

BUSINESS AND ECONOMIC RESEARCH CENTER
JENNINGS A. JONES COLLEGE OF BUSINESS



Green Jobs in Tennessee:

Economic Impact of Selected Green Investments

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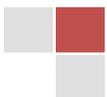
2011

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Disclaimer Notice

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Executive Summary

Although no clear definition exists, the term *green jobs* has been widely used to describe jobs in businesses that are particularly related to renewable energy, energy efficiency, or environmental sustainability. Both federal and state governments have invested significantly in efforts to define and measure the extent of the green economy in the United States. As part of these initiatives, the Business and Economic Research Center has partnered with the Tennessee Department of Labor and Workforce Development to estimate the economic impact of six ground-breaking green investments in Tennessee: Hemlock Semiconductor, Wacker Chemie AG, Volkswagen, Nissan Leaf and Storage Battery Manufacturing, Tennessee Solar Institute and West Tennessee Solar Farm, and eTec Battery Charging Stations.

The purpose of this study is to estimate the economic impact of the investments on Tennessee's economy. This study addresses the following major research questions:

- Where can the six major green investments be classified within the national and local green activity frameworks?
- How many green jobs will be created with these investments?
- What are the major occupations associated with these green investments?

This study used multi-region IMPLAN models to estimate the economic impact of these investments.

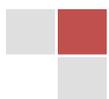
Key Findings

Construction Phase:

- By 2014 total green investments by these six major companies will be more than \$5.5 billion.
- The number of direct green jobs generated in 2011 was 5,674 with a total economic impact of 9,369 jobs across Tennessee.
 - Total number of green construction jobs (direct + indirect + induced) was 6,893.

Operation Phase:

- At full employment level, these companies are expected to employ directly 4,572 people by 2014.
- The total number of permanent jobs is 16,559, of which
 - 10,143 jobs are green jobs.



- These investments are likely to generate increased demand for the following occupational categories and occupations.
 - Green Increased Demand Occupations
 - Team assemblers
 - First-line supervisors
 - Electrical and electronic equipment assemblers
 - Laborers
 - Green Enhanced Skills Occupations
 - Machinists
 - Inspectors and testers
 - Maintenance and repair workers
 - Green New and Emerging Occupations
 - Engineers
 - Solar energy installation managers
 - Logistics engineers and analysts
 - Energy brokers
- The green manufacturing jobs created with these investments represent nearly 1.5 percent of the state's total manufacturing jobs, which may stop the downward trend in the manufacturing sector.

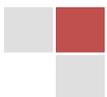
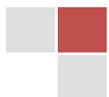


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I. Introduction

Although no clear definition exists, the term *green jobs* has been widely used to describe jobs in businesses that are particularly related to renewable energy, energy efficiency, or environmental sustainability. The driving forces behind this growing emphasis on green jobs are primarily the following interrelated factors:

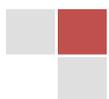
- increasing federal and state environmental regulations and incentives,
- ongoing debate about climate change and the necessity to reduce green house gas emissions,
- efforts to reduce the dependence on fossil fuels for national security reasons, and
- technological changes.

Both federal and state governments have invested significantly in efforts to define and measure the extent of the green economy in the United States. The same is true for European countries. As part of these initiatives, the Business and Economic Research Center (BERC) has partnered with the Tennessee Department of Labor and Workforce Development (TDLWD) to estimate the economic impact of six groundbreaking green investments in Tennessee.

The purpose of this study is to estimate the economic impact of the six investments on Tennessee's economy. A growing body of literature has already addressed many issues surrounding the definition of green jobs, the unit of analysis for identifying green jobs, and green economic activity clusters. After reviewing the existing literature, this study addresses the following major research questions:

- Where can the six major green investments be classified within the national and local green activity framework?
- How many green jobs will be created with these investments?
- What are the major occupations associated with these green investments?

The rest of the paper is organized as follows. Section two briefly summarizes Tennessee's green investment strategies and six major investments since the beginning of the U.S. economic recession. Section three reviews the literature and develops a framework for analyzing these investments. Section four deals with the construction stage of these investments and explores the impact of the resulting temporary green jobs within the green economic activity framework of the Bureau of Labor Statistics (BLS) and TDLWD. Section five addresses the permanent job impact of these green investments on the economies of Local Workforce Investment Areas (LWIAs) in Tennessee. Section six summarizes the study findings.



II. Tennessee's Green Investment Strategy: A Snapshot

As the U.S. economy has experienced one of its worst economic recessions, the state of Tennessee has made several headlines by attracting major investors in the state's fledgling green economy. The state's strategy involves two distinct paths: (1) to build up the state's technical capacity through grants and research and development and (2) to attract major companies to invest in Tennessee's green economy.

For the first path, Tennessee initiated a solar institute to help Tennessee regions build the necessary technical foundation and research and development. Administered by the Tennessee Solar Institute, this initiative resulted in several rounds of grants to companies covering the following major areas:

- technical assistance for marketing and energy audit,
- workforce development,
- renewable energy products,
- process improvements,
- technology improvements,
- facilities and equipment improvements, and
- installation grants.

In addition, once completed, the West Tennessee Solar Farm will be a laboratory environment for researchers to further investigate solar energy generation, storage, and transmission.

For the second path, major manufacturing companies have announced their plans to invest in the state's green economy since 2008. The investors that this report covers are:

- Nissan North America (electric car, the Leaf),
- Nissan North America (storage battery production),
- Volkswagen (efficient diesel car),
- Hemlock Semiconductor (polysilicon),
- Wacker Chemie AG (polysilicon), and
- eTec (battery charging stations).

Table 1 and Map 1 briefly summarize these major green investments. In this study, our unit of analysis is green economic activity as described below. Although this study pays close attention to the types of green jobs created through these investments, the primary goal is to describe, classify, and analyze the impacts of these six green investments on Tennessee's economy.

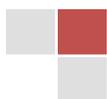


Table 1: Green Investments in Tennessee: Identifying Goods and Services**

Investment	Goods and Services	Industry	NAICS	Green Economic Activity Clusters	
				Bureau of Labor Statistics (BLS)	Tennessee Department of Labor and Workforce Development
(1) Hemlock Semiconductor	Polysilicon	Semiconductor and Related Device Manufacturing	334413	Energy Efficiency	Energy Efficiency
(2) Wacker Chemie AG	Polysilicon	Semiconductor and Related Device Manufacturing	334413	Energy Efficiency	Energy Efficiency
(3.1) The West Tennessee Solar Farm	Solar Energy	Other Electric Power Generation	221119	Energy from Renewable Sources	Renewable Energy
(3.2) The Tennessee Solar Institute	Research and Training	Research and Development in the Physical, Engineering, and Life Sciences	541712	Varies (Innovation & Installation Grants to Diverse Groups of Firms)	Varies (Innovation & Installation Grants to Diverse Groups of Firms)
(4) Volkswagen	Efficient Diesel Cars	Automobile Manufacturing	336111	Energy Efficiency	Energy Efficiency
(5.1) Nissan North America	Electric Car	Automobile Manufacturing	336111	Energy Efficiency	Energy Efficiency
(5.2) Nissan North America	Lithium Ion Battery	Primary Battery Production	335912	Energy Efficiency	Energy Efficiency
(6) eTec	Charging Stations	Other Building Equipment Contractors	238290	Energy Efficiency	Energy Efficiency
(*) All Areas	Construction	Industrial Building Construction	236210	Pollution Reduction and Removal, Greenhouse Gas Reduction, and Recycling and Reuse	Green Construction

Definitions (www.census.gov) for Table 1:

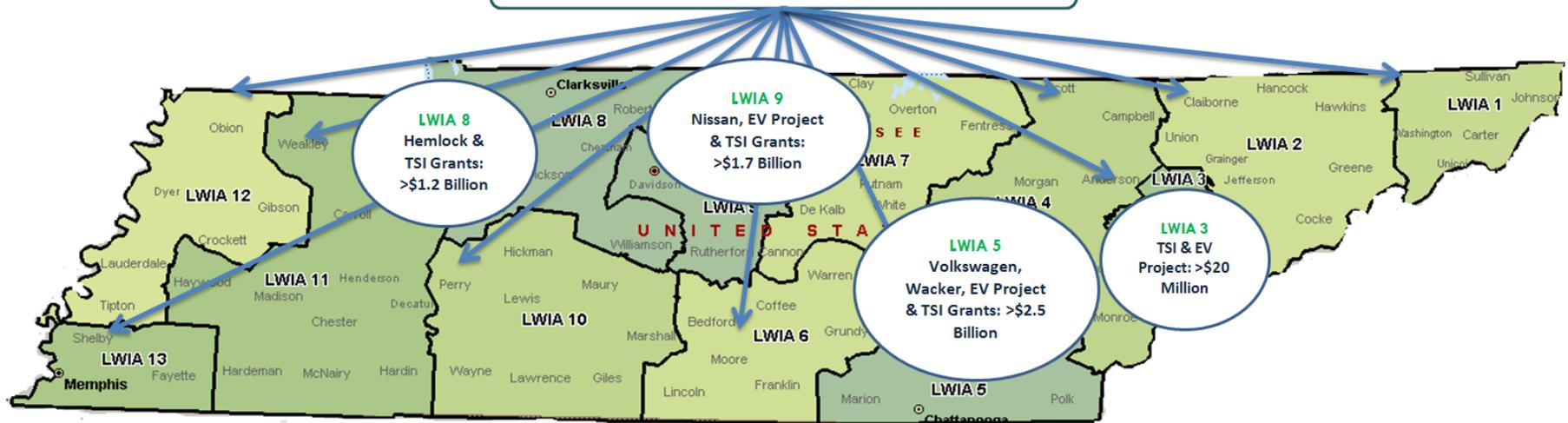
(1, 2) 334413 Semiconductor and Related Device Manufacturing: This U.S. industry comprises establishments primarily engaged in manufacturing semiconductors and related solid state devices. Examples of products made by these establishments are integrated circuits, memory chips, microprocessors, diodes, transistors, solar cells and other optoelectronic devices. **(3.1) 221119 Other Electric Power Generation:** This U.S. industry comprises establishments primarily engaged in operating electric power generation facilities (except hydroelectric, fossil fuel, nuclear). These facilities convert other forms of energy, such as solar, wind, or tidal power, into electrical energy. The electric energy produced in these establishments is provided to electric power transmission systems or to electric power distribution systems. **(3.2) 541712 Research and Development in the Physical, Engineering, and Life Sciences (except Biotechnology):** This U.S. industry comprises establishments primarily engaged in conducting research and experimental development (except biotechnology research and experimental development) in the physical, engineering, and life sciences, such as agriculture, electronics, environmental, biology, botany, computers, chemistry, food, fisheries, forests, geology, health, mathematics, medicine, oceanography, pharmacy, physics, veterinary and other allied subjects. **(4, 5.1) 336111 Automobile Manufacturing:** This U.S. industry comprises establishments primarily engaged in (1) manufacturing complete automobiles (i.e., body and chassis or unibody) or (2) manufacturing automobile chassis only. **(5.2) 335912 Primary Battery Manufacturing:** This U.S. industry comprises establishments primarily engaged in manufacturing wet or dry primary batteries. **(6) 238290 Other Building Equipment Contractors:** This industry comprises establishments primarily engaged in installing or servicing building equipment (except electrical, plumbing, heating, cooling, or ventilation equipment). The repair and maintenance of miscellaneous building equipment is included in this industry. The work performed may include new work, additions, alterations, maintenance, and repairs.

****Important Disclosure:** Information presented in this report regarding the six major green investments has been solely obtained from publicly available sources and does not represent the official position of the companies making these investments. BEREC, however, attempted to gather the same information from the company officials but has not received any information from them in a timely manner.

MAP 1: GREENING TENNESSEE'S ECONOMY: STATE'S INVESTMENT STRATEGIES

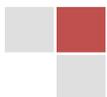
Tennessee Solar Institute (TSI)

Solar Innovation & Installation Grants



Note 1: The figures on the map reflect total investment amount. These figures are estimated by using various print and online media sources, company press releases, environmental assessment reports for the selected investments, and recovery.gov.

Note 2: Dark shades represent the heavy concentration of green investments.



III. Literature and Analytical Framework

The BEREC critically reviewed 40 major studies and surveys conducted between 2008 and 2010 for the purpose of classifying six major green investments in Tennessee. These studies and surveys are listed in the reference section. The review revealed the lack of a standard metric in understanding and analyzing green jobs across the states. In this regard, the recent BLS effort regarding the final definition of green jobs is helpful. The final BLS definition of green jobs was published in the Federal Register on September 21, 2010.

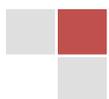
Overall, the literature suggests the following trends in research on green jobs.

- Continuing debate about the definition of *green jobs*: is it a certain type of occupation regardless of industry, an industry-based concept regardless of the type of occupation, or both?
- While some states are still in the process of conducting green jobs surveys, some states have made notable progress in this area. California, Michigan, Washington, and Oregon have already completed surveys.
- California and several European states have moved beyond the conceptual issues regarding green jobs and started a dialogue and partnership between green businesses, government agencies, and educational institutions to address skill issues in a growing green economy.
- Notwithstanding the measurement issues regarding green jobs, a consensus has emerged regarding broader green activity clusters in the literature: renewable energy, energy efficiency, natural resource conservation, environmental sustainability, and education, training, compliance, and public awareness.
- In the area of green occupations, a commonly used typology has emerged: green increased demand occupations, green enhanced skills occupations, and green new and emerging occupations (O*NET OnLine at <http://online.onetcenter.org>).

III.1. Green Jobs, Industries, and Economic Activity Clusters

III.1.a. BLS Green Activity Clusters

To classify the six green investments, the BEREC adapted BLS green jobs terminology. According to the BLS, green jobs are “jobs in businesses that produce goods or provide services that benefit the environment or conserve natural resources,” or “jobs in which workers’ duties involve making their establishment’s production processes more environmentally friendly or use fewer natural resources” (Federal Register, September 21, 2010).

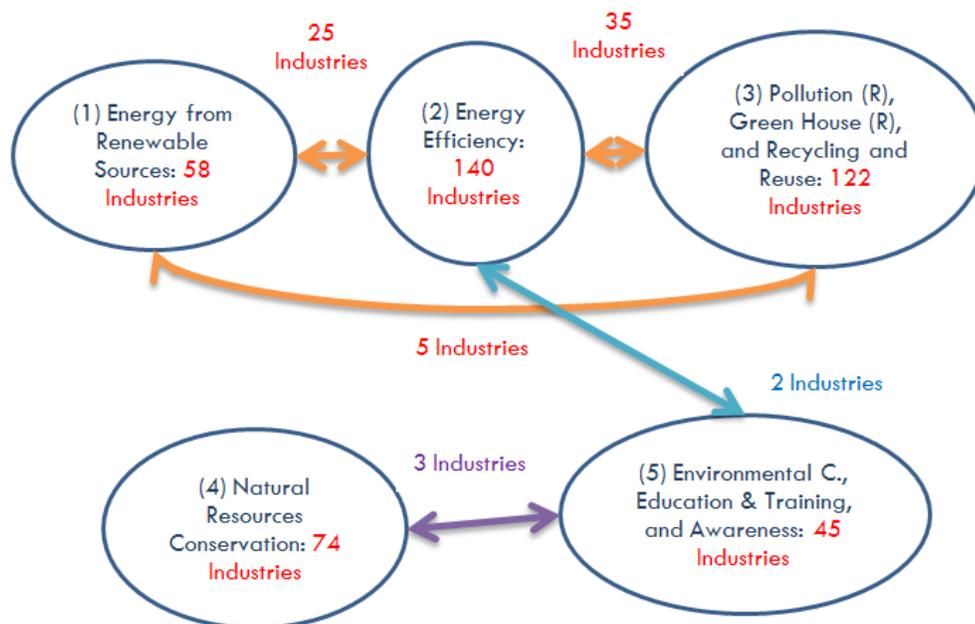


How are these jobs related to overall industry clusters and sectors? The BLS analyzes these jobs under one or more of five economic activity clusters:

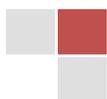
- energy from renewable sources;
- energy efficiency;
- pollution reduction and removal, greenhouse gas reduction, and recycling and reuse;
- natural resources conservation; and
- environmental compliance, education and training, and public awareness.

At the final step of the process, the BLS identifies the six-digit NAICS sectors that belong to one or more of the five clusters. A total of 333 industries is included for green job surveys. The following represents the relationship between industries and clusters. As Chart 1 demonstrates, a considerable overlap between the green economic activity clusters may create measurement problems unless a green job survey is well designed.

Chart 1: BLS Green Jobs, Industry, and Economic Activity Relationships: Overlapping Membership



Other Overlaps: (3) and (4) → 8 Industries; (3) and (5) → 2 Industries; (1), (2) and (3) → 6 Industries; (1), (2), (3) and (4) → 3 Industries; and (1,2,4), (2,3,4), (2,3,5) and (3,4,5) each has one common industry



III.1.b. TDLWD Green Activity Clusters

Tennessee's green job survey started before the BLS published its final green activity clusters. Finalized in May 2011, the TDLWD green job survey assigns industries and jobs to 10 green activity clusters. For more information about the TDLWD green job survey results, see *2011 Tennessee's Green Jobs Report* at www.sourceten.org.

To align the study findings with the TDLWD methodology, this report also tabulates economic impact findings using 10 major green activity clusters selected by the TDLWD green job survey:

- energy efficiency;
- renewable energy;
- sustainable transportation;
- green construction;
- environmental protection;
- agriculture and forestry;
- green manufacturing;
- recycling and waste reduction;
- research, design, and consulting; and
- governmental and regulatory administration.

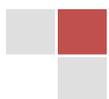
It is important to note that the number of green jobs in this report is in addition to the green jobs identified by the TDLWD green jobs survey.

III.2. Occupational Classifications

Identifying green sectors or economic activity clusters does not mean all jobs under these economic activities are green jobs. What are the green economy-related occupations? Of course, one method of measurement is through surveys. In the absence of a survey, the BEREC relies on the literature to determine the occupations that are somewhat related to the green economy. The literature on occupational employment highlights three linkages between standard occupational classifications and green jobs:

- **Green Increased Demand Occupations:** the function and skill requirements for these jobs do not change, but demand for these occupations increases because of green investments.
- **Green Enhanced Skills Occupations:** these occupations require additional skill if the occupations are employed in green activities.
- **Green New and Emerging Occupations:** these occupations are new and emerging because of green economic activities.

The BEREC found several studies particularly useful in this area:



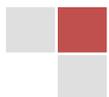
- Environmental Defense Fund. 2009. *Green Jobs Guidebook*. http://www.edf.org/documents/8489_Green%20Jobs%20Guidebook%20FINAL%20with%20cover.pdf
- O*NET OnLine. <http://online.onetcenter.org/>
- Centers of Excellence (COE). 2009. *Understanding the Green Economy in California: A Community College Perspective*. www.coecc.net/green/

For the purpose of identifying types of green jobs, this study first allocates green jobs to occupations using the Bureau of Labor Statistics (BLS) industry staffing pattern (www.bls.gov) and then matches occupational categories with the green job categories developed by O*NET Online at <http://online.onetcenter.org>.

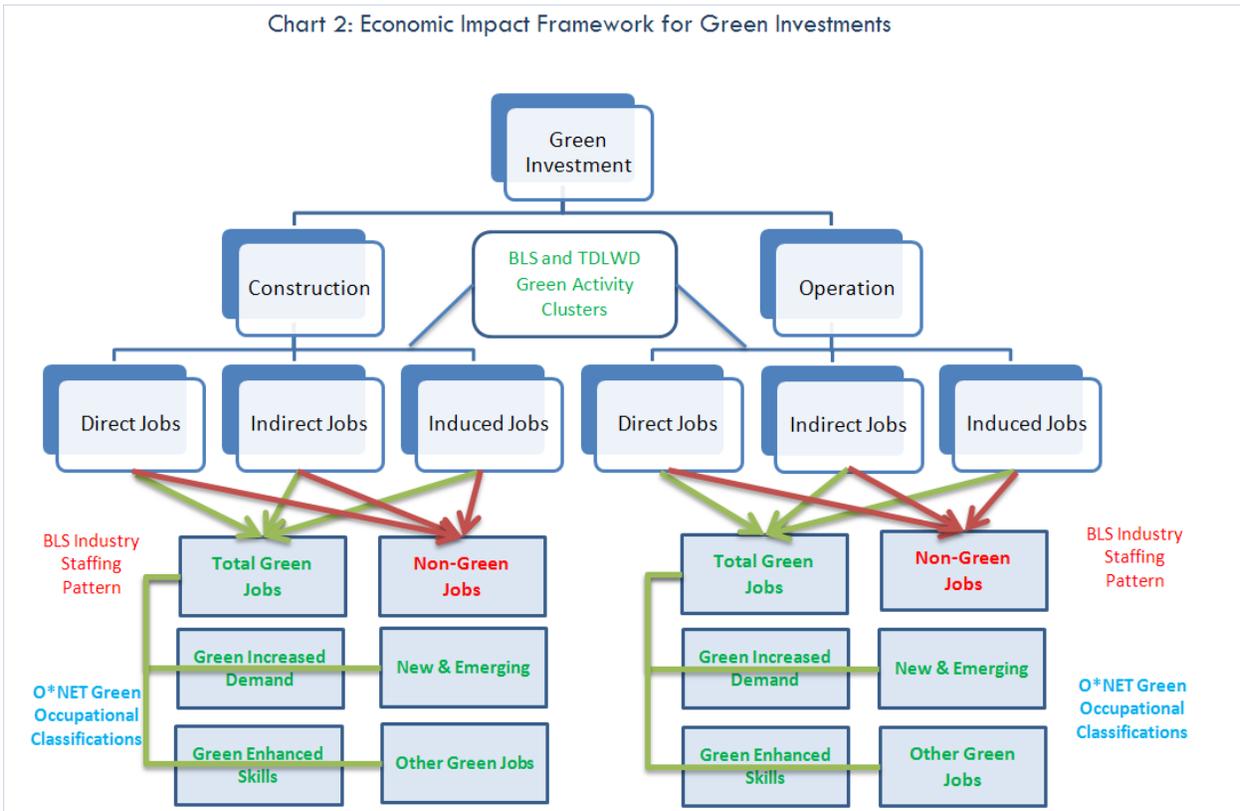
III.3. The Six Investments and the Green Economy: Conceptual Framework

Based on the literature review and the analysis of six major green investments in Tennessee, the BERCC developed the following approach to estimate and classify the job impact of these investments on Tennessee's economy:

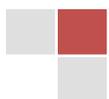
- identify goods and services each investment will produce or provide,
- treat all direct jobs as green jobs using the BLS methodology that all jobs in a company producing green products and services should be treated as green jobs,
- identify the industries by North American Industry Classification System (NAICS) code from www.census.gov to which those goods and services belong,
- assign industries to one of the green economic activity clusters using BLS and TDLWD green activity clusters,
- identify staffing patterns of each industry using national industry employment by occupation,
- classify occupations using O*NET OnLine green skill classifications,
- run an IMPLAN regional model for Tennessee using total employment figures for each investment,
- identify top supply chain industries (indirect jobs),
- repeat the same process to classify supply chain industries by green economic activity clusters, and
- calculate total (direct, induced, and indirect) green jobs.

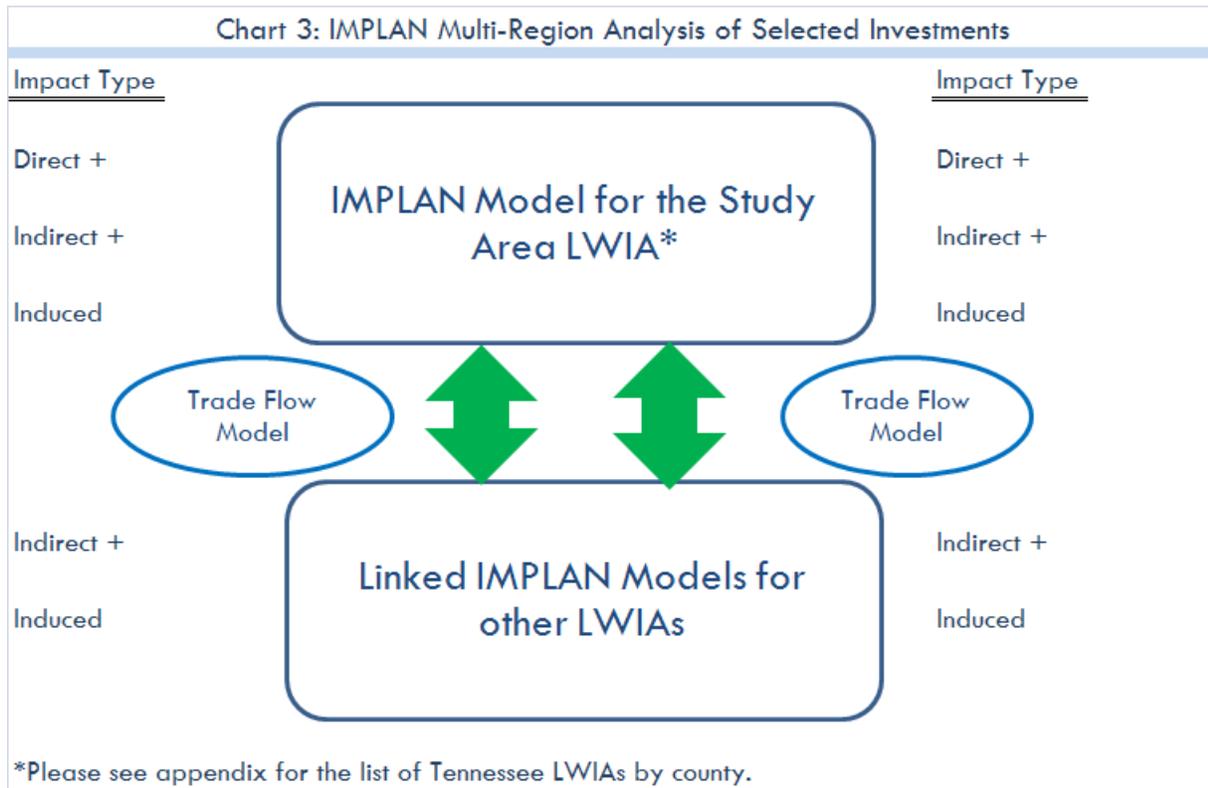


The framework for estimating green jobs impact and total impact of green investments in Tennessee is given in Chart 2. To estimate indirect and induced job impacts of the selected green investments, the BERC constructed a multi-region IMPLAN model for each investment at the LWIA level.



The IMPLAN multi-region model not only assesses the impact of investment in the targeted region but also the impact of a given investment in neighboring regions through trade flows. For each LWIA in Tennessee, the BERC constructed a multi-region trade-flow model to calculate the indirect and induced job impacts of the selected green investments in Tennessee. Chart 3 presents a summary of the procedure used in this analysis for LWIAs and their associated counties.

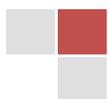




III.4. Occupational Templates for Green Investments in Tennessee

As highlighted in Chart 2, occupational templates for green investments are prepared using a national industry staffing pattern (www.BLS.gov) and O*NET OnLine green occupation classifications. The BERCC includes the following elements in the occupational template:

- name of investment,
- NAICS code for the green economic activity, and
- green occupation classification type (green increased demand, green enhanced skills, and green new and emerging).



IV. Construction Stage: Temporary Job Impacts

The six green investments announced in Tennessee since 2008 have a price tag of more than \$5.5 billion. Although these investments spread across Tennessee, the major ones have concentrated in middle Tennessee. Based on public statements and major newspaper accounts, the construction phase of these investments started in 2008 and will continue until 2014 with construction employment peaking in 2011 at 5,674 jobs.

IV.1. Investment Timeline and Direct Construction Jobs

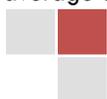
Charts 4 and 5 give a summary of the approximate construction starting and ending year of each of the six major investments and average annual direct construction jobs associated with the each. For example, construction of the Volkswagen campus in Chattanooga started in 2008 and is expected to end in 2011. Average annual construction employment associated with the Volkswagen campus is estimated at 1,557 jobs. On the other end of the timeline, the Wacker Chemie AG polysilicon production facility started in 2011 and is expected to continue until 2014, employing 882 construction workers annually.¹

Chart 4: Major Green Investments and Construction Timeline

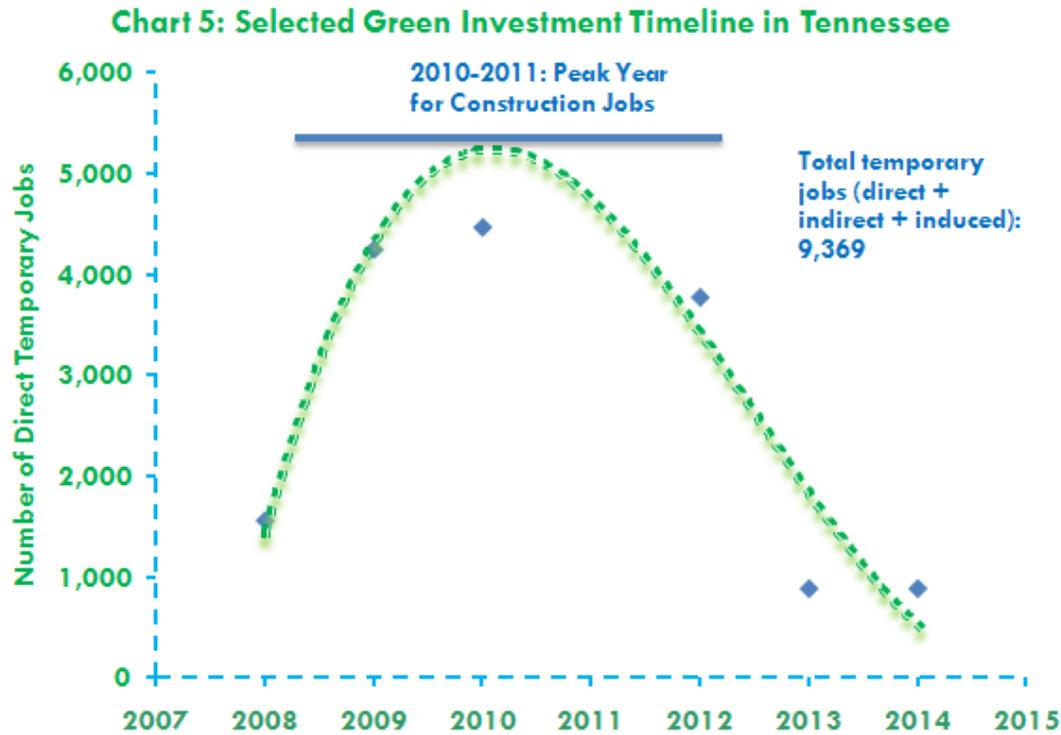
Investment Type / Years	Direct Construction and Installation Jobs	Year						
		2008	2009	2010	2011	2012	2013	2014
Nissan Retrofit & Battery	1,544							
Volkswagen	1,557							
Wacker Chemie	882							
Hemlock	1,150							
Tennessee Solar Institute	~221							
West Tennessee Solar Farm	200							
Charging Stations	120							
Total by Years		1,557	4,251	4,472	5,674	3,776	882	882

As Chart 4 demonstrates, nearly 221 construction jobs are associated with the Tennessee Solar Institute, related to the spending associated with the installation grants awarded by the Tennessee Solar Institute to companies across Tennessee. The total amount for installation grants was a little

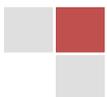
¹ In estimating average annual construction employment, the BERC consulted a variety of references. A primary source was company press releases regarding construction phases and related timelines. Where available, the BERC also used information regarding these investments publicized through state agencies, recovery.gov, and major regional newspapers. Furthermore, the BERC consulted environmental assessment reports for the selected sites to get information about the facility size, nature of the projects, proposed improvement to the sites, and other physical characteristics of the investment that might be important in calculating the number of construction jobs. The BERC then used all available information to estimate total construction spending by using RSMeans Square Foot Costs and then average annual construction employment by using the regional IMPLAN model.



over \$9 million. Companies in all 13 Tennessee LWIAs benefited from this federal grant administered by the Tennessee Solar Institute.



Based on information in Chart 4, Chart 5 plots the number of direct temporary jobs across the years with a dotted line to give a perspective on temporary job prospects. In calculating the economic impact of temporary construction jobs, the BEREC used the current year (2011), which is the peak year in terms of number of jobs, as a reference.



IV.2. Temporary Green Construction Jobs: Regional Snapshot

The six major investments benefit the construction sector generously with 5,674 direct green construction jobs. Although the six investments are heavily concentrated in a few LWIAs, especially LWIA 3, LWIA 5, LWIA 8, LWIA 9, and LWIA 11, all LWIAs recorded a varying degree of new jobs because of indirect and induced jobs. The number of indirect jobs through the supply chain is estimated at around 1,767, while jobs associated with employee payroll spending (induced) total 1,928. Added together, the total temporary green construction impact is 9,369 jobs. Map 2 presents the total construction job impact of the six investments by LWIAs.



Map 2: GREENING TENNESSEE'S ECONOMY: STATE'S INVESTMENT STRATEGIES

Construction Impact of Selected Green Investments

LWIA 3: Tennessee Solar Institute and the EV Project
 LWIA 5: Wacker Chemie, Volkswagen, and the EV Project
 LWIA 8: Hemlock Semiconductor, LLC
 LWIA 9: Nissan Leaf, Nissan Battery Manufacturing, and the EV Project
 LWIA 11: West Tennessee Solar Farm

Temporary Job Impact:
 Direct : 5,674
 Indirect : 1,767
 Induced : 1,928

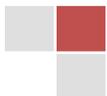


Note 1: Direct construction impact figures represent the annual average construction employment for each investment.

Note 2: For certain investments, BEREC calculated construction spending using media sources, company press releases, environmental assessment reports, recovery.com website, and RSMeans Square Foot Costs for the manufacturing facilities.

Note 3: Dark shades represent the heavy concentration of green investments.

Note 4: We assume that annual construction related jobs due to green investments will be stable until 2014.



IV.3. Construction Job Impact by Green Activity Clusters

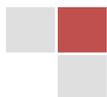
This section breaks down the total construction job impact (direct + indirect + induced) by BLS and Tennessee green activity clusters. Additional details regarding construction jobs by green activity clusters are provided in Appendices B1-B5.

IV.3.a. Green Construction Jobs by BLS and Tennessee Green Activity Clusters. Table 2 cross-tabulates temporary construction-related jobs by the U.S. and Tennessee green activity clusters. Although the concordance between the two green activity cluster definitions is obvious, the Tennessee green activity cluster definition seems to be more inclusive. Nearly 75 percent (6,893) of temporary construction-related jobs are considered green jobs by the Tennessee green activity cluster definition, whereas 70 percent of total jobs may be considered green jobs by the BLS definition. One caveat is in order when reading the numbers in Table 2: the total number of jobs may not add up to 9,369 because 182 jobs are included in the BLS definition but not in the Tennessee definition. Similarly, 532 jobs included in the Tennessee green activity definition are excluded from the BLS definition. The job numbers highlighted in red (2,293) indicate jobs that do not fit into any of the green activity cluster definitions.

In terms of Tennessee green activity clusters, nearly 77 percent of the green jobs are green construction, followed by research and development (5 percent), recycling (4 percent), and sustainable transportation (4 percent).

Table 2: Temporary Jobs Associated with the Selected Green Investments by Green Activities: Total Job Impact

Tennessee Green Activities (Rows)	U.S. Green Activities (Columns)										Total Green Jobs by Tennessee Green Activities
	Energy Efficiency	Energy from Renewable Sources	Environmental Compliance, Education and Training, and Public Awareness	Natural Resource Conservation	Pollution Reduction and Removal, Greenhouse Gas Reduction, and Recycling and Reuse	Green Jobs Not Associated with a U.S. Green Activity	Green Jobs Not Associated with a U.S. Green Activity	Green Jobs Not Associated with a U.S. Green Activity	Green Jobs Not Associated with a U.S. Green Activity	Green Jobs Not Associated with a U.S. Green Activity	
Sustainable Transportation	8				160	109					277
Green Construction					5,287						5,287
Energy Efficiency	31					108					139
Renewable Energy		223									223
Environmental Protection	101			8							111
Research and Development	139	5		39	34	123					368
Green Manufacturing	96					2					107
Recycling						10					285
Agriculture and Forestry					2						2
Government Regulation and Administration				94							94
Green Jobs Not Associated with a Tennessee Green Activity	34			59	1	88					2,293
Total Green Jobs by U.S. Green Activities	409	228		200	37	5,670					6,544
Number of Jobs Not Green											2,293
Total Job Impact of Green Construction											9,369



IV.3.b. *Total Temporary Jobs by Tennessee Green Activity Cluster and LWIA.* Table 3 presents total construction-related jobs by Tennessee green activity cluster and LWIA. Although many jobs are concentrated in LWIA 5, 8, and 9, other regions also benefit substantially given the current state of the overall economy.

Table 3: Temporary Job Impact of the Selected Green Investments by Tennessee Green Activity and LWIA

	L W I A	Grand Total												
Tennessee Green Activities	1	2	3	4	5	6	7	8	9	0	1	2	3	
Sustainable Transportation			49	6	109			10	100		3			277
Green Construction					2,593			1,150	1,544					5,287
Energy Efficiency					67			22	45		6			139
Renewable Energy						4		5		2	201		12	223
Environmental Protection			3		54			17	35				2	111
Research and Development			9	23	99	31		45	153		7			368
Green Manufacturing		5			39		6	19	27		2	2	8	107
Recycling			4	5	112			37	117		5		6	285
Agriculture and Forestry					2									2
Government Regulation and Administration					42			9	40		2			94
Jobs Not Associated with a Green Activity	5	13	56	42	938	34	21	341	861	15	85	9	52	2,474
Grand Total	5	18	121	76	4,056	69	27	1,655	2,921	17	311	11	81	9,369

IV.3.c. *Total Temporary Jobs by Tennessee Green Activity Cluster and Major Industry.* Table 4 presents construction-related total jobs by Tennessee green activity cluster and major industry across Tennessee. Table 4 also highlights the sources of major impact by sector. It comes as no surprise that the construction sector accounts for all direct impact associated with green construction, renewable energy, and sustainable transportation clusters. Indirect jobs are primarily in the architectural, engineering, and related services, legal services, and transportation by truck sectors, associated with research and development, government regulations and administration, and sustainable transportation. Jobs in the wholesale trade, services to buildings and dwellings, and direct and electronic sales sectors are either induced or both induced and indirect.

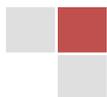


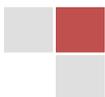
Table 4: Temporary Job Impact of the Selected Green Investments by Tennessee Green Activity, Major Industry, and Source of Impact

NAICS	Description	Sustainable Transportation	Green Construction	Energy Efficiency	Renewable Energy	Environmental Protection	Research and Development	Green Manufacturing	Recycling	Agriculture and Forestry	Government Regulation and Administration	Grand Total	Sources of Impact
23XXXX	Construction	160	5,287	31	223							5,701	Direct
5413XX	Architectural, engineering, and related services						274					274	Indirect
42XXXX	Wholesale trade businesses								258			258	Indirect & Induced
5411XX	Legal services										94	94	Indirect
5617XX	Services to buildings and dwellings					83						83	Indirect & Induced
484XXX	Transport by truck	62										62	Indirect
454XXX	Retail nonstores - direct and electronic sales			61								61	Induced
	Other green activity jobs	55	0	47	0	28	94	107	27	2	0	360	All
	Other jobs not associated with green activities											2,474	
	Total economic impact	277	5,287	139	223	111	368	107	285	2	94	9,369	

IV.3.d. *Tennessee Green Activity Clusters and Temporary Green Jobs.* Table 5 shows only total green jobs associated with the six investments. Along with the information in Table 4, these green jobs are then allocated to occupational clusters using the BLS industry staffing pattern. This process allows us to connect major occupational clusters with O*NET green industry occupations, discussed in the next section.

Table 5: Tennessee Green Activities and Temporary Green Jobs

Green Activities	Total Green Jobs
Sustainable Transportation	277
Green Construction	5,287
Energy Efficiency	139
Renewable Energy	223
Environmental Protection	111
Research and Development	368
Green Manufacturing	107
Recycling	285
Agriculture and Forestry	2
Government Regulation and Administration	94
Total	6,893

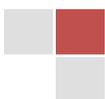


IV.3.e. *Temporary Green Jobs by O*NET Green Occupations and Occupational Categories.* Using the BLS industry staffing pattern and O*NET green occupational categories, the BERC assigned 2,611 temporary green jobs to one of the green occupations highlighted in Table 6. Because of increasing construction activity, demand for “green enhanced skills” occupations is expected to increase by 1,180 jobs, including construction laborers, pipe fitters and steamfitters, plumbers, heating and air conditioning mechanics and installers, roofers, sheet metal workers, maintenance and repair workers, and civil engineers. Individuals holding one of these occupations may need to go through additional skill training to be eligible for work in the green construction sector.

Table 6: Temporary Green Jobs Associated with Selected Green Investments*		Jobs
Green Enhanced Skills		1,180
17-2051.00	Civil Engineers	24
47-2061.00	Construction Laborers	555
47-2152.01	Pipe Fitters and Steamfitters, Plumbers	268
47-2181.00	Roofers	85
47-2211.00	Sheet Metal Workers	80
49-9021.01	Heating and Air Conditioning Mechanics and Installers	137
49-9042.00	Maintenance and Repair Workers, General	31
Green Increased Demand		1,401
47-2011.00	Boilermakers	13
47-2031.01	Construction Carpenters	501
47-2051.00	Cement Masons and Concrete Finishers	126
47-2073.00	Operating Engineers and Other Construction Equipment Operators	189
47-2111.00	Electricians	359
47-2131.00	Insulation Workers, Floor, Ceiling, and Wall	20
47-2221.00	Structural Iron and Steel Workers	48
47-3012.00	Helpers--Carpenters	47
49-9098.00	Helpers--Installation, Maintenance, and Repair Workers	23
51-4121.06	Welders, Cutters, and Welder Fitters	36
53-7062.00	Laborers and Freight, Stock, and Material Movers, Hand	40
Green New and Emerging		30
17-2199.03	Energy Engineers	30
<i>Sub Total</i>		2,611
Other Green Jobs Not Assigned to O*NET occupations		4,282
Total Green Jobs		6,893

*Staffing pattern and green job categories were from O*Net and BLS.

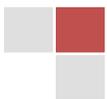
The second occupational category highlighted in Table 6 is “green increased demand” occupations. The job increase associated with this category is 1,401, heavily concentrated in four



major occupations: construction carpenters, electricians, operating engineers and other construction equipment operators, and cement masons and concrete finishers. Workers in these occupations may be able to find employment because of new construction activity without going through additional skill training.

The third occupational category includes “green new and emerging” occupations. According to BERC estimates, demand for energy engineers is expected to increase by 30 because of increased green construction activity.

Although many green jobs are associated with increasing green construction activity, the BERC highlighted only the major green occupations profiled by O*NET online.



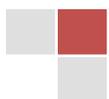
V. Permanent Job Impacts of the Selected Green Investments

Once they become operational, the six selected investments will generate sizeable employment opportunities for Tennessee residents through direct, indirect, and induced jobs. Before analyzing the type of jobs created by these investments, a few cautionary words are in order with regard to the assumptive structure of the BERC's calculations. The first assumption is that all investments reach full employment capacity by 2014. According to media reports, some companies have already started hiring but still are not at their proposed full-employment capacity. The second assumption is that the companies' press releases regarding the number of jobs they will create reflect the actual number of jobs that will be created by 2014. The third assumption is that the proposed 1,300 Nissan North America jobs will be split between the Leaf and storage battery production facilities. Given the size of each facility, the split is expected to be in the neighborhood of 300 and 1,000 jobs, respectively.

In estimating the job impact of a manufacturing facility, the identification and construction of an appropriate study area is critically important. Often, because of Tax Increment Financing (TIF) and other local incentives, the appropriate study area is a county. However, in this study, the BERC defined the study area at the LWIA level to capture the impact of each investment on the regional labor market. As in the analysis of the construction phase, the BERC constructed multi-region IMPLAN models to capture the spillover impact of the manufacturing operation in a region across the other communities.

The multi-region IMPLAN model analyzes direct permanent jobs, indirect jobs associated with the supply-chain, and induced jobs. To clarify the meanings of these terms, let us assume that an automobile manufacturing company employs 2,000 people. These are direct jobs. Because of this company, an auto parts manufacturing company locates to the area and employs 300 people. These 300 jobs are indirect jobs. The employees of both the automobile manufacturing company and the auto parts manufacturing company spend their earnings in the local economy, stimulating additional economic activity, especially through retail sectors. For example, because of the increased purchasing power of the area residents, a grocery store may decide to locate in the region and employ 100 people. These are "induced jobs." The total economic impact in this example is 2,400 jobs.

This section of the report follows logic similar to the example above to analyze the permanent job impact of the six investments. Although the investments are concentrated in a few regions, we expect to see a sizeable impact in other regions through supply-chain linkages and induced demand for goods and services.

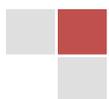


V.1. Permanent Job Impacts: A Regional Snapshot

The six green investments are highly concentrated in middle Tennessee: Volkswagen and Wacker Chemie AG (LWIA 5), Nissan Leaf and Storage Battery Manufacturing (LWIA 9), and Hemlock Semiconductor (LWIA 8). Because of this concentration, nearly 85 percent of the permanent jobs created through these investments are located in these regions.

Map 3 gives a snapshot of the employment impact of these investments by LWIA. These six investments will be expected to create nearly 17,000 jobs by 2014 when they become fully operational. Given the current dreadful job market across the nation, 17,000 jobs are a real boon to the economies of the regions where these investments are located. From a different angle, an investment of \$5.5 billion in Tennessee by major global players in the green sector is a major step in the process of redefining the economic landscape toward becoming technology driven, efficient, and sustainable.

Of the nearly 17,000 permanent jobs, almost 4,600 jobs are direct, 7,100 jobs indirect, and 5,000 jobs induced. As shown in Map 3, all regions receive some job benefit from these investments. For example, although there is no investment in LWIA 4, spillovers from neighboring LWIA 5 create nearly 700 indirect and induced jobs in LWIA 4. Similarly, LWIA 6 benefits from 352 indirect and induced jobs because of its proximity to LWIA 5. The job impacts grow smaller as the distance between the investment region and other regions increases. For example, the total indirect and induced job impacts in LWIA 12 (northwest corner of the state) are just 44. Similarly, the indirect and induced job impacts in LWIA 1 (northeast corner of the state) are 61.



Map 3: GREENING TENNESSEE'S ECONOMY: STATE'S INVESTMENT STRATEGIES

Selected Green Investments: Permanent Jobs

LWIA 3: Tennessee Solar Institute and the EV Project
 LWIA 5: Wacker Chemie, Volkswagen, and the EV Project
 LWIA 8: Hemlock Semiconductor, LLC
 LWIA 9: Nissan Leaf, Nissan Battery Manufacturing, and the EV Project
 LWIA 11: West Tennessee Solar Farm

Permanent Job Impact:

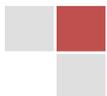
Direct	:	4,572
Indirect	:	7,073
Induced	:	4,914
Total	:	16,559



Note 1: Direct permanent jobs represent the peak job level for each investment.

Note 2: For certain investments, BEREC calculated number of permanent jobs using media sources, company press releases, environmental assessment reports, and recovery.com website.

Note 3: Dark shades represent the heavy concentration of green investments.



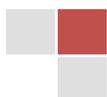
V.2. Permanent Job Impacts by Green Activity Cluster and Occupation

This section breaks down total permanent jobs by BLS and TDLWD green activity clusters, TDLWD and LWIA, TDLWD and major industry, green occupation and TDLWD and O*NET green occupational category. Additional tables are presented in Appendix C1-C5.

V.2.a. *Permanent Job Impacts by BLS and TDLWD Green Activity.* Table 7 presents the concordance between the BLS and TDLWD green activity clusters. Of nearly 17,000 jobs, 7,282 jobs are assigned a green activity category by both clusters. Using TDLWD green cluster activity methodology, the BERC classified an additional 2,862 jobs under a green activity cluster, whereas BLS methodology resulted in additional classification of an additional 507 jobs. Overall, nearly 6,000 permanent jobs are not classified under a green activity cluster, representing 37 percent of all permanent jobs.

Table 7: Employment Impact of the Selected Green Investments by Green Activity: Total Permanent Jobs

U.S. Green Activities (Columns) Tennessee Green Activities (Rows)	Energy Efficiency	Energy from Renewable Sources	Environmental Compliance, Education and Training, and Public Awareness	Natural Resource Conservation	Pollution Reduction and Removal, Greenhouse Gas Reduction, and Recycling and Reuse	Jobs Associated with Only Tennessee Green Activity	Total Green Jobs by Tennessee Green Activities
	Agriculture and Forestry				18		
Energy Efficiency	4,782				5	342	5,129
Environmental Protection	277		36		17	9	339
Government Regulation and Administration			132				132
Green Manufacturing	13				1,240	35	1,288
Recycling			270		22	1,717	2,009
Renewable Energy		24					24
Research and Development	40	202	77	10	94	125	548
Sustainable Transportation	23					634	657
Jobs Associated with Only U.S. Green Activity	99		187		221		
Total Green Jobs by the U.S. Green Activities	5,234	226	702	28	1,599		7,789
Number of Jobs Non-Green							5,909
Total Permanent Job Impact							16,559



V.2.b. *Permanent Job Impacts by Tennessee Green Activities and LWIAs.* According to BERC estimates, total number of green jobs because of the six major investments is 10,144, representing 61 percent of total job impacts of these investments throughout Tennessee. Table 8 presents total job impacts (direct + indirect + induced) by Tennessee green activity clusters and LWIAs. In terms of regional breakdown, three LWIAs (5, 8, and 9) get the lion's share with 50, 11, and 25 percent of total jobs, respectively.

In terms of Tennessee green activity clusters, energy efficiency accounts for nearly 31 percent of all jobs related to these investments, followed by 12 percent in recycling, eight percent in green manufacturing, four percent in sustainable transportation, and three percent in research and development.

Table 8: Employment Impact of the Selected Green Investments by Tennessee Green Activity and LWIA

Tennessee Green Activities	L W I A 1	L W I A 2	L W I A 3	L W I A 4	L W I A 5	L W I A 6	L W I A 7	L W I A 8	L W I A 9	L W I A 0	L W I A 1	L W I A 2	L W I A 3	Grand Total
Agriculture and Forestry					11		1	2	2	1				18
Energy Efficiency	2	5	24	29	2,986	13	9	595	1,463	2	2			5,130
Environmental Protection			21	12	158	3	1	44	95	2			3	339
Government Regulation and Administration			5	3	70			15	39					132
Green Manufacturing	13	95	68	259	281	164	111	73	137	35	24	18	10	1,288
Recycling	3	13	47	58	1,142	15	14	215	478	4	5	2	11	2,008
Renewable Energy					2			3	5	3	11			23
Research and Development	4		34	113	168	13		80	125	4	2		6	548
Sustainable Transportation		4	17	20	397	9	5	41	160	2	2			657
Jobs Not Associated with a Green Activity	40	92	195	273	3,013	137	99	705	1,630	63	62	24	84	6,416
Grand Total	61	209	411	767	8,228	352	241	1,774	4,135	116	108	44	114	16,560

V.2.c. *Permanent Job Impacts by Tennessee Green Activity Cluster and Major Industry.* Several sectors in the state's economy record sizeable employment gains because of the six investments. Three sectors that account for nearly 27 percent of total job impacts are automobile manufacturing, semiconductor and related device manufacturing, and storage battery manufacturing. These sectors directly contribute to the state's economy. Furthermore, four major supply-chain industries contribute to nearly 21 percent of total job growth: wholesale trade, motor vehicle parts manufacturing, transportation by truck, and management of companies and enterprises. Table 9 presents a detailed picture of major industries and their share of total employment impact by Tennessee green activity clusters.

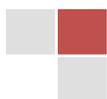


Table 9: Employment Impact of the Selected Green Investments by Tennessee Green Activity, Industry, and Source of Impact

NAICS Description	Agriculture and Forestry	Energy Efficiency	Environmental Protection	Government Regulation and Administration	Green Manufacturing	Recycling	Renewable Energy	Research and Development	Sustainable Transportation	Total	Sources of Impact
336111 Automobile manufacturing		2,302								2,302	Direct
42XXXX Wholesale trade businesses						1,579				1,579	Indirect
334413 Semiconductor and related device manufacturing		1,191								1,191	Direct
3311XX Motor vehicle parts manufacturing					1,137					1,137	Indirect
335911 Storage battery manufacturing		1,000								1,000	Direct
484XXX Transport by truck									359	359	Indirect
55XXXX Management of companies and enterprises						356				356	Indirect
5617XX Services to buildings and dwellings			277							277	Indirect & Induced
5417XX Scientific research and development services								203		203	Indirect
454XXX Retail Nonstores - Direct and electronic sales		192								192	Induced
23XXXX Construction (Maintenance and Repair)										172	Indirect & Induced
441XXX Retail Stores - Motor vehicle and parts		149								149	Induced
5411XX Legal services				132						132	Indirect & Induced
54161X Management, scientific, and technical consulting services								119		119	Indirect
5413XX Architectural, engineering, and related services								103		103	Indirect
Other green activity jobs	18	124	62	0	151	73	23	123	298	872	All
Other jobs not associated with green activities										6,416	
Total economic impact	18	5,130	339	132	1,288	2,008	23	548	657	16,559	

V.2.d. *Permanent Green Jobs and Tennessee Green Activity Clusters.* As previously mentioned, nearly 61 percent of total economic impacts may be classified under one of 10 Tennessee green economic activity clusters as green jobs. How are these green jobs distributed across Tennessee green activity clusters? Table 10 presents a breakdown of these green jobs by green activity cluster.

Energy efficiency is leading other clusters, accounting for nearly 51 percent of all green jobs. Recycling and green manufacturing represent the second and third largest categories with 20 and 13 percent of all green jobs, respectively. Other notable green activity sectors are sustainable transportation, research and development, and environmental protection, accounting for seven, five and three percent of total green jobs.

Table 10: Tennessee Green Activities and Permanent Green Jobs

Green Activities	Green Jobs
Agriculture and Forestry	18
Energy Efficiency	5,130
Environmental Protection	339
Government Regulation and Administration	132
Green Manufacturing	1,288
Recycling	2,008
Renewable Energy	23
Research and Development	548
Sustainable Transportation	657
Total	10,143



V.2.e. *Permanent Jobs and O*NET Occupational Categories.* Table 11 presents a detailed picture of O*NET occupational categories by selected green occupation. At the aggregate level, “green increased demand” occupations increase by 2,195 jobs, “green enhanced skills” occupations by 772 jobs, and “green new and emerging” occupations by 116 jobs. These three broad occupational categories account for a little over 30 percent of all green jobs associated with the six investments.

Green increased demand occupations are those that do not require an additional skill set to perform green economic activity. Four occupations under this category accounting for nearly 70 percent of total green increased demand occupations are team assemblers, electrical and electronic equipment assemblers, first-line supervisors, and laborers.

Green enhanced skills occupations require a skill upgrade for people who hold these occupations to perform green economic activities. According to BERC estimates, 772 jobs can be classified under this O*NET occupational category. Inspectors and testers, machinists, maintenance and repair workers, and shipping, receiving, and traffic clerks are four major occupations that represent 69 percent of all green enhanced skills occupations.

As a final category, green new and emerging occupations are considered new occupations that do not have a Standard Occupational Classification (SOC) code under the current system. O*NET classifications of these occupations suggest certain types of clusters of occupations that may be related to certain occupations under the current SOC system. BERC estimates put the number of jobs under this category at around 116, primarily concentrated under the SOC codes of 17-2199, 41-3099, 47-1011, and 13-1081. These occupational clusters are engineers, energy brokers, solar energy installers, and logistics engineers and analysts, respectively. These four clusters of occupations constitute more than 71 percent of all green new and emerging occupations.

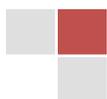
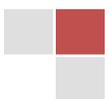


Table 11: Permanent Green Jobs by Occupation: Selected O*NET Green Occupations and BLS Industry Staffing Pattern

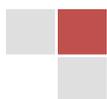
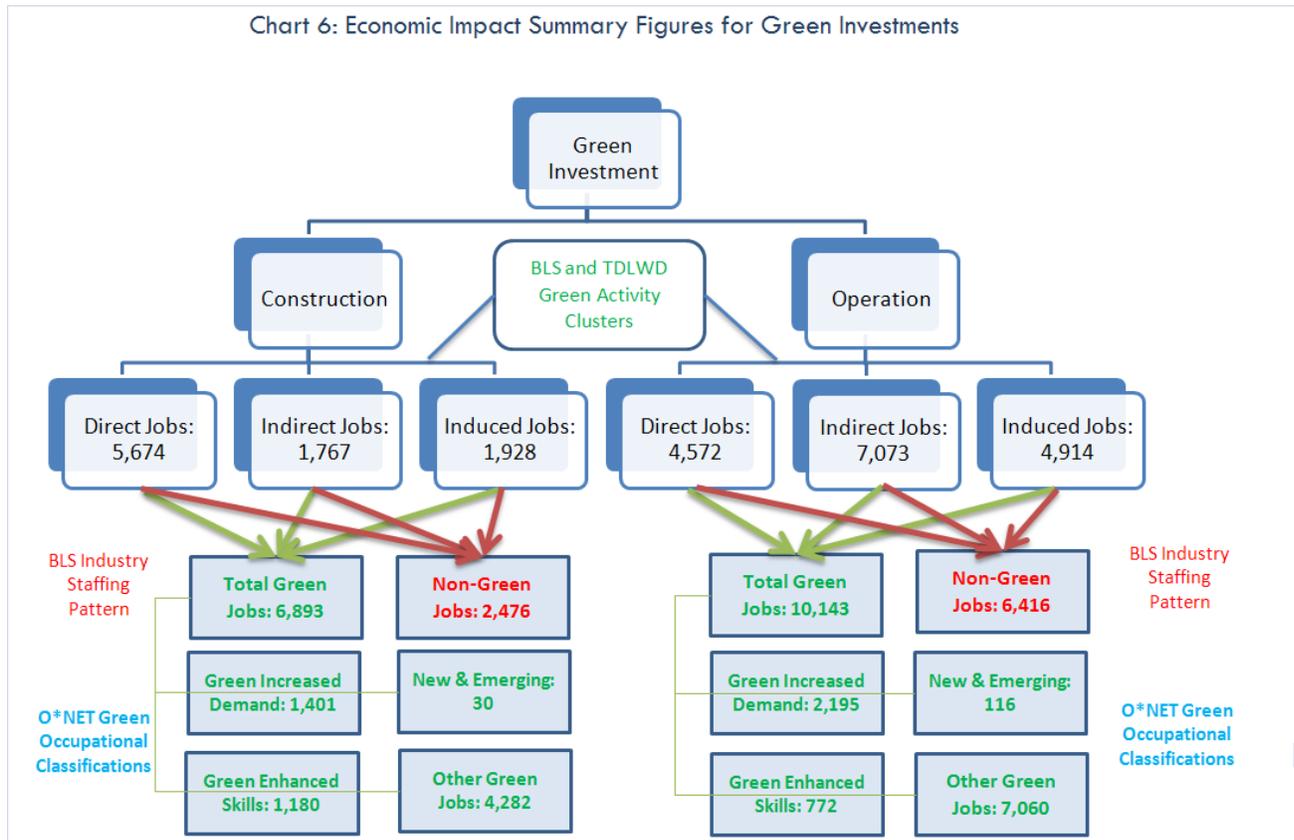
SOC Code	Title	Number of Jobs
(A) Green Increased Demand Occupation		2,195
51-2092	Team Assemblers	1,003
51-2022	Electrical and Electronic Equipment Assemblers	286
51-1011	First-Line Supervisors/Managers of Production and Operating Workers	178
53-7062	Laborers and Freight, Stock, and Material Movers, Hand	101
51-4121	Solderers and Brazers, Welders	78
43-4051	Customer Service Representatives	76
49-9041	Industrial Machinery Mechanics	70
51-4031	Cutting, Punching, and Press Machine Setters, Operators, and Tenders, Metal and Plastic	69
17-3023	Electronics Engineering Technicians	51
51-2031	Engine and Other Machine Assemblers	48
49-9044	Millwrights	35
43-5061	Production, Planning, and Expediting Clerks	33
49-1011	First-Line Supervisors/Managers of Mechanics, Installers, and Repairers	31
11-3051	Industrial Production Managers	29
47-2031	Construction Carpenters	26
47-2111	Electricians	20
53-7051	Industrial Truck and Tractor Operators	20
51-4011	Computer-Controlled Machine Tool Operators, Metal and Plastic	19
47-2073	Operating Engineers and Other Construction Equipment Operators	13
49-2094	Electrical and Electronics Repairers, Commercial and Industrial Equipment	8
(B) Green Enhanced Skills		772
51-9061	Inspectors, Testers, Sorters, Samplers, and Weighers	176
51-4041	Machinists	153
49-9042	Maintenance and Repair Workers, General	127
43-5071	Shipping, Receiving, and Traffic Clerks	74
53-3032	Truck Drivers, Heavy and Tractor-Trailer	54
17-3023	Electrical Engineering Technicians	51
41-4011	Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products	35
47-2061	Construction Laborers	30
17-3026	Industrial Engineering Technicians	29
49-3023	Automotive Specialty Technicians	21
47-2152	Pipefitters, Plumbers	14
17-2051	Civil Engineers	9
(C) Green New and Emerging		116
17-2199	Validation, Energy, Manufacturing, Mechatronics, Microsystems, Photonics, Robotics, Nanosystems, & Solar Energy Systems Engineers	31
41-3099	Energy Brokers	19
47-1011	Solar Energy Installation Managers	18
13-1081	Logistics Engineers & Analysts	15
17-3029	Electrical Engineering, Electromechanical Engineering, Electronics Engineering, Industrial Engineering, Manufacturing Engineering, Mechanical Engineering, & Nanotechnology Engineering Technologists and Technicians	10
41-3031	Securities and Commodities Traders	9
13-1041	Regulatory Affairs Specialists	9
17-3024	Robotics Technicians	5
Sub Total (A+B+C)		3,083
Other Green Jobs		7,060
Total Green Jobs		10,143



VI. Summary and Conclusion

During the greatest recession of recent U.S. history, the state of Tennessee has made significant progress in transforming its economy through six major green investments. In the midst of an eroding manufacturing base, these green investments have the capacity to turn the tide of manufacturing employment, as the direct manufacturing jobs associated with these investments represent about 1.5 percent of the state’s total manufacturing jobs. Both at the construction and operation stages, these investments are likely to create new economic dynamism for future job growth.

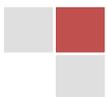
Chart 6 summarizes the study’s findings. At the construction stage, 6,893 green jobs will be created, while at the operation stage, the number of permanent green jobs will be 10,143. These green job figures are in addition to the green jobs identified by the TDLWD in 2011.



Appendix A: Components of Tennessee Local Workforce Investment Areas

Appendix A: Tennessee Local Workforce Investment Areas by County

LWIA 1	LWIA 5	LWIA 8	LWIA 11
Carter County	Bledsoe County	Cheatham County	Benton County
Johnson County	Bradley County	Dickson County	Carroll County
Sullivan County	Hamilton County	Houston County	Chester County
Washington County	McMinn County	Humphreys County	Decatur County
Unicoi County	Marion County	Montgomery County	Hardeman County
	Meigs County	Robertson County	Hardin County
<u>LWIA 2</u>	Polk County	Stewart County	Haywood County
Claiborne County	Rhea County	Sumner County	Henderson County
Cocke County	Squatchie County	Williamson County	Henry County
Grainger County			McNairy County
Greene County	<u>LWIA 6</u>	<u>LWIA 9</u>	Madison County
Hamblen County	Bedford County	Davidson County	Weakley County
Hancock County	Coffee County	Rutherford County	
Hawkins County	Franklin County	Trousdale County	<u>LWIA 12</u>
Jefferson County	Grundy County	Wilson County	Crockett County
Sevier County	Lincoln County		Dyer County
Union County	Moore County	<u>LWIA 10</u>	Gibson County
	Warren County	Giles County	Lake County
<u>LWIA 3</u>		Hickman County	Lauderdale County
Knox County	<u>LWIA 7</u>	Lawrence County	Obion County
	Cannon County	Lewis County	Tipton County
<u>LWIA 4</u>	Clay County	Marshall County	
Anderson County	DeKalb County	Maury County	<u>LWIA 13</u>
Blount County	Fentress County	Perry County	Fayette County
Campbell County	Jackson County	Wayne County	Shelby County
Cumberland County	Macon County		
Loudon County	Overton County		
Monroe County	Pickett County		
Morgan County	Putnam County		
Roane County	Smith County		
Scott County	Van Buren County		
	White County		



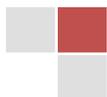
Appendix B: Detailed Tables for Construction-Related Jobs

Appendix B1: Temporary Jobs Associated with the Selected Green Investments by Green Activity: Direct Jobs

Tennessee Green Activities (Rows) \ U.S. Green Activities (Columns)	Energy Efficiency	Energy from Renewable Sources	Environmental Compliance, Education and Training, and Public Awareness	Natural Resource Conservation	Pollution Reduction and Removal, Greenhouse Gas Reduction, and Recycling and Reuse	Direct Jobs Associated with a Tennessee Green Activity	Grand Total
Sustainable Transportation					160		160
Green Construction					5,287		5,287
Energy Efficiency							
Renewable Energy		223					223
Environmental Protection							
Research and Development							
Green Manufacturing							
Recycling							
Agriculture and Forestry							
Government Regulation and Administration							
Direct Jobs Associated with a U.S. Green Activity							
Grand Total		223			5,448		5,670
Non-Green Jobs							4
Total Direct Jobs							5,674

Appendix B2: Temporary Jobs Associated with the Selected Green Investments by Green Activity: Indirect Jobs

Tennessee Green Activities (Rows) \ U.S. Green Activities (Columns)	Energy Efficiency	Energy from Renewable Sources	Environmental Compliance, Education and Training, and Public Awareness	Natural Resource Conservation	Pollution Reduction and Removal, Greenhouse Gas Reduction, and Recycling and Reuse	Indirect Jobs Associated with a Tennessee Green Activity	Grand Total
Sustainable Transportation	4					73	76
Green Construction							
Energy Efficiency	13					6	19
Renewable Energy							
Environmental Protection	77						77
Research and Development	135	3	27	33	118	21	337
Green Manufacturing	95				2	10	107
Recycling					7	202	209
Agriculture and Forestry							
Government Regulation and Administration			75				75
Indirect Jobs Associated with a U.S. Green Activity	29		12	1	40		
Grand Total	353	3	114	34	167	671	900
Non-Green Jobs							783
Total Indirect Jobs							1,766



Appendix B3: Temporary Jobs Associated with the Selected Green Investments by Green Activity: Induced Jobs

Tennessee Green Activities (Rows)	U.S. Green Activities (Columns)								Induced Jobs Associated with a Tennessee Green Activity	Grand Total
	Energy Efficiency	Energy from Renewable Sources	Environmental Compliance, Education and Training, and Public Awareness	Natural Resource Conservation	Pollution Reduction and Removal, Greenhouse Gas Reduction, and Recycling and Reuse					
Sustainable Transportation	4							36	40	
Green Construction								102	121	
Energy Efficiency	18									
Renewable Energy										
Environmental Protection	24			8				2	34	
Research and Development	4	2		12	1			5	30	
Green Manufacturing	1							0	1	
Recycling								3	76	
Agriculture and Forestry					2				2	
Government Regulation and Administration				19					19	
Induced Jobs Associated with a U.S. Green Activity	5			47	0			48		
Grand Total	56	2		86	3			56	204	
Non-Green Jobs									324	
Total Induced Jobs									1,505	
									1,929	

Appendix B4: Temporary Job Impact of the Selected Green Investments by U.S. Green Activity, LWIA, and Source of Impact

Local Workforce Investment Areas	Energy Efficiency	Energy from Renewable Sources	Environmental Compliance, Education and Training, and Public Awareness	Natural Resource Conservation	Pollution Reduction and Removal, Greenhouse Gas Reduction, and Recycling and Reuse	Jobs Not Associated With a Green Activity	Grand Total	Sources of Impact
LWIA 1						5	5	Indirect
LWIA 2	5					13	18	Indirect
LWIA 3	3			9	49	60	121	All
LWIA 4		2	4	17	9	44	76	Indirect & Induced
LWIA 5	107	1	76	2	2,764	1,104	4,056	All
LWIA 6		4			31	34	69	Indirect
LWIA 7	6					21	27	Indirect
LWIA 8	71	5	23	2	1,174	381	1,655	Direct
LWIA 9	201	2	95		1,641	983	2,921	All
LWIA 10		2				15	17	Indirect & Induced
LWIA 11	4	201	2	7	3	94	311	All
LWIA 12	2					9	11	Indirect
LWIA 13	11	12				59	81	Indirect & Induced
Grand Total	409	228	200	38	5,670	2,823	9,369	



Appendix B5: Temporary Job Impact of the Selected Green Investments by U.S. Green Activity, Major Industry, and Source of Impact

NAICS	Description	Energy Efficiency	Energy from Renewable Sources	Environmental Compliance, Education and Training, and Public Awareness	Natural Resource Conservation	Pollution Reduction and Removal, Greenhouse Gas Reduction, and Recycling and Reuse	Grand Total	Sources of Impact
23XXX	Construction	31	223			5,448	5,701	Direct
5413XX	Architectural, engineering, and related services	136			34	105	274	Indirect
5411XX	Legal services			94			94	Indirect
5617XX	Services to buildings and dwellings	83					83	Indirect & Induced
	Other green activity jobs	160	5	106	4	117	393	All
	Other jobs not associated with green activities						2,824	
	Total economic impact	409	228	200	38	5,670	9,369	



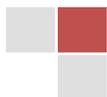
Appendix C: Detailed Tables for Permanent Job Impacts

Appendix C1: Employment Impact of the Selected Green Investments by Green Activity: Direct Jobs

Tennessee Green Activities (Rows)	U.S. Green Activities (Columns)										Direct Jobs Associated with a Tennessee Green Activity	Grand Total
	Energy Efficiency	Energy from Renewable Sources	Environmental Compliance, Education and Training, and Public Awareness	Natural Resource Conservation	Pollution Reduction and Removal, Greenhouse Gas Reduction, and Recycling and Reuse							
Agriculture and Forestry												
Energy Efficiency	4,494										4	4,498
Environmental Protection												
Government Regulation and Administration												
Green Manufacturing											9	9
Recycling												
Renewable Energy		11										11
Research and Development	4	9										32
Sustainable Transportation												
Direct Jobs Associated with a U.S. Green Activity												
Grand Total	4,498	20									13	4,551
Non-Green Jobs												21
Total Direct Jobs												4,572

Appendix C2: Employment Impact of the Selected Green Investments by Green Activity: Indirect Jobs

Tennessee Green Activities (Rows)	U.S. Green Activities (Columns)										Indirect Jobs Associated with a Tennessee Green Activity	Grand Total
	Energy Efficiency	Energy from Renewable Sources	Environmental Compliance, Education and Training, and Public Awareness	Natural Resource Conservation	Pollution Reduction and Removal, Greenhouse Gas Reduction, and Recycling and Reuse							
Agriculture and Forestry				3								3
Energy Efficiency	231										1	298
Environmental Protection	217			0							14	232
Government Regulation and Administration			84									84
Green Manufacturing	12									1,228		1,268
Recycling			259							14		1,796
Renewable Energy		11										11
Research and Development	34	188	61	8						79		458
Sustainable Transportation	13											547
Indirect Jobs Associated with a U.S. Green Activity	82		83							107		
Grand Total	589	199	488	10						1,443	2,729	4,696
Non-Green Jobs												2,106
Total Indirect Jobs												7,074

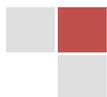


Appendix C3: Employment Impact of the Selected Green Investments by Green Activity: Induced Jobs

U.S. Green Activities (Columns)	Tennessee Green Activities (Rows)							Induced Jobs Associated with a Tennessee Green Activity	Sources of Impact	Grand Total
	Energy Efficiency	Energy from Renewable Sources	Environmental Compliance, Education and Training, and Public Awareness	Natural Resource Conservation	Pollution Reduction and Removal, Greenhouse Gas Reduction, and Recycling and Reuse					
Agriculture and Forestry				15					15	
Energy Efficiency	57						0	276	333	
Environmental Protection	60			36			3	9	107	
Government Regulation and Administration				48					48	
Green Manufacturing	1						3	7	11	
Recycling				11			8	194	212	
Renewable Energy		2							2	
Research and Development	2	5		16	2		15	19	58	
Sustainable Transportation	10							100	110	
Induced Jobs Associated with a U.S. Green Activity	17			104			114			
Grand Total	146	7		215	17		142	527	897	
Non-Green Jobs									3,782	
Total Induced Jobs									4,914	

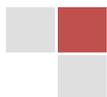
Appendix C4: Employment Impact of the Selected Green Investments by U.S. Green Activity, LWIA, and Source of Impact

Local Workforce Investment Areas	U.S. Green Activities							Jobs Not Associated With a Green Activity	Sources of Impact	Grand Total
	Energy Efficiency	Energy from Renewable Sources	Environmental Compliance, Education and Training, and Public Awareness	Natural Resource Conservation	Pollution Reduction and Removal, Greenhouse Gas Reduction, and Recycling and Reuse					
LWIA 1	4				14		43	Indirect	61	
LWIA 2	2		4		93		110	Indirect	209	
LWIA 3	32	21	21		85		253	Indirect & Induced	411	
LWIA 4	30	70	43	10	265		348	Indirect & Induced	767	
LWIA 5	3,001	64	350	11	381		4,421	Direct, Indirect & Induced	8,228	
LWIA 6	7		2		180		163	Indirect	352	
LWIA 7	5			1	114		120	Indirect	241	
LWIA 8	617	29	40	2	120		965	Direct, Indirect & Induced	1,774	
LWIA 9	1,526	28	243	2	259		2,077	Direct, Indirect & Induced	4,135	
LWIA 10	2	3		1	35		75	Indirect	116	
LWIA 11	2	11			24		71	Indirect	108	
LWIA 12					18		26	Indirect & Induced	44	
LWIA 13	3				10		101	Indirect & Induced	114	
Total	5,233	226	702	27	1,598		8,773		16,560	



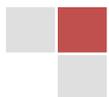
Appendix C5: Employment Impact of the Selected Green Investments by U.S. Green Activity, Industry, and Source of Impact

NAICS Description	Energy Efficiency	Energy from Renewable Sources	Environmental Compliance, Education and Training, and Public Awareness	Natural Resource Conservation	Pollution Reduction and Removal, Greenhouse Gas Reduction, and Recycling and Reuse	Total	Sources of Impact
336111 Automobile manufacturing	2,302					2,302	Direct
334413 Semiconductor and related device manufacturing	1,191					1,191	Direct
3311XX Motor vehicle parts manufacturing	2				1,135	1,137	Indirect
335911 Storage battery manufacturing	1,000					1,000	Direct
55XXXX Management of companies and enterprises			356			356	Indirect
5617XX Services to buildings and dwellings	277					277	Indirect & Induced
5417XX Scientific research and development services		203				203	Indirect
23XXXX Construction (Maintenance and Repair)	172					172	Indirect & Induced
81111X Automotive repair and maintenance, except car washes					134	134	Indirect & Induced
5411XX Legal services			132			132	Indirect & Induced
5413XX Architectural, engineering, and related services				10	94	103	Indirect
523XXX Securities, commodity contracts, investments, and related activities					90	90	Indirect & Induced
5418XX Advertising and related services			87			87	Indirect
32621X Tire manufacturing					76	76	Indirect
8113XX Commercial and industrial machinery and equipment repair and maintenance	65					65	Indirect
Other Green Activity Jobs	223	23	127	17	69	460	All
Other Jobs Not Associated with Green Activities						8,772	
Total Economic Impact	5,233	226	702	27	1,598	16,558	



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