPENDIX 1: LITERATURE REVIEW

ARGONNE NATIONAL LABORATORY, ILLINOIS

In 2011, Anderson Economic Group, LLC published an economic analysis of the Argonne National Laboratory for the University of Chicago. Highlights include:

- Argonne is responsible for almost 5,000 new jobs in Illinois.
- Argonne has generated almost $700 million in net new earnings for households and businesses in 2010.
- The laboratory supports U.S. science by hosting important science infrastructure and contributing to the pipeline of future scientists and engineers.

BROOKHAVEN NATIONAL LABORATORY, LONG ISLAND, NEW YORK

In 2009, Appleseed Inc. published an economic analysis of the Brookhaven National Laboratory. Findings include:

- In FY 2009, $704 million in economic impact was generated by the lab and its visitors.
- In FY 2009, 5,400 jobs were created throughout New York State.
- In FY 2009, of the 3,000 employees, 98% were living on Long Island.
- In FY 2009, of the more than 3,000 visiting researchers from university, corporate, and government institutions, nearly 700 were from New York State.
- Employment grew 12% from 2006 to 2009.
- In FY 2009, 2 million in goods and services were purchased from New York State companies, including $62.7 million from Long Island companies.
- A total of $45.1 million was paid to New York State contractors, including $34.9 million to Long Island-based contractors.

NATIONAL ENERGY LABORATORY OF HAWAI'I AUTHORITY (NELHA)

In 2012, the Economic Research Organization at the University of Hawai'i (UHERO) published an economic impact of the NELHA Ocean Science and Technology Park located in Kailua-Kona, Hawaii. Report highlights include:

- Total expenditures from businesses at NELHA in 2010 were $81.0 million, of which about $50 million was paid to Hawaii entities.
- In 2011, NELHA generated 583 jobs in Hawai'i.
- UHERO estimated the total economic output to the greater Hawaii economy was $87.7 million, which generated $4.5 million in state tax revenue in 2010.

THE NATIONAL ENERGY TECHNOLOGY LABORATORY (NETL)

In 2011, the U.S. Department of Energy published an economic impact assessment of NETL in 2009 on Oregon, Pennsylvania, and West Virginia, as well as the nation as a whole. Using an input-output model, highlights of the report include:

- In FY 2009, 689 jobs were created in the United States, as well as more than 300 in both Pennsylvania and West Virginia, and 57 in Oregon.
- In FY 2009, $81 million was paid in federal wages and salaries to the United States, including more than $30 million in both Pennsylvania and West Virginia, and over $7 million in Oregon.
- In FY 2009, the total direct impact on the United States was $1.2 million.

SANDIA NATIONAL LABORATORIES

In 2011, an economic impact analysis of the Sandia National Laboratory on the state of New Mexico was conducted. Notable findings include:

- In FY 2011, out of 1,658 new hires, 584 graduated from a New Mexico university and 457 students were participating in year-round internships.
- In FY 2011, of the $920.8 million paid in total contract-related payments, 42% or $386.6 million was directly paid to New Mexico businesses.
- Of the FY 2011 total contract-related payments in New Mexico, 77%, or $296.1 million, was paid to small businesses.
- In FY 2011, more than $1.4 billion was paid in labor and noncontract related payments.

SANDIA SCIENCE AND TECHNOLOGY PARK (SS&TP)

In May 2012, the Mid-Region Council of Governments published an economic impact assessment of the Sandia Science and Technology Park located in southeast Albuquerque. Highlights include:

- The average annual salary across all industries in the park is more than $70,000, about $30,000 higher than in the Albuquerque area. This average salary includes Sandia National Laboratory employees, who represent about 42% of all employees in the SS&TP and earn about $90,000 per year on average.
- In addition to nearly 2,500 direct jobs at the end of 2011, the analysis indicates that for every job within the SS&TP, 1.7 additional jobs were created in the region.
- Because most of the impacts from the SS&TP are the result of employment and wages, the secondary benefits are expected to be sustained.
- The park represents a viable and attractive location for other high-tech companies.