

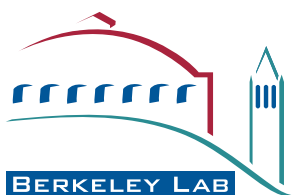


# **Economic Impact Study 2007**

*for*

**Lawrence Berkeley National Laboratory**

**Prepared by  
CBRE consulting, inc,  
Sedway group**





**STEVEN CHU**  
**DIRECTOR**

January 7, 2008

Dear Friend of Berkeley Lab:

Lawrence Berkeley National Laboratory has recently updated its 1996 and 2001 Economic Impact studies, and I would like to share the latest results with you. Most importantly, the data tells us that Berkeley Lab's substantial economic benefit for the local community and the region is greater than ever. Data used for this study came from fiscal year 2004-05 numbers, and does not include the EBI and JBEI initiatives or the impact of the Molecular Foundry. Today's impacts are even greater.

Here are the key figures that our analysis has confirmed:

- The Lab's overall economic impact – that is, the effect brought by direct, indirect and induced spending – on the global economy is an estimated \$1.4 billion a year;
- The impact on nine Bay area counties comprising the San Francisco region is \$682 million annually;
- In Berkeley, direct spending of \$104.4 million, plus indirect and induced spending of an additional \$81.6 million, results in a total economic impact of \$186 million a year;
- Within the State of California, Berkeley Lab's combined impact is calculated at \$800 million.

In addition, an estimated 11,700 jobs resulted from the Lab's direct spending and its related indirect and induced spending, and more than 20 startups – with a market capitalization of more than \$2.5 billion – emerged from Lab technologies. Add to this the spending by the Lab's 2,500 guest researchers annually, and the total impact becomes even more impressive.

The future, too, looks bright, with four major building projects on the Hill planned over the next five years. The estimated \$360 million in project costs will translate into building industry and supply contracts as well as job opportunities and regional economic growth.

I hope you will take the opportunity to review the attached report summary, and to forward to me any questions you might have. Berkeley Lab looks forward to continuing its strong regional partnerships with business and industry for our mutual economic benefit as it addresses the world's scientific and technological challenges.

Sincerely,

Steve Chu

## I. SUMMARY OF FINDINGS

### PURPOSE OF STUDY

CBRE Consulting was engaged to conduct an economic impact analysis demonstrating the benefits of Lawrence Berkeley National Laboratory ("Berkeley Lab" or "LBNL") to the City of Berkeley, the Bay Area region, and the State of California. Such a study is designed to help Berkeley Lab understand and demonstrate its impacts on the local community, the surrounding region, and beyond. These impacts are many, but for the purpose of the study CBRE Consulting focused on job generation, wages, and local and regional spending. At the end of this report is an appendix that explains the study methodology and the various impact effects.

### STUDY FINDINGS

The following table summarizes the findings of this study. It was determined that during its 2004 to 2005 fiscal year Berkeley Lab contributed nearly \$105 million directly to the economy of Berkeley. Including indirect and induced spending, the contribution rises to over \$186 million. Total economic impact on California for the same period was estimated at almost \$800 million, and Berkeley Lab's gross economic impact on the global economy was estimated at nearly \$1.4 billion.

Spending by Geography	Direct Spending (1)	Multiplier (Weighted Average) (2)	Indirect and Induced Spending	Total Direct, Indirect, and Induced Spending (3)	Percentage of Total Impacts
<b>City of Berkeley</b>					
Purchasing	\$14,466,793	0.2188	\$3,165,769	\$17,632,562	
Payroll	\$52,850,279	1.0700	\$56,547,782	\$109,398,061	
Capital Expenditures	\$37,170,179	0.5912	\$21,973,796	\$59,143,975	
<b>Total:</b>	<b>\$104,487,251</b>	<b>0.7818</b>	<b>\$81,687,347</b>	<b>\$186,174,598</b>	<b>13%</b>
<b>All Bay Area (4)</b>					
Purchasing	\$62,480,754	0.6411	\$40,057,701	\$102,538,455	
Payroll	\$230,610,241	1.2180	\$280,893,855	\$511,504,096	
Capital Expenditures	\$37,541,307	0.8145	\$30,577,340	\$68,118,647	
<b>Total:</b>	<b>\$330,632,302</b>	<b>1.0632</b>	<b>\$351,528,896</b>	<b>\$682,161,198</b>	<b>49%</b>
<b>All California</b>					
Purchasing	\$125,596,556	0.4855 (5)	\$60,975,484	\$186,572,040	
Payroll	\$233,761,124	1.3034	\$304,686,210	\$538,447,334	
Capital Expenditures	\$37,541,307	0.9734	\$36,543,037	\$74,084,344	
<b>Total:</b>	<b>\$396,898,987</b>	<b>1.0134</b>	<b>\$402,204,731</b>	<b>\$799,103,718</b>	<b>58%</b>
<b>All US/International (6)</b>					
Purchasing	\$248,402,666	1.2390	\$307,777,204	\$556,179,870	
Payroll	\$237,794,801	2.0057	\$476,945,865	\$714,740,666	
Capital Expenditures	\$37,541,307	2.0725	\$77,804,332	\$115,345,639	
<b>Total:</b>	<b>\$523,738,774</b>	<b>1.6469</b>	<b>\$862,527,401</b>	<b>\$1,386,266,175</b>	<b>100%</b>

Note: Figures may not total due to rounding.

(1) Spending and multiplier calculations are cumulative of all inclusive geographies.

(2) Multipliers are not additive.

(3) Total spending is equal to direct spending plus indirect and induced spending.

(4) All Bay Area includes the City of Berkeley.

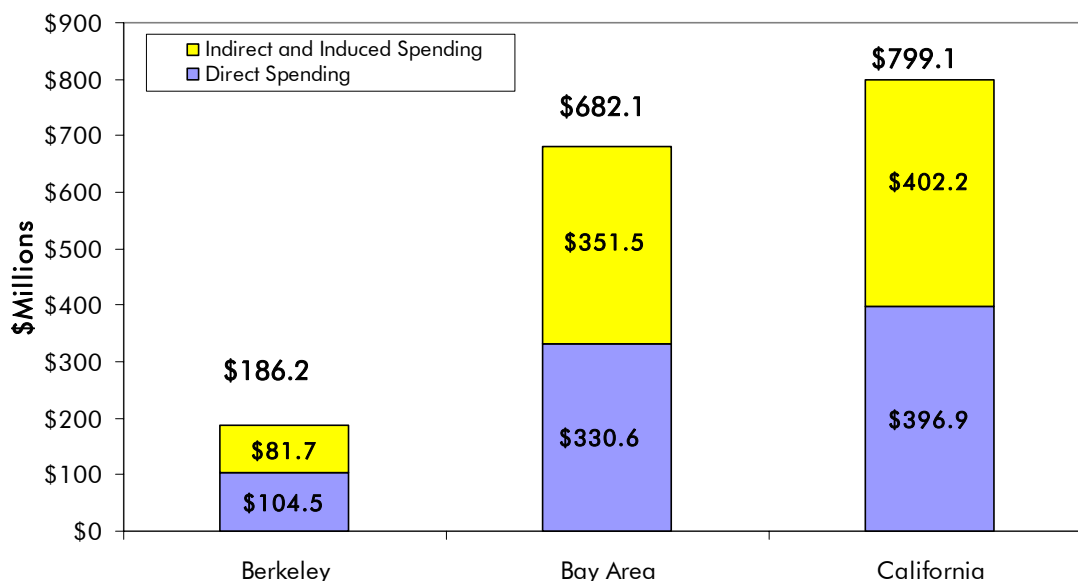
(5) All California purchasing includes approximately \$50 million in fringe benefits that have no associated multipliers. Thus the weighted average multiplier for All California purchasing is artificially low.

(6) Includes only \$2.5 million in direct expenditures spent internationally, thus these dollars are included in direct spending totals only.

Sources: LBNL CFO Office - Procurement and Property; LBNL Office of Capital and Physical Planning; LBNL Office of Design and Construction; LBNL Controller's Office; and CBRE Consulting.

The findings from Table 1 are also graphically presented in Figure 1. From this, one can visually see that 49 percent of combined direct and indirect/induced spending occurred in the Bay Area, and 13 percent occurred in just the City of Berkeley.

**Figure 1: Total Spending Impacts,  
Lawrence Berkeley National Lab, FY 2004-05**



A summary of Berkeley Lab's spending in FY 2004-05 is presented in Table 2, which highlights that total spending equaled approximately \$523.7 million, with \$330.6 million occurring within the Bay Area.

Type of Expenditure	Total Spending	Bay Area Spending (\$)	Bay Area Spending (%)
Salaries and Wages	\$237,794,801	\$230,610,241	97%
Goods & Services (1)	\$248,402,666	\$62,480,754	25%
Construction	\$37,541,307	\$37,541,307	100%
<b>Total</b>	<b>\$523,738,774</b>	<b>\$330,632,302</b>	<b>63%</b>

Note: Figures may not total due to rounding.

(1) Includes purchasing for goods and services, and subcontracts.

Sources: LBNL CFO Office - Procurement and Property; LBNL Office of Capital and Physical Planning; LBNL Controller's Office; and CBRE Consulting.

Table 2 indicates that Berkeley Lab's spending in the Bay Area accounts for 63 percent of its total spending. Table 2 also indicates that a majority, or 97 percent, of payroll dollars went to Bay Area residents.

## **TRANSFER OF TECHNOLOGY**

In addition to direct, indirect, and induced economic impacts from payroll, purchasing, and capital expenditures, Berkeley Lab also contributes significantly to economic development through the innovation of new technologies. Unlike typical federal investments in a community, such as a military base, a national laboratory provides the added economic benefit of licensing these new technologies to start-up companies as well as to existing companies – creating new companies and new jobs. Although this report does not calculate the full, multiplier impact of these new companies and jobs on the economy, the direct impact on job creation and capitalization is impressive and is growing.

Since 1990, Berkeley Lab technology has formed the basis for over 20 start-ups, creating approximately 1,000 new jobs in these companies alone. The technologies licensed by these start-ups reflect the mission of a national laboratory to tackle society's most difficult problems in medicine, energy, and the environment. A quick sampling of technologies licensed from Berkeley Lab includes genomics-related software, nanotechnology, drug development, x-ray imaging, materials sciences processing, biomolecular tagging, and energy-efficiency home improvements.

From a purely financial perspective, the impact of start-ups and other licensing agreements from Lab technology is significant. The market capitalization of the 20 plus start-up companies grew to over \$2.5 billion in 2006. Additionally, licensing income to the Lab from new technologies grew from less than \$500,000 in 1997 to more than \$2.5 million in 2005. Approximately \$800,000 of this licensing income was returned to the inventors.

## **GUEST RESEARCHERS**

In the interest of conservatively estimating Berkeley Lab's total economic impact, CBRE Consulting did not include the significant potential spending by guest researchers. Approximately 2,500 researchers visit as guests each year, which equates to roughly two-thirds the number of Berkeley Lab employees. About 40 percent of these guest researchers are working at Berkeley Lab on an average day. While Berkeley Lab does not compensate them, these researchers unavoidably spend money in Berkeley and the surrounding area during their visit. This spending is directed at accommodations, food, transportation, and more.

## II. PAYROLL AND EMPLOYMENT

Payroll and employment for Berkeley Lab have direct, indirect, and induced impacts on Berkeley. Labor covers full-time and part-time employees and includes employees in both research and non-research positions. Part-time employees also include those on variable schedules. All findings relate to FY 2004-05.

### EMPLOYMENT (Table 3):

- Berkeley Lab had 2,684 full-time and 675 part-time employees in FY 2004-05.
- Total fiscal year payroll amounted to \$237.8 million.
- 487 full-time and 255 part-time Berkeley Lab employees reside in the City of Berkeley.
- Payroll to employees residing in the City of Berkeley equaled \$52.9 million.

Employees (1)	City of Berkeley		Bay Area		California		US + International (2)	
	FT	PT	FT	PT	FT	PT	FT	PT
Research	336	184	1,439	407	1,474	420	1,586	452
Non-Research	<u>151</u>	<u>71</u>	<u>1,049</u>	<u>190</u>	<u>1,064</u>	<u>209</u>	<u>1,098</u>	<u>223</u>
<b>Total</b>	<b>487</b>	<b>255</b>	<b>2,488</b>	<b>597</b>	<b>2,538</b>	<b>629</b>	<b>2,684</b>	<b>675</b>
<b>Payroll</b>	<b>\$52,850,279</b>		<b>\$230,610,241</b>		<b>\$233,761,124</b>		<b>\$237,794,801</b>	
Guest Employees (3)	233	113	636	297	686	331	868	423

Note: Figures may not total due to rounding. FT= full-time; PT=part-time.

(1) Employment figures reflect actual headcount, not full-time equivalents.

(2) US + International is the equivalent of all of California plus all remaining US and International employees.

(3) Guest employees are not paid by LBL, and therefore are not included in the LBNL totals.

Sources: LBNL Human Resources Department; LBNL Controller's Office; and CBRE Consulting.

### EQUIVALENT EMPLOYMENT (Table 4):

- Equivalent Employment in the City of Berkeley was 593.
- Bay Area Equivalent Employment was 2,752.
- California Equivalent Employment was 2,810.
- All US/International Equivalent Employment was 2,977.

Geography (1)	Direct Jobs			Multiplier (2) (3)	Indirect and Induced Jobs (4)	Total Direct & Indirect Jobs	Percent of Total Jobs
	(LBNL Employment)	Direct Spending					
City of Berkeley	593	\$104,487,251		9.3498	977	1,570	13%
Bay Area	2,752	\$330,632,302		5.8318	1,928	4,680	40%
California	2,810	\$396,898,987		6.3241	2,510	5,320	45%
<b>All US/International</b>	<b>2,977</b>	<b>\$523,738,774</b>		<b>16.6994</b>	<b>8,746</b>	<b>11,723</b>	<b>100%</b>

Note: Figures may not total due to rounding.

(1) Bay Area includes Berkeley. California includes Bay Area.

(2) Job multipliers are calculated per \$1 million of spending.

(3) The Multiplier is equivalent to Indirect and Induced Jobs divided by the result of Direct Spending divided by one million.

(4) Equivalent Employment was calculated by the Human Resources Department.

Sources: LBNL CFO Office - Procurement and Property; LBNL Office of Capital and Physical Planning; LBNL Controller's Office; and CBRE Consulting

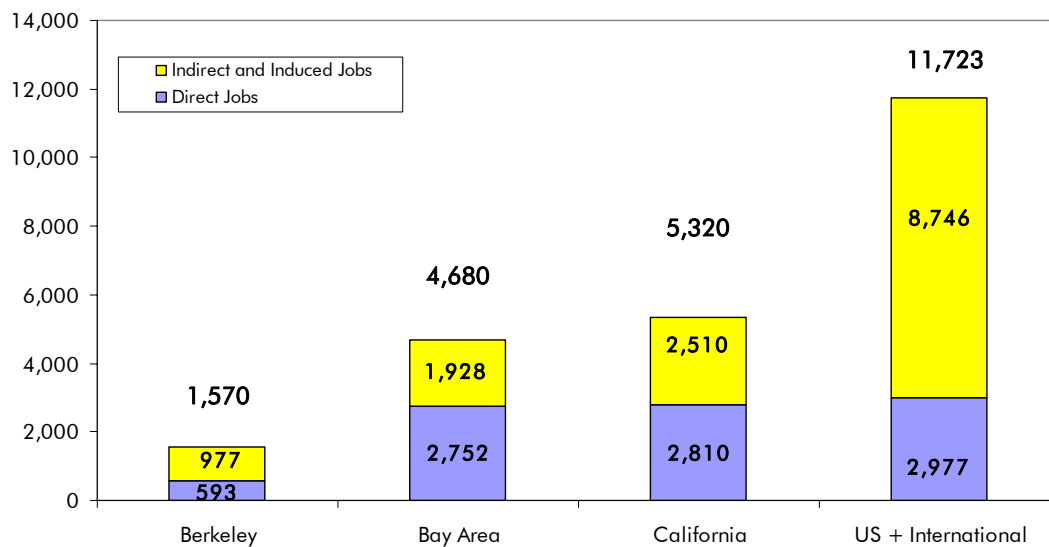
**TOTAL INDIRECT AND INDUCED EQUIVALENT JOBS (Table 4):**

- City of Berkeley indirect and induced jobs were estimated to equal 977.
- Indirect and induced jobs in the Bay Area were estimated to equal 1,928.
- Indirect and induced jobs in California were estimated to equal 2,510.
- Total jobs resulting from direct, indirect, and induced spending across all geographies, including the U.S. and internationally were estimated at 11,723.

**TOTAL DIRECT AND INDIRECT/INDUCED JOBS PRODUCED BY BERKELEY LAB SPENDING (Table 4 and Figure 2):**

- Jobs resulting from Berkeley Lab’s spending totaled 5,320 in California, including both direct and indirect/induced, comprising 45 percent of all jobs.
- 40 percent of the direct and indirect/induced jobs were in the Bay Area, totaling 4,680 jobs.
- 13 percent, or 1,570, direct and indirect/induced jobs were in the City of Berkeley.

**Figure 2: Total Employment Impacts,  
Lawrence Berkeley Lab, FY 2004-05**



### III. PURCHASING AND CAPITAL EXPENDITURES

Purchasing for Berkeley Lab encompasses spending for goods and services and has direct, indirect, and induced impacts on the City of Berkeley. Capital expenditures include construction of new buildings, as well as tenant improvements such as retrofitting, demolition, and upgrading of facilities. All findings are presented for FY 2004-05.

The methodology for estimating indirect and induced economic impacts is based on estimates of direct Berkeley Lab purchasing in particular geographic areas. In order to estimate direct purchasing in this way, Berkeley Lab staff identified the addresses of all vendors and employees that received payment(s) from Berkeley Lab during the 2004-05 fiscal year.

#### DIRECT PURCHASING (Table 5)

- Direct purchasing in the City of Berkeley was approximately \$14.5 million.
- Purchasing in the Bay Area totaled \$62.5 million.
- Direct spending in All California by Berkeley Lab amounted to \$125.6 million.
- Total direct purchasing exceeded \$248.4 million.

<b>Purchasing by Geography</b>	<b>Direct Spending (1)</b>	<b>Multiplier (Weighted Average) (2)</b>	<b>Indirect and Induced Spending</b>	<b>Total Direct, Indirect, and Induced Spending (3)</b>
<b>City of Berkeley</b>	\$14,466,793	0.2188	\$3,165,769	\$17,632,562
<b>All Bay Area (4)</b>	\$62,480,754	0.6411	\$40,057,701	\$102,538,455
<b>All California</b>	\$125,596,556	0.4855	\$60,975,484	\$186,572,040
<b>All US/International</b>	\$248,402,666	1.2390	\$307,777,204	\$556,179,870

Note: Figures may not total due to rounding.

(1) Spending and multiplier calculations are cumulative of all inclusive geographies.

(2) Multipliers are not additive, and rounding may appear to distort the totals in this table.

(3) Total spending is equal to direct spending plus indirect and induced spending.

(4) All Bay Area includes the City of Berkeley.

Sources: LBNL CFO Office - Procurement and Property; LBNL Office of Capital and Physical Planning; LBNL Office of Design and Construction; LBNL Controller's Office; and CBRE Consulting.

#### INDIRECT AND INDUCED PURCHASING (Table 5):

- Indirect and induced spending created in the City of Berkeley was estimated to equal \$3.2 million.
- Bay Area indirect and induced spending was estimated to equal \$40.1 million.
- Berkeley Lab indirect and induced spending in California was estimated to equal \$61.0 million.
- Total Berkeley Lab indirect and induced spending equaled an estimated \$307.8 million.

#### TOTAL DIRECT AND INDIRECT/INDUCED PURCHASING (Table 5):

- Direct and indirect/induced spending created in the City of Berkeley was estimated to equal \$17.6 million.
- Bay Area direct and indirect/induced spending was estimated to equal \$102.5 million.
- Berkeley Lab direct and indirect/induced spending in California was estimated to equal \$186.6 million.
- Total Berkeley Lab direct and indirect/induced spending was \$556.2 million.



**MAJOR CAPITAL PROJECTS (Table 6):**

- The largest single capital project was the construction of the Molecular Foundry Building, which cost \$37.6 million.
- \$1.6 million was spent on tenant improvements to the Potter Building.
- \$1.2 million was spent on the renovation of the JGI Data Center.
- Capital projects totaled \$48.8 million, of which \$37.5 million was invoiced in FY 2004-05.

<b>Table 6: Lawrence Berkeley Lab Major Capital Projects, FY 2004-05</b>	
<b>Project</b>	<b>Expenditure</b>
B67 Molecular Foundry Building Construction	\$37,626,257
B977 Potter Building Tenant Improvements	1,606,796
B400 JGI Data Center Renovation	1,166,579
B64 Lab & Office Space Renovation	534,747
Health & Safety Improvements Projects	465,028
B51 Demolition Relocations	456,533
B939 Tenant Improvements	436,171
B943 Electrical System Upgrade for Computer	422,500
SCADA Fiber Network System Installation	310,966
All Others	<u>5,822,469</u>
<b>Total</b>	<b>\$48,848,046 (1)</b>
<b>Total Capital Projects invoiced in FY 2004-05</b>	<b>\$37,541,307</b>

(1) Major capital projects are total project cost, and not the invoices for this fiscal year.

Sources: LBL Office of Capital and Physical Planning; and CBRE Consulting.

**CAPITAL EXPENDITURES (Table 7):**

- Berkeley Lab's capital expenditures resulted in an estimated \$22.0 million of indirect and induced spending in Berkeley.
- The total economic impact on Berkeley of Berkeley Lab's capital expenditures was estimated to be \$59.1 million.

<b>Table 7: Lawrence Berkeley Lab Capital Expenditure, FY 2004-05</b>				
<b>Expenditure by Geography</b>	<b>Direct Spending (1)</b>	<b>Multiplier (Weighted Average) (2)</b>	<b>Indirect and Induced Spending</b>	<b>Total Direct, Indirect, and Induced Spending (3)</b>
City of Berkeley	\$37,170,179	0.5912	\$21,973,796	\$59,143,975
All Bay Area (4)	\$37,541,307	0.8145	\$30,577,340	\$68,118,647
All California	\$37,541,307	0.9734	\$36,543,037	\$74,084,344
US + International	\$37,541,307	2.0725	\$77,804,332	\$115,345,639

Note: Figures may not total due to rounding.

(1) Spending and multiplier calculations are cumulative of all inclusive geographies.

(2) Multipliers are not additive, and rounding may appear to distort the totals in this table.

(3) Total spending is equal to direct spending plus indirect and induced spending.

(4) All Bay Area includes the City of Berkeley.

Sources: LBL Office of Design and Construction; and CBRE Consulting.

## IV. INCOME

By adding direct, indirect, and induced impacts, CBRE Consulting was able to get a clear picture of total Berkeley Lab income benefits to both the City of Berkeley and the Bay Area. Total direct and indirect/induced income generates a total personal income figure that is unique and separate from total spending.

This indirect and induced income can be thought of as income earned by non-Berkeley Lab employees, but as a consequence of Berkeley Lab's existence. Indirect and induced personal income is income in addition to the direct payroll of University faculty and staff. The indirect and induced personal income impacts are generated by the spending associated with Berkeley Lab payroll as well as goods and services purchases and capital expenditures. The estimated personal income multiplier associated with the Lab's total spending was 0.69 in FY 2004-05, which indicates that \$1 of Berkeley Lab spending generated \$0.69 in personal income. All findings are presented for FY 2004-05.

### INDIRECT AND INDUCED INCOME FROM BERKELEY LAB SPENDING (Table 8):

- Of the total \$599.5 million in indirect and induced income, which includes employee earnings plus earnings received by vendor employees, \$318.9 million is attributed to the Bay Area.
- Approximately \$45.1 million in indirect and induced income is attributed to the City of Berkeley.

Geography	Direct Spending (1)	Multiplier (1) (2)	Indirect and Induced Income	Total Personal Income Generated	Percent of Total California Income Impacts
<b>Berkeley</b>	\$104,487,251	0.43	\$45,063,030	\$97,913,309	16%
<b>Bay Area</b>	\$330,632,302	0.27	\$88,292,532	\$318,902,773	53%
<b>California</b>	\$396,898,987	0.28	\$109,189,902	\$342,951,026	57%
<b>All US/International</b>	\$523,738,774	0.69	\$361,735,363	\$599,530,164	100%
<b>Total</b>	<b>\$523,738,774</b>	<b>0.69</b>	<b>\$361,735,363</b>	<b>\$599,530,164</b>	

Note: Figures may not total due to rounding.

(1) Spending and multiplier calculations are cumulative of all inclusive geographies. Direct spending includes payroll.

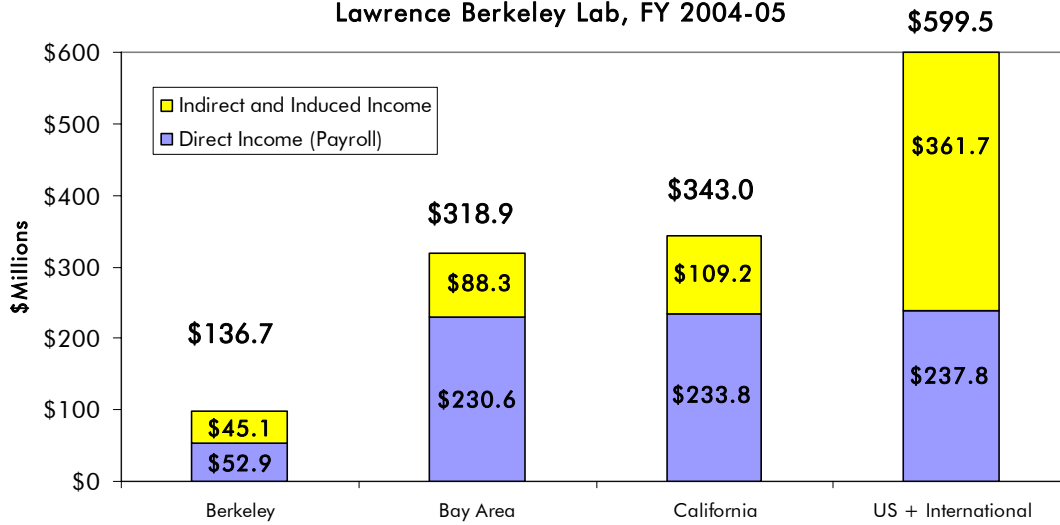
(2) Multiplier is equal to Indirect and Induced Income divided by Direct Spending.

Sources: LBNL CFO Office - Procurement and Property; LBNL Office of Capital and Physical Planning; LBNL Controller's Office; and CBRE Consulting.

### PERSONAL DIRECT AND INDIRECT/INDUCED INCOME GENERATED FROM BERKELEY LAB (Table 8 and Figure 3):

- Berkeley Lab spending generated a total of \$599.5 million in personal income in FY 2004-05.
- 53 percent of the personal income generated by Berkeley Lab was in the Bay Area.
- 16 percent, or \$97.9 million, of the personal income generated by Berkeley Lab was in the City of Berkeley.

**Figure 3: Total Personal Income Impacts,  
Lawrence Berkeley Lab, FY 2004-05**



- The Lab generated a total of \$318.9 in personal income in the Bay Area.
- A total of \$343.0 million of personal income was generated in California by Berkeley Lab.

## V. CONCLUSIONS

Berkeley Lab is responsible for millions of dollars of spending in the City of Berkeley, as well as employment and indirect increases in income. The overall benefits also include the transfer of technology in the nature of start-up companies and corresponding jobs, licensing income, and the resultant indirect and induced spending, jobs, and income effects of the technology transfer.

### OVERALL BENEFITS TO THE CITY OF BERKELEY (Table 9):

- With overall direct and indirect/induced spending from Berkeley Lab, Berkeley residents and businesses gained \$186.1 million dollars in FY 2004-05.
- In FY 2004-05 Berkeley Lab was responsible for 1,570 equivalent jobs in the City of Berkeley.
- Berkeley Lab spending in FY 2004-05 led to \$97.9 million in personal income in the City of Berkeley, \$318.9 million in the Bay Area, and \$343.0 million in California.
- Berkeley Lab spending resulted in total US and International spending of \$1.4 billion, 11,723 equivalent jobs, and income of \$599.5 million.

<b>Table 9: Lawrence Berkeley Lab Impacts By Geography, FY 2004-05</b>				
	<b>Berkeley</b>	<b>Bay Area</b>	<b>California</b>	<b>US/International</b>
<b>Spending</b>				
Direct	\$104,487,251	\$330,632,302	\$396,898,987	\$523,738,774
Indirect	\$81,687,347	\$351,528,896	\$402,204,731	\$862,527,401
<b>Total Spending</b>	\$186,174,598	\$682,161,198	\$799,103,718	\$1,386,266,175
<b>Employment</b>				
Direct	593	2,752	2,810	2,977
Indirect	977	1,928	2,510	8,746
<b>Total Jobs</b>	1,570	4,680	5,320	11,723
<b>Income</b>				
Direct	\$52,850,279	\$230,610,241	\$233,761,124	\$237,794,801
Indirect	\$45,063,030	\$88,292,532	\$109,189,902	\$361,735,363
<b>Total Income</b>	\$97,913,309	\$318,902,773	\$342,951,026	\$599,530,164

Note: Figures may not total due to rounding.

Source: CBRE Consulting, Tables 1, 3, and 8.

With \$186.2 million spent in the City of Berkeley, almost 1,600 full-time jobs (equivalent), and over \$97.9 million in personal income generated, Berkeley Lab has a direct positive impact on the City of Berkeley economy. Berkeley Lab acts as a vehicle for both non-research and high-paying research positions in the Berkeley economy. The prospect for graduate students as well as newly matriculated students from the University of California Berkeley to obtain higher paying research jobs is dramatically increased with the opportunities offered by Berkeley Lab. Berkeley Lab also acts as a catalyst for construction jobs, which will continue in the long term with new development and building improvements at Berkeley Lab.

## APPENDIX: METHODOLOGY

### STUDY METHODOLOGY

Data provided by Berkeley Lab were entered into a series of linked spreadsheets prepared by CBRE Consulting. The spreadsheets were developed in such a manner that they can be updated in the future by Berkeley Lab.

All data collected and analyzed pertained to the most recent fiscal year for which data were uniformly available from Berkeley Lab (fiscal year 2004 to 2005). Data from Berkeley Lab were generated for four geographic regions, as follows: City of Berkeley, Bay Area (nine-county), the State of California, and all US/International. The data included payroll, spending, and capital expenditures.

CBRE Consulting then analyzed and summarized the data to identify Berkeley Lab's direct impacts on the study geographies. CBRE Consulting quantified the associated indirect impacts (e.g., multiplier impacts). The multiplier impacts of these expenditures and jobs were estimated pursuant to the IMPLAN model for each study geography.<sup>1</sup>

CBRE Consulting developed a basic economic input model to aggregate the data in a meaningful fashion. The model was designed to be relatively automated so that Berkeley Lab can employ it in future years by entering its latest fiscal year data.

### THE MULTIPLIER CONCEPT: INDIRECT AND INDUCED ECONOMIC IMPACTS

The impact of Berkeley Lab on the region's economy is greater than the total of Berkeley Lab's direct spending on salaries and wages, goods and services, and construction. The reason behind this is money spent by Berkeley Lab is spent again by the employees and local businesses that are its recipients. Employees use their salaries and wages to purchase from local businesses. Local businesses make their own purchases and hire employees, who also spend their salaries and wages in the local economy. The multiplier represents the number of times each dollar spent by the Berkeley Lab cycles through the relevant economy, generating additional income and jobs before it effectively leaves the system through savings, taxes, and expenditures made outside the region.

Economic multipliers are generated through the use of input-output models. These are statistical models that quantify relationships among industries. They examine the pattern of purchases by industries and the associated distribution of jobs and wages by industry. Input-output models identify, for example, all the industries from which a construction contractor purchases its supplies and in what proportion. In turn, the model then identifies the industries that are suppliers to these suppliers, or "second generation" suppliers. This continues until all major purchases are accounted for contributing to the construction contractor's original purchases. These original purchases are called the "direct sales." All other associated sales from within the supply chain are considered "indirect and induced sales." There are other indirect and induced effects associated with the contractor purchases. These include retail and other expenditures made by the construction workers paid to use the materials purchased by the construction contractor.

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<sup>1</sup> The IMPLAN model is an input-output economic model designed to assess multipliers for different industry classifications.

The size of these indirect and induced effects depends upon the definition of the region being looked at as well as the nature of the economy within the region. A large region with a closed economy, which means that most needs are being met by industries located within the region, would keep many of the sales, earnings, and jobs impacts within the region. In a region like this, the multiplier effects would be relatively large, with a large share of the effects captured within the region. In contrast, a small region with an open economy, which means an economy with a limited array of producers providing goods and services, would leak sales to other regions. Because many purchases would be made from industries outside the local economy, the multiplier impacts on the local economy would be minimized.

### **THE IMPLAN MODEL**

There are several input-output models commonly used by economists to estimate the preceding “multiplier” effects. Because of the difficulty of measuring multiplier effects, all of the models have limitations. Still, economists generally agree that the models can provide an approximate measure of the indirect and induced spending, total jobs, and personal income generated by a given amount of direct spending in a particular geographic area. To calculate the multiplier effects of Berkeley Lab’s spending, CBRE Consulting used an input-output model developed by the U.S. Department of Agriculture known as IMPLAN (IMpact Analysis for PLANning). The IMPLAN model organizes the economy into 505 separate industries and has comprehensive data on every area of the United States. CBRE Consulting organized all appropriate Berkeley Lab purchasing and payroll into the IMPLAN industry classifications and used the 2002 IMPLAN multipliers for Berkeley, the Bay Area, California, and the US to calculate the total effect of Berkeley Lab’s spending for its most recent fiscal year.

### **METHODOLOGY FOR ESTIMATING DIRECT, INDIRECT, AND INDUCED ECONOMIC IMPACTS**

In conducting this analysis of Berkeley Lab’s total spending impacts, CBRE Consulting worked with Berkeley Lab to limit the estimates of direct spending to those expenditures that could be identified as having occurred in a specific location. For example, the spending associated with a catered event on the Berkeley Lab campus is counted as direct spending in the location of the vendor providing the catering. On the other hand, the estimates of direct Berkeley Lab spending do not include spending that cannot be attributed to the location where the actual purchase or expenditure occurred. For example, the estimate of direct Berkeley Lab spending for the City of Berkeley does not include Berkeley Lab’s reimbursement of a faculty member for a journal subscription, since the reimbursement itself does not reflect the actual location where the journal purchase took place.

There is another important note about the assumptions regarding the geography of impacts. Jobs are counted in the location of the employer, while payroll is assumed to reflect the home address of the employee. For example, for the 2004-05 fiscal year, all direct employment by Berkeley Lab occurs in the City of Berkeley, yet direct Berkeley lab payroll is broken down based on whether the employees live in the City of Berkeley, the Bay Area, or elsewhere in California.

The impact of Berkeley Lab payroll is analyzed differently than the impact of Berkeley Lab goods and services purchasing and capital expenditures. This is because Berkeley Lab’s payroll is a direct expenditure of Berkeley Lab, but is also direct income to the residents who are Berkeley Lab employees. The full amount of Berkeley Lab’s payroll is counted as direct income, based on employees’ places of residence. However, the indirect spending, employment and income

impacts of Berkeley Lab's payroll are based on the spending of Berkeley Lab employees. Employee spending reflects an assumption, provided by IMPLAN, that employee disposable income is equal to 86 percent of earned income. Induced spending, employment and income multipliers associated with disposable income were then applied to the calculated indirect spending estimates in the same way that they were applied to goods and services purchasing and capital expenditures.

#### **AUTOMATED ECONOMIC IMPACT WORKSHEETS**

The model designed for Berkeley Lab is designed to update itself automatically. As long as the purchasing and payroll categories remain the same, the links in the model will update without any additional manipulation to the model. Directions for each sheet are located on the top of each page, and general instructions are included in the "Read Me" tab located at the beginning of the model.