

# MEASUREMENT AND ANALYSIS OF EMPLOYMENT IN THE GREEN ECONOMY

Workforce Information Council  
Green Jobs Study Group  
Final Report

October 1, 2009



The Green Jobs Study Group acknowledges the excellent support for this project provided by JBS International, Inc., specifically Marilyn Silver, Barbara Derwart, Laura Putnam, and Jim Woods. Jim Woods authored the report and Barbara Derwart facilitated the working session. The Study Group also thanks Gary Crossley, WIC Executive Director, for providing support to the group.

### **Workforce Information Council Green Jobs Study Group**

<b>Federal Members</b>	
<i>Bureau of Labor Statistics</i>	
<b>Dixie Sommers</b> Federal Co-chair	Assistant Commissioner Office of Occupational Statistics and Employment Projections
<b>Rick Clayton</b>	Chief Division of Administrative Statistics and Labor Turnover
<b>Patricia Getz</b>	Assistant Commissioner Office of Industry Employment Statistics
<b>Ken Robertson</b>	Chief Division of Current Employment Statistics
<b>George Stamas</b>	Chief Division of Occupational Employment Statistics
<i>Employment and Training Administration</i>	
<b>Pamela Frugoli</b>	O*NET/Competency Assessment Team Lead Employment and Training Administration
<b>State Members</b>	
<b>Bonnie Graybill</b> State Co-chair	Deputy Chief, Labor Market Information Division California Employment Development Department
<b>Allyson Hathaway</b>	LMI Economist Colorado Department of Labor and Employment
<b>Ed Legge</b>	Chief, Workforce Information and Partner Services Division Pennsylvania Department of Labor and Industry
<b>Rebecca Rust</b> (with Vesselka McAlarney)	Director, Labor Market Statistics Center Florida Agency for Workforce Innovation
<b>Frank M. Surdey</b>	Managing Economist New York State Department of Labor
<b>Roger Therrien</b> (with Nick Jolly and Patrick Flaherty)	Director of Research Connecticut Department of Labor
<b>Greg Weeks</b>	Director, Labor Market and Economic Analysis Washington Employment Security Department

## Table of Contents

Executive Summary .....	5
Chapter 1: Measuring Green Jobs – Objectives and Guiding Principles .....	9
Chapter 2: Defining Green Jobs and Related Concepts .....	13
Chapter 3: Survey Approaches to Estimating Green-Related Employment .....	21
Chapter 4: Analytical and Qualitative Methods to Study Green-Related Employment .....	35
Chapter 5: Labor Market Information for a Green Economy .....	45
Chapter 6: Action Plan.....	49
References.....	52

### **Appendices**

Appendix 1. Workforce Information Council Green Jobs Study Group Charter.....	55
Appendix 2. Green Definition Exhibits .....	59
Appendix 3. Comparison of Survey Items of Questions on Four State Green Jobs Surveys .....	63



## Executive Summary

Given the growing interest in and need for information about green jobs, the Workforce Information Council (WIC) chartered the Green Jobs Study Group in March 2009 to address three goals:

- Define green jobs and identify what needs to be measured related to green jobs;
- Develop alternative methods of measuring green jobs; and
- Develop an action plan.

Since establishment of the Green Jobs Study Group, some key developments have occurred that impact the original intent of the report. The President's Fiscal Year (FY) 2010 Budget proposes funding for the Bureau of Labor Statistics (BLS) to initiate a survey to estimate green jobs by industry with plans to continue surveys in subsequent years including implementation of a green jobs occupational survey. BLS also is working through definitions and approaches that are specific to a national survey. At the same time, many states have undertaken studies as directed by their state officials and/or applied for state Labor Market Information (LMI) improvement grants from the Employment and Training Administration "to collect, analyze, and disseminate labor market information, and to enhance the labor exchange infrastructure for careers within the energy efficiency and renewable energy industries." In light of these efforts, the focus of the Study Group has shifted to identifying lessons learned and sharing information among states.

As such, the purpose of this report is to provide information to the WIC, LMI units, and other interested parties on working definitions and methods to estimate and analyze green job employment. We emphasize that these are working definitions and do not constitute an official set of terms and methods. Unique state policy direction and objectives will drive and determine the scope of what is considered green and the specific questions included on a state survey or in an analysis. The material presented in this report can serve, however, as a starting point to inform states that plan to undertake green job studies.

While many studies were reviewed for this report, the principal resources reviewed—including four state surveys of green jobs in Washington, Michigan, Oregon, and California and two analytical reviews from Connecticut and New York—come from state LMI units. Having developed and used measurable definitions of green jobs and green economic activities, these states provide a learning laboratory. Based on their work, we believe that a combination of a measurable definition of green jobs, survey-based green job data, and existing LMI provides the strongest base on which to develop and provide information on green jobs.

A green job may be viewed generically as one in which the work impacts positively on energy and/or environmental sustainability. However, a measurable definition requires more detail and context. This report proposes for the WIC the following working definition of a green job:

*A green job is one in which the **work is essential** to products or services that improve energy efficiency, expand the use of renewable energy, or support environmental sustainability. The job involves work in any of these green economic activity categories:*

- *Renewable Energy and Alternative Fuels*
- *Energy Efficiency and Conservation*
- *Pollution, Waste, and Greenhouse Gas (GHG) Management, Prevention, and Reduction*
- *Environmental Cleanup and Remediation and Waste Clean-up and Mitigation*
- *Sustainable Agriculture and Natural Resource Conservation*
- *Education, Regulation, Compliance, Public Awareness, and Training and Energy Trading*

As this is a working definition, it is worthwhile to note several important features:

- The definition presupposes the job as the unit of observation, i.e., data are defined and collected at the level of jobs. Data can be coded subsequently to the SOC or related to the industry via the NAICS, but are initially defined at the job level.
  - From an industry perspective, alternative definitions might be considered in the context of “green industries” as the unit of observation;
  - However, this report focuses exclusively on the job as the unit of observation and not an industry based definition.
- The definition is composed of a brief sentence that ties the job to the fundamental notions of “green,” i.e., to energy and/or environmental sustainability.
- The definition is associated with a set of green economic activities. These categories are fundamental and crucial to measurement as they are used to define the scope of what is considered green, provide guidance to a survey respondent, and serve as one level of analysis of results.
- The definition includes a qualifier on the degree of relationship, “**work is essential to products and services.**” This implies that there is an important and significant link of the work to green products and services and green economic activities. Although subjective, this component of the definition is critical to measurement as it provides guidance to survey respondents in determining what jobs may be considered green.

Based on the experiences of states in conducting green jobs surveys, additional elements should be added on the survey instrument to fully implement a measurable concept of green jobs.

- The survey questionnaire should specify a time period (for example, “Include jobs for the past three months,” or for a given year). This helps not only the respondent but provides a frame of reference for subsequent estimates and analysis.
- The questionnaire should provide clear examples of activities that might be considered green or should not be considered green for each of the green economic activities.

In addition to these suggestions, the report includes a series of lessons learned on conducting a green jobs survey. The lessons learned address aspects such as: survey planning, response modes, instrument design, testing the survey instrument, sampling, follow-up procedures, data

capture and editing, estimation, and data analysis and dissemination. Surveying green jobs, by its very nature, introduces several issues that are different from traditional industry and occupational surveys, so the lessons from the existing state LMI surveys are particularly instructive and useful to future studies.

One of the key lessons learned from the states' surveys is that it is particularly important to establish clearly the purpose and parameters of a survey. There are several different elements and approaches that might be considered in a green jobs survey, so it is necessary to address a series of questions up front:

- Is the survey intended to measure the number of green jobs? If so, is it intended to measure the number of green jobs by green economic activity categories?
- Is the survey intended to measure other items in addition to or instead of the number of green jobs (e.g., wages, demographics, training requirements, green business practices)?
- At what level of industry (e.g., 3-digit or 6-digit NAICS) and occupation classification and geography will green job data be grouped?
- Is the survey focused on the entire economy or segments that might be considered part of the greening of the economy? Does it include both the private and public sectors?

In addition, it is particularly useful to consider how the survey data will be used in conjunction with existing LMI including occupational estimates, wage data, and O\*NET data. To the extent that a survey can be highly focused, it may be possible to realize higher response rates and enhanced quality of responses if questions focus solely on data not currently available. With or without survey data, however, analysis of existing LMI is key to developing information on green jobs. This report highlights several points with regard to existing LMI learned from analyses in New York, Connecticut, and Michigan including:

- Carefully determine/review the purpose of the study. What are the key questions to be answered? What data sources are available? If a green job survey is part of the study, how can data from the survey be integrated or analyzed with other LMI?
- The scope of the study must be clearly defined. For example, in New York the focus was on selected renewable energy sectors and energy efficiency with emphasis on weatherization and not all green economic activities.
- Consider not only “traditional” information but also use of other studies, focus groups for qualitative information, and other sources.

To facilitate the Study Group's efforts to share information among states, the report concludes with a brief action plan that covers elements including:

- The need for ongoing work on definitions and convergence and comparability among national and state green jobs studies;
- A means to provide contact on a regular basis to share methods, lessons learned, and results; and
- A process for identifying state technical assistance needs and ways to provide technical assistance in response to identified needs.





## **Chapter 1: Measuring Green Jobs – Objectives and Guiding Principles**

**This chapter describes the greening economy; examines the growing need for information on green-related employment as part of a nationwide labor market information system; highlights lessons learned from previous studies; and establishes the scope of this report in meeting the goals of the Workforce Information Council Green Jobs Study Group.**

### **The Need for Information on Green-Related Employment**

In the U.S. and globally, a debate is taking place on energy and the environment, including what constitutes green economic activity and green jobs. At the same time, initiatives and investments in renewable energy, greater energy efficiency, and environmental sustainability are increasing. The result has been increased demand for information about the employment in the “greening” economy. To address this demand, the Workforce Information Council (WIC) chartered the Green Jobs Study Group (Study Group) “to develop proposals to measure and analyze the employment needs of the greening economy.”<sup>1</sup> In support of this objective, the WIC established three goals for the Study Group:

- Goal 1: Define “green jobs” and identify what needs to be measured.
- Goal 2: Develop alternative methods of measuring “green jobs,” including estimating costs of measurement.
- Goal 3: Develop a specific action plan to collect and publish the information required by policy makers.

This report addresses each of the goals with the exception of estimating costs. The report lays a foundation for common concepts and definitions, measurement techniques, and analytical approaches to gather information on green-related employment. This foundation can inform state Labor Market Information (LMI) units, the U.S. Bureau of Labor Statistics (BLS), the Employment and Training Administration (ETA), and other interested parties that may undertake studies to estimate and analyze employment levels and workplace topics associated with the greening economy. A brief Action Plan is presented at the end of the report.

With increased demand for information on green-related employment, there is a need for:

- Baseline measurement of green jobs, categorized into industries and occupations.
- Information on skill requirements for green-related work. Are requirements similar to those of existing occupations or are there new or unique needs?
- Follow-up measurement to understand trends in the number, type, and distribution of green jobs.
- A responsive nationwide system that supports this measurement process and facilitates sharing of results and methods among states.

---

<sup>1</sup> See Appendix 1 for a copy of the charter.

- Survey capabilities at the state and federal levels to gather information on green jobs.
- Ability to classify and relate jobs from green job surveys into industries (NAICS) and occupations (SOC).
- Ability to distinguish between green and non-green jobs in the same occupation.
- Capability to identify new industries and occupations and consider these in the revision of the North American Industrial Classification System (NAICS) and the Standard Occupational Classification (SOC), and add new lay titles to the O\*NET system.
- Analysis of green jobs in conjunction with other LMI and the O\*NET databases.
- Information on green-related certifications and licenses.

Private business, government at all levels, and the public expect that BLS and state LMI units develop information on green jobs and activity. Recognizing this need, the President's FY 2010 Budget proposes funding for BLS to collect information on green-related employment. If funded, BLS will survey establishments to obtain relevant data. Similarly, many states have initiated studies of green-related employment. This information will support business needs, economic development planning, and workforce development by enabling users to understand the workplace requirements of green jobs, the particular skills needed, and the curricula and programs available to train workers to meet the greening economy's needs.

The report documents various definitions constructed by states; their similarities and differences serve as starting points for other states as they undertake studies. Recognizing that states must address unique needs based on state direction and initiatives, the report provides some working definitions intended to inform and not constrain state efforts. On the other hand, the greater the consistency in definitions, the more useful and valid any cross state comparisons are.

### **Lessons Learned and Scope of the Report**

A number of public and private studies already have been undertaken to estimate or analyze green jobs and the greening of the economy. These studies provide an invaluable laboratory of experience. To share lessons learned from the experiences of states that have already conducted green jobs surveys or in-depth analyses, this report highlights specific efforts undertaken by LMI units including surveys in Washington, Michigan, Oregon, and California and LMI-based analyses in Connecticut and New York. The first four states already have tackled major conceptual and pragmatic issues in defining and measuring green jobs through surveys. Connecticut outlined a basic framework for analyzing labor market information with regard to green jobs, and New York and Michigan included detailed analyses using existent LMI and other sources to examine green employment.

There is some variation among the studies including:

- Assumptions, concepts, and definitions that address varying interests and purposes,
- Specific objectives and goals of the studies,
- Definitions of green jobs and green economic activity categories, and
- Methodologies to survey and/or analyze green-related employment.

While there is no single defining set of concepts, there are significant points of agreement and common elements among the studies that will help frame definitions and methods covered in this report. A working definition of green jobs and green economic activities is presented in the report, recognizing that states may need to modify some definitions and methods given specific state objectives and direction. A working definition that provides a common frame of reference will allow states to document differences in concepts and approaches, making it easier to share information and methods among states.



## **Chapter 2: Defining Green Jobs and Related Concepts**

**This chapter highlights the Study Group’s guiding principles for developing a measurable definition of green jobs; reviews existing green concepts and definitions; analyzes green jobs definitions used in four state surveys; proposes a comprehensive set of green economic activity categories; and offers the WIC a measurable working definition of green jobs.**

### **Principles for Developing a Measurable Definition of Green Jobs**

To understand the significance of changes in energy and environmental products, services, and business practices, with their incumbent effect on employment and the need for workers, it is useful to undertake rigorous studies that measure and analyze green economic activities and jobs. The foundation for such analysis is a definition of green jobs that is specific and clear enough for use in measurement. Some principles for developing a measurable definition of green jobs identified by the Green Jobs Study Group and through the review of state studies include:

1. Concepts and definitions must tie directly to green economic activities. The definition of a green job starts with an economic activity and then identifies jobs related to the activity.
2. Green-related definitions must be actionable for the purpose of the data collection effort to be undertaken. This may require some alternative definitions since states may use variations of “green” depending on their needs.
3. The job is the unit of observation for occupational employment measurement.
4. Data should be categorized by industry (product or service produced) and by occupation (type of work performed) using NAICS and SOC classification systems.
5. The definition of green jobs for statistical measurement should conceptually recognize three elements; jobs that are:
  - a) Involved in producing green products;
  - b) Involved in greening production processes; or
  - c) In the supply chain to produce green products and services.Methods and the degree to which each of the above can be measured are still open to question and require further development.
6. The definition should be based solely on economic activity and not include factors such as wages, degree of unionization, or benefits. Information on these factors can be provided, however, for use in analyses of policy or program interest.

### **Existing Definitions**

To adequately focus a definition of green jobs, the Study Group reviewed larger, fundamental concepts of green. Definitions that seem suited to this report’s objectives are highlighted below.

*Environmental Sustainability*—maintaining practices that contribute to the long-term quality of the environment. (Note: this is a generic definition that includes a wide range of factors such as environmental preservation and conservation, pollution control, waste disposal, natural resource management, etc.)

*Green Economy*—“The green economy encompasses the economic activity related to reducing the use of fossil fuels, decreasing pollution and greenhouse gas emissions, increasing the efficiency of energy usage, recycling materials, and developing and adopting renewable sources of energy” (Dierdorff, et. al., 2009).

*Green-Related Industry*—an industry sector that is likely to include establishments that produce products or services that are related to the green economy.

*Green Economic Activity Category*—a category of activities that impacts positively on greater use of renewable energy, increased energy efficiency, or environmental sustainability.

*Green-Related Occupations*—occupations that are likely to include jobs where the work activity supports the production of green products and services, or “greener” processes regardless of whether the establishment produces green products.

The above definitions provide a larger conceptual framework for understanding green jobs. ***Perhaps the most significant of these, with regard to developing a measurable definition of green jobs, is the green economic activity category.*** The concept of a green job necessarily requires a link to a green economic activity. Moreover, that connection may be a step beyond the primary purpose of a product or service. For example, the primary purpose of a consumer purchasing a new central air conditioning unit to replace an existing unit is to cool a home. A secondary outcome may be that the new unit is more efficient and over time will lower monthly bills. A green-related outcome is that the unit contributes to reduced energy use (energy efficiency) and reduced carbon emissions (if the electricity is generated by fossil fuels) ***relative to the older, less efficient unit.*** Given that buildings account for over 70 percent of U.S. electricity and 36 percent of natural gas use (U.S. DOE, Energy Efficiency and Renewable Energy, 2008), such efficiency gains are far from trivial. In this example, we might view a green job as one that is essential to the manufacturing of the air-conditioning unit; another might be the installer or service mechanic for the unit.

The following section illustrates the relationship between definitions of green jobs and green economic activity categories as evidenced by the California, Michigan, Oregon, and Washington green jobs surveys.

## **State Survey Definitions**

Developing a definition for measurement purposes can be informed through review of the experiences of four states that have undertaken green jobs surveys. California, Michigan, Oregon, and Washington already have identified and addressed many of the pragmatic and technical issues of measuring green jobs. Not every issue has been resolved, but the experience

of these states provides a sound basis for defining green jobs and delineating a candidate set of green economic activity categories for measurement purposes.

Figure 2.1 summarizes green jobs definitions, qualifiers, supplemental information used to qualify what is being measured, and the green economic activity categories included on the survey questionnaire used in each study.

**Figure 2.1 Definitions and Categories of Green in Four State LMI Green Jobs Surveys**

State Study/Survey	Definition of Green Jobs	Green Economic Activity Categories
California (Survey underway with planned publication in late 2009 )	Jobs that produce goods or services in any of the five green economic categories (see column to the right).  <i>Qualifier: Two-tiered approach: how many employees <b>produce goods and services and currently work any of their time</b> in one of the green economic activity categories, and of these, how many work <b>50% or more of their time</b> in one of the green economic categories?</i>	<ul style="list-style-type: none"> <li>• Generating and storing renewable energy</li> <li>• Recycling existing materials</li> <li>• Energy efficient product manufacturing, distribution, construction, installation, and maintenance</li> <li>• Education, compliance, and awareness</li> <li>• Natural and sustainable product manufacturing</li> </ul> <p>Survey includes examples of businesses to be included for each green economic activity category.</p>
Michigan <i>Michigan Green Jobs Report: Occupations and Employment in the New Green Economy</i> (2009)	“Jobs directly involved in generating or supporting a firm’s green-related products and services.”  <i>Qualifier: Estimate employees that have a <b>primary focus</b> in one of the categories to the right.</i>  The questionnaire notes that jobs in businesses that supply parts, components, products, or services to support the green economic activity categories are included.	<ul style="list-style-type: none"> <li>• Renewable energy production</li> <li>• Increased energy efficiency</li> <li>• Pollution prevention or environmental cleanup</li> <li>• Clean transportation and fuels</li> <li>• Sustainable Agriculture and natural resource conservation</li> </ul> <p>A two-page set of definitions of core green-related activities was included with the questionnaire.</p>
Oregon <i>The Greening of Oregon’s Workforce: Jobs, Wages, and Training</i> (2009)	Green job: a job that provides a service or produces a product in any of the five green categories.  <i>Qualifier: Only list jobs where work in green categories was <b>essential to the job in 2008</b>. The survey instrument specifies jobs engaged in producing or delivering products and services.</i>	<ul style="list-style-type: none"> <li>• Producing energy efficiency</li> <li>• Producing renewable energy</li> <li>• Preventing, reducing, or mitigating environmental degradation</li> <li>• Cleaning up and restoring the natural environment</li> <li>• Providing education, consulting, policy promotion, accreditation, trading and offsets or similar services supporting the above 4 categories</li> </ul> <p>The questionnaire includes specific examples of what should be included or excluded as green for each of the five green economic activity categories.</p>
Washington Report published in 2009	Green Jobs: jobs that promote environmental protection and energy security.  Jobs that directly support environmental protection and clean energy in one of the four green categories.  <i>Qualifier: Staff that worked in any one of the core areas as their <b>primary job function</b>...in the <b>past three months</b>.</i>	<ul style="list-style-type: none"> <li>• Renewable energy</li> <li>• Energy efficiency</li> <li>• Mitigation and cleanup of pollution</li> <li>• Preventing or reducing pollution</li> </ul>

Several important points relevant to a measurable definition of green jobs are clear from the experience of the four states as summarized in Figure 2.1.

- **The definitions are brief and directly reference green economic activity categories for further elaboration and measurement purposes.** The green economic activities are critical for the survey respondent to determine if a job is green. They also may be used as a level at which data are collected, for example collecting job titles by green economic activity categories as was done in the Washington and Michigan surveys.
- **The definitions include reference to the *type of relationship to economic activity* (e.g., “jobs engaged in the production of green products and services”).** The definitions developed by Michigan, California, and Oregon specify jobs that produce products and services in green economic activity categories. It is unclear whether or to what extent the surveys pick up jobs responsible for greening processes within a firm, regardless of whether the job or firm produces green products or services.
- **The definitions include supplemental information with examples of businesses or specific activities that are included (and excluded) in the green economic activity categories.** Three of the four survey instruments provided descriptions or examples for each green economic activity category. Oregon also included examples of what should *not* be included as green. This additional detail is valuable to measurement because it helps the respondent determine whether they conduct any of the listed activities. It is also valuable for interpretation of results and any comparison with other sources of green jobs information.
- **Most definitions include a qualifier describing the level of green-related work, such as primary, essential, any, or 50% time.**

The above definitions of green jobs, combined with green economic activity categories, are fundamental to data collection and measurement.

## Green Economic Activities

Of the 43 studies reviewed for this report, 26 include definitions of the green economy that directly include or are tied to green economic activity categories. The major elements of these definitions are summarized in Exhibit 2.2 in Appendix 2. The prevalence of green economic activities in these definitions reinforces the importance of viewing green jobs in the context of green economic activities.

The development of a set of unduplicated and accepted green economic activities is one of the challenges in developing a definition of green jobs for data collection purposes. However, this is also an opportunity to build on earlier work of others. In addition to the green economic activities mentioned in existing report definitions, a more focused analysis examined green economic activity categories found in seven sources: the four states that conducted surveys (CA, MI, OR, and WA), current BLS work to relate industries to green economic activities, the



O\*NET categories, and the 2009 PEW Charitable Trusts report, *The Clean Energy Economy: Repowering Jobs, Businesses and Investments Across America*. The comparison identified 18 categories of green economic activity. This list was refined and narrowed by identifying categories that appear most often in the seven studies and grouping categories that overlap or are very similar. See Appendix 2, Exhibits 2.3 and 2.4 for details.

From the analysis of various definitions, a proposed list of green economic activity categories is presented in Figure 2.2.

**Figure 2.2 Proposed Green Economic Activity Categories**

<b>Green Economic Activity</b>	<b>Activities Included (but not limited to)</b>
Renewable Energy and Alternative Fuels	Manufacturing, production, construction, design, research, delivery, operation, storage and maintenance of wind, solar, biomass, hydro, alternative transportation fuels, geothermal, ocean, methane, and waste incineration as a fuel source.
Energy Efficiency and Conservation	Manufacturing, construction, installation, production of energy efficient products (such as Energy Star rated appliances, more efficient lighting), energy efficiency services, weatherization, building retrofitting/efficiency, energy efficient production processes, energy distribution improvements (smart grid), transportation technology, and battery development and storage improvement.
Pollution, Waste, and GHG Management, Prevention, and Reduction	Activities related to controlling commercial, transportation, and industrial emissions and pollution; water treatment, recycling operations, waste product management and treatment. Includes controlling and reducing emissions of CO <sub>2</sub> , other greenhouse gases, waste water, and other pollutants.
Environmental Cleanup and Remediation and Waste Clean-up and Mitigation	Environmental remediation including the cleanup and disposal of pollution, waste, and hazardous materials; Superfund/Brownfield redevelopment; and landfill restoration.
Sustainable Agriculture and Natural Resource Conservation	Products and services to conserve, maintain, and improve natural resources and environment, including low carbon agriculture, land management, water management and conservation, wetlands restoration, and environmental conservation. Includes Bioscience related activities.
Education, Regulation, Compliance, Public Awareness and Training, and Energy Trading	Activities to educate the public, business, and government on energy efficiency, renewable energy, energy rating systems certifications (Energy Star, LEEDS), and more efficient energy consumption. Also informing appropriate parties and enforcing compliance requirements and regulations, promoting state energy standards and plans, and training on effective use of energy related products and processes. In theory, energy trading could include buying and selling of power or fuels related to energy efficiency and renewable energy as well as cap and trade activity to control pollution.

This is a working framework of green economic activities. States may prefer to vary some of the categories to focus more specifically on important sectors in their economies. For example, Michigan specified a separate category for Clean Transportation and Fuels. Other states may include some elements not on this list. For example, current policy in Florida is to include nuclear energy as part of the greening economy. The above provides a basis from which states might start and against which specific state differences can be documented to facilitate any sharing or comparison of studies and green-related employment estimates. With green economic activity concepts in hand, attention is turned to defining a measurable definition of green jobs.

## A Measurable Definition of Green Jobs

Generally, green jobs are jobs in which the work relates directly to the production or delivery of green products or services related to green economic activity categories. Of the 43 studies reviewed for this report, 22 included a definition of green jobs or green collar jobs. The key concepts in the definitions are consistent with the definitions used in the four state surveys. A summary of the review of frequently occurring terms found in these definitions is included in Exhibit 2.1 in Appendix 2. The most common terms reference environmental and energy issues including: conservation, clean up, use of alternative energy, and energy efficiency. These common elements are also noted when definitions of the green economy are considered.

Figure 2.3 presents four alternative definitions of green jobs. The first three are basic definitions currently used in some studies. The fourth, constructed for this report, is a working definition for possible use by states in conjunction with the green economic activity categories (shown in Figure 2.2). The suggested definition constructed for this report is intended as a definition for measuring green jobs and ultimately green-related occupational employment.

The definition of green jobs alone is insufficient to determine the parameter or the extent of what we can measure. It is the combination of the definition, the green economic activity categories, and instructions on the survey instrument that provide the full context for measuring green jobs.

- In the proposed Study Group working definition (last row), a qualifier is built directly into the definition: ***work that is essential***. It implies that there is some level of importance and relevance of the work to a green-related activity, and that without the work, the product or service would not be provided. From a measurement standpoint a respondent would provide some subjective interpretation of “essential” in determining whether a job qualified as “green.” Note that Washington and Michigan used a more stringent qualifier; the green-related work had to be a primary function. To the extent a more objective qualifier could be established, the less the subjectivity in the response.
- Green Economic Activity Categories—the green economic activity categories are important in measuring and analyzing green jobs in several respects:
  - They provide more specific information to support measurement than the definition alone.
  - The categories help survey respondents better determine whether the jobs meet the green criteria specified by the combination of definition and green activities.

- The categories may be used at a level for collecting data. Both Michigan and Washington collected job titles by green economic activity categories. Oregon did not, but the categories were instrumental in providing guidance to the respondent as to what should or should not be considered green.

**Figure 2.3: Alternative Green Definitions**

Source	Definition	Comment
Generic	A green job provides products or services in any of the green economic activity categories.	A high level concept that must be spelled out for practical use in measurement.
Variation of early WA state definition	Jobs that directly support environmental protection and clean energy in one of the green economic activity categories.	This variant provides some information in the definition itself before the reference to the categories, and could stand alone without the reference.
UNEP Report: <i>Green Jobs: Towards decent work in a sustainable, low carbon world</i>	Green jobs: positions in agriculture, manufacturing, construction, installation, and maintenance, as well as scientific and technical, administrative, and service-related activities that contribute substantially to preserving or restoring environmental quality.	Definition stands by itself by specifying types of positions that contribute to environmental quality. The UNEP document elaborates on the definition including (but is not limited to) jobs that “protect and restore ecosystems and biodiversity, reduce energy, materials, and water consumption... de-carbonize the economy, and minimize...all forms of waste and pollution.” The UNEP report adds additional criteria related to “good jobs.”
Definition Constructed for the Study Group to measure green jobs	A green job is one in which the <b>work is essential</b> to products or services that improve energy efficiency, expand the use of renewable energy, or support environmental sustainability. The job involves work in any of the green economic activity categories.	The definition specifies work that is essential (while this is subjective, it does provide some notion of the degree of the relationship). The Washington and Michigan studies included jobs in which the primary function of the job was related to the green activities.  For the proposed report definition, essential is selected as the qualifying term. A definition must be considered in the context of the green economic activity categories.

## Summary

*A measurable definition of green jobs includes several components and supporting information including:*

1. A general one or two sentence description relating the job to the greening economy.
2. A direct relationship to green economic activity area categories.
  - a. For consistency among states, agreement should be reached on a standard set of categories from which states can break out more detail if necessary.

- b. The categories set the scope of what is green and what is not.
- c. They are crucial to informing the survey respondent to reduce subjectivity in responses.
- d. *A degree of relationship* of the work to the green economic activity categories should be indicated.
  - For example, the work related to the green economic activity is essential to the work, a primary function, or characterized by a percentage relationship.
  - This relationship can be specified in the basic definition and on a survey questionnaire—preferably both.

As presented in Figure 2.3, the suggested measurable definition is:

*A green job is one in which the **work is essential** to providing products or services that improve energy efficiency, expand the use of renewable energy, or support environmental sustainability. The job involves work in any of the green economic activity categories:*

- *Renewable Energy and Alternative Fuels*
- *Energy Efficiency and Conservation*
- *Pollution, Waste and GHG Management, Prevention and Reduction*
- *Environmental cleanup and remediation and Waste Clean-up and Mitigation*
- *Sustainable Agriculture and Natural Resource Conservation*
- *Education, Regulation, Compliance, Public Awareness and Training and Energy Trading*

The combination of definition and green categories suggested in this chapter provides a scope for measuring jobs engaged in producing green products and services. Some degree of jobs in the supply chain also could be collected. For example, jobs related to manufacturing of wind turbines may be counted if the respondent considers the product as green. However, the definition does not adequately address how far along a supply chain products be included as green. For example, it would be problematic if manufacturers of bolts indicated that bolts were a green product because they were used in building wind turbines. Further research on supply chain relationships and methods of measurement would be useful both in measuring and interpreting survey results.

## **Chapter 3: Survey Approaches to Estimating Green-Related Employment**

This chapter opens with a *Lessons Learned* section based in large part on the information shared by states at a work session on July 16-17, 2009, and the state surveys reviewed for this report. The chapter also explores the green jobs surveys implemented by California, Michigan, Oregon, and Washington with an examination of the principal purposes of each survey, a review of the questionnaire items, and a summary of the sampling approaches.

As discussed in Chapter 2, when estimating employment in the green economy, the job is the unit of observation. Jobs exist within business establishments (i.e., the industry), and can be classified according to the product or service produced, the type of work performed (i.e., the occupation), as well as by geography. Therefore, a business survey is likely the best method to estimate and track trends in green jobs. The survey should be designed to identify green activity conducted by business establishments, and the jobs related to these activities. The experiences of four state LMI units that have designed and implemented green jobs surveys are instructive in how to develop and conduct such surveys.

### **Lessons Learned from Review of State LMI Surveys**

A number of the lessons learned from a review of the state surveys and most importantly from discussants at the Green Jobs Study Group work session are highlighted below.

A survey approach appears to be the best method of estimating green jobs since the SOC and NAICS classifications are not structured to differentiate “green” workers from other workers in the same industries or occupations. Participants at the Green Jobs Study Group work session indicated there is:

- A need for a national survey that establishes a standard set of definitions and methodologies;
- A need for flexibility within a state to modify definitions of green jobs; and
- Keen interest that data be produced for the state and sub-state levels, but recognition of the limits of any initial national surveys. The planned BLS industry initiative, if funded, may generate considerable geographic detail, as it will be coded to the universe of QCEW establishments in selected sectors. However, an occupational survey would be sample-based and not large enough to present very much geographic detail.

### ***Designing a Green Jobs Survey***

States interested in undertaking a survey can learn from the experience of others and should consider the following when planning the process and developing the timeline for the effort:

1. Planning—developing the scope of the study.
2. Response Modes—determining survey implementation and response mode(s)—mail, phone, Internet, a combination.
3. Survey Instrument—designing, developing the survey instrument.

4. Testing the survey instrument.
5. Sampling—determining the sample and drawing the sample of establishments to be surveyed.
6. Follow-up procedures to obtain desired response rate.
7. Data editing and data capture—processing responses and assigning classification codes.
8. Estimation.
9. Data analysis, presentation and dissemination.

## 1. Planning

- The purpose and context of the survey establish the basic framework for the green-related data to be collected. To determine the type of information to be collected and analyzed, develop a thorough knowledge of customers (requesting or using the output) and their needs. Steps to consider:
  - Clearly define goals and purposes.
  - Identify what is to be measured.
  - Develop definitions of terms (e.g. green jobs, green activity).
  - Build in sufficient time to plan the project, review the definition and other aspects of the plan, develop and pretest the instrument, undertake a cognitive review, implement, and follow-up with respondents.
  - Include a cognitive review. As an evaluative approach, cognitive review can focus on the entire survey-administration process or solely on the questionnaire.<sup>2</sup> A cognitive review is conducted so that unnecessary hurdles in the response process are removed. The cognitive review ensures instructions are clear, questions are understood as intended, and that responses meet the requirements of survey sponsors.
  - Manage scope creep.
- Measuring and analyzing green jobs is different from the traditional measurement and analysis of occupations and industries.
  - Green activity is crosscutting and involves jobs in many industries and occupations.
  - The term “green jobs” raises many different opinions and poses significant risks of response bias, so careful design and testing is important. Some participants at the work session indicated that it might be useful to simply classify jobs by the economic categories they impact and not use the term green jobs or overemphasize the term in the questionnaire.
  - The concept or definition of green can change over time. For example, is a product that is energy efficient today still energy efficient five years from now relative to more efficient products that may be developed? By implication, shifting definitions of green products and services over time could impact counts of workers involved in those activities. At this time, the primary interest of many states and BLS is to

---

<sup>2</sup> See Gordon Willis: “Cognitive Interviewing: A ‘How To’ Guide,”  
<http://appliedresearch.cancer.gov/areas/cognitive/interview.pdf>

develop baseline estimates of green-related employment. As such, this issue may not be critical, but could be of greater importance in future measurement.

- Planning should include key stakeholders in the process. The potential of scope creep must be considered:
  - The risk of serving multiple masters can become real and overburden a study.
  - There is a fine balance between reviewing definitions and reaching consensus.
  - One approach is to review definitions through a large constituency, but pursue final consensus with a smaller group using input from the broader range of partners.
  - The study must be objective.
- Scope decisions: in the planning phase, it is important to consider whether the survey:
  - Includes all industries;
  - Excludes industries deemed not likely to include green jobs;
  - Focuses only on pre-identified candidate green-related industries; and
  - Includes the private sector and/or the public sector.

## 2. Response Modes

- Web-based online response capability should be considered.
  - California’s online response software allows users to save partial responses and return later to complete them.
  - Built in logic tests are useful to online and data entry tools.
  - Any online entry should allow for secure saving of partial results.
  - Online survey software that saves and sums responses to a database can ease staff time required for key entry, editing, and analysis.
  - Ensure the Web-based tools protect the confidentiality of respondent information.
- Although it is often assumed that giving a respondent a choice of response mode may reduce nonresponse, some studies have shown that offering a larger number of response methods in the initial contact or mailing package can lead to a somewhat lower response rate.<sup>3</sup> BLS has had success in using multiple collection methods for a survey when the respondent is aware of the available methods. It is important to clearly explain the various options and not confuse respondents if multiple methods are used.

---

<sup>3</sup> For example, in a test involving the American Community Survey the Census Bureau found that offering an Internet option, in addition to a mail response option, led to a drop in overall response. See Deborah H. Griffin, Donald P. Fischer, Michael T. Morgan, “Testing an Internet Response Option for the American Community Survey,” <http://www.census.gov/acs/www/Downloads/ACS/Paper29.pdf> . In a review of this subject, de Leeuw concluded that there is no firm empirical evidence that offering multiple modes raises overall response, plus offering more than one mode raises the possibility of greater measurement error associated with the use of different modes. See Edith de Leeuw, “To Mix or Not to Mix Data Collection Modes in Surveys,” *Journal of Official Statistics*, Vol. 21, No. 2, 2005, pp. 233–255, <http://www.jos.nu/Articles/article.asp>

### 3. Survey Instrument

- Understanding that the job is the unit of analysis is critical to defining green employment for occupational employment purposes and designing the survey process and instrument.
  - Collecting information on “green” jobs makes it possible to do internal microanalysis of establishments that have green jobs, and analyze and publish information on green-related occupations and green-related industries.
  - Estimates of green jobs can be aggregated at the industry and occupational level using the NAICS and SOC systems.
  - Optimally, estimations of jobs within establishments should be done to the most detailed NAICS level possible (6-digit NAICS rather than 3-digit).
- Green definitions (see Chapter 2) should be included on the instrument and should:
  - Link definition to defined green economic activity categories;
  - Establish a degree of relationship (such as the work is essential to the activity);
  - Reference a time period (such as a quarter or a year); and
  - Include specific examples of what should and should not be included under a green economic activity category.
- The initial screening question on whether the respondent needs to continue the survey is critical. Clarify that you want the survey returned even if the establishment does not have the types of activities being studied. Without these returns, response bias is a danger. It is useful to obtain the total employment of firms that do not produce green products and services
- Design the survey questions to minimize handoffs at the establishment. Cognitive review and pre-testing may help identify whether handoffs are likely and may suggest design changes to avoid them.
- Ideally, design the survey so that one person can provide the response. The extent to which a single respondent can accurately respond to all of the questions may improve response rates.
- The instructions may be part of the survey instrument or included as an enclosure.
- The instrument should include clear definitions of green jobs and economic activities along with examples of elements to be included or excluded under each category.
- The survey instrument can be associated with enclosures including endorsements.
- Some surveys may pick up jobs related to green processes within an establishment whether or not the establishment produces green output.

### 4. Testing of the Survey Instrument

- Unclear or poorly worded questions can deter responses, elicit biased responses, or produce information that is not what was intended to be studied.
- Formal cognitive review and pre-tests are recommended to improve response rates and to reduce response bias.



- Examples of items to consider in testing include:
  - Are the questions clear and effective?
  - Can the respondent provide the requested information?
  - Is the instrument well-designed?

## 5. Sampling

- In developing a sample, states may need to explore options:
  - What stratification should be used (e.g., by establishment size, industry, area)?
  - What sampling method will be used?
  - Assigning sampling weights for use in estimation.
  - Is there value in over-sampling industries that have been pre-identified as potential green industries, while still surveying all industries?
- The Job Vacancy Survey (JVS) software is useful in developing the survey sample, based on the experience of Michigan. For information on the JVS see: <http://www.jvsinfo.org/tools.htm>.

## 6. Follow-up Procedures

- If respondents self-identify green jobs, it is important to ensure that phone interviewers do not provide direct advice on whether to categorize any item as green or not.
- Ad-hoc surveys require extensive follow-up to get acceptable response rates.
- The state green jobs survey experience suggests that significant non-response prompting is needed, especially on a one or first-time survey.
- While most of the first surveys had satisfactory response rates, over time it will be important to raise those rates. A national survey would require higher response rates to meet federal statistical standards.
- Training phone interviewers proved important in collecting data by phone or following up with non-respondents.

## 7. Data Editing, Data Capture, Processing Responses, and Assigning Classification Codes

- Generally most jobs were coded relatively easily to appropriate NAICS and SOC categories based on state experience.
- Participants at the work session indicated online entry tools for phone interviewers and data entry of mailed responses were important.
- Online entry tools for Web responses should include features that allow respondents to save partial responses for subsequent completion.

## 8. Estimation

- Generally each of the studies weighted the results to represent all industries included in the survey scope to compute estimates of the green jobs by industry and by occupation.

## 9. Data Analysis, Presentation, and Dissemination

- The survey states indicated that greater integration of survey data and traditional LMI, as appropriate, would be worthwhile in future studies and reports.
- Several of the states used Web dissemination as the primary means of delivering the report.
- The work session participants were interested in additional analysis including:
  - Looking at how much growth comes from existing firms versus births—might provide some linkages to other things like venture capital and patents;
  - Examining companies that responded that they have green jobs to see how long they have been in business and to compare green to non-green businesses;
  - Exploring other business dynamics; and
  - Mapping micro data job titles back to SOC to inform the BLS effort.

These lessons learned provide an invaluable laboratory of experience that may serve as a starting point for the development of new surveys and studies.

### **State LMI Surveys**

Four states, California, Michigan, Oregon, and Washington, have designed green jobs surveys. In this chapter, we cover the varied approaches taken by these states in addressing several major elements of their green jobs survey design and implementation:

- Principal purposes of the survey
- Context of how survey data may be used and analyzed with other sources of LMI
- Green jobs definitions and green activities categories in the context of survey and instrument design
- Survey questionnaire items
- Survey design
- Response rates, follow up, and estimating methods

For details and discussion of individual state surveys, see the report from the Study Group work session of July 16-17, *Measurement and Analysis of Green Job: Report of the WIC Green Jobs Study Group Work Session Discussion, Final Draft: July 26, 2009*. The study may be downloaded from: <http://www.workforceinfocouncil.org/GreenJobs.asp>. Download the document, *Report on the July 16-17, 2009, Work Session*.

### *Principal purposes of green jobs surveys*

There are many ways and levels at which green-related employment can be examined. As such, establishing the purpose of the survey is paramount to effective survey design. The following questions may be considered when clarifying the purpose of the survey:

- Is the survey intended to measure the number of green jobs? If so, is it intended to measure the number of green jobs by green economic activity categories?
- Is the survey intended to measure other items in addition to or instead of the number of green jobs (e.g., wages, demographics, training requirements, green business practices)?
- At what level of industry and occupational classification and geography will green job data be grouped (e.g., 3-digit or 6-digit NAICS)?
- Is the survey focused on the entire economy or segments that might be considered part of the green economy (e.g., employment related to renewable energy or to pollution abatement)?

### *Context of how survey data may be used with existent LMI and other data*

It is equally important to establish how the survey data will be used in conjunction with other data and to design the survey to facilitate use of its result with other data. For example, one survey might be designed to estimate green jobs but not collect wage data—instead using OES wage data in the analysis. Another might collect wage data for green jobs directly, which would require different questions and survey design. Figure 3.1 compares the purposes and context of survey use of the four state LMI surveys.

While there is much in common among the four state surveys, it is clear that the data collected and the way in which it is used in conjunction with other LMI will vary. Each survey collects data to develop an estimate of green jobs of some type, but key differences in state interest and needs affect design of the survey and questionnaire including, but not limited to:

- The range of jobs to be included. For example, Michigan included a question on “how many employees hold support jobs for green-related activities.”
- Collection of wage data through the green-related jobs survey.
- Obtaining information on education or training needs via the survey.
- Identifying key green business practices.

These differences demonstrate the variation in how states customize surveys to meet their specific needs. These variations can inform future state survey initiatives and enable states to learn from and possibly apply findings from other states without collecting identical information. They also illustrate the importance of clearly establishing the purpose and context of the survey to provide a broad framework for collecting green-related data.

**Figure 3.1 Comparing Purpose and Context of Four State Green Jobs Surveys**

State	Purpose	Context/Use of Survey
California	To estimate current green jobs and identify emerging or evolving occupations related to the green economy. To identify current or changing business practices toward a cleaner, more sustainable environment and identify means to assist business in cutting costs through energy efficiency and reduced emissions.	To identify new and emerging green jobs with a focus on 34 pre-defined occupational categories with specific green-related activities or skills. Survey also collects information on green business practices and other related information, employing a significantly different set of questions and questionnaire design than the other states.
Michigan	To estimate direct green jobs, with measurement of some support jobs. Other purposes include compiling data on employer expectations of hiring difficulties, filling job vacancies, and unique skill requirements.	Survey designed as part of three-pronged approach including quantitative (survey) data, analysis of LMI data, and qualitative information from focus groups.
Oregon	To count jobs where work in green activities is <i>essential</i> to the function of the job, along with associated wages, special job requirements, and education.	Emphasis on collecting wage and educational requirements. The report analyzes green jobs, aggregated to the SOC and NAICS level independent of green categories.
Washington	“The goal of the survey was to identify the number of jobs [direct only] that have been created within the state’s emerging “green economy” and to establish a baseline measure that can be used to track industry and job growth over time.” (Hardcastle, 2009)	Survey kept short to reduce burden on employer with results intended for use with LMI wage, projections and work requirements information. Washington also determined there was value in collecting information on whether a job was full- or part-time and whether the business had any green-related industry certifications.

### ***Definitions and Categories of Green Jobs and Economic Activity***

As discussed in Chapter 2, clear definitions of green jobs linked to defined green economic activity categories are necessary to any study. The magnitude of green jobs estimates will depend, to a significant degree, on the definitions used. The definition, purpose, and context of use of the survey influence the scope of the survey, the population to be surveyed, questionnaire design, and sampling methods. The definitions of green jobs and green economic categories not only direct the questionnaire design, but also guide respondents completing the survey, providing a basis for determining which jobs to include as green.

### ***Survey Questionnaire Items***

Questionnaire design flows directly from fundamental decisions about purpose, use, and definitions of key terminology, as well as from decisions on the collection mode. Analysis of the state survey instruments provides insight for use in future state and national surveys. Across the four state surveys, 27 survey items can be grouped into 5 main categories for purposes of discussion. See Appendix 3, Exhibit 3.1 for the high-level overview of data elements collected in each state survey, summarized in the following sections.

1. Qualifying or Screening Question: Each survey includes a basic screening question that determines whether the respondent fills out the entire survey or just certain questions. Variations among screening questions, depicted in Figure 3.2, may be instructive to future survey design.

The screening question is important in several ways. Primarily, the screening question provides information that helps the respondent determine whether their firm provides products or services that meet the green criteria. In addition, basic information, such as total employment and type of business, from firms that do not produce green-related output is valuable. At a minimum, asking if a firm provides green products or services offers a point of comparison of how many responding establishments produce green products and services and how many do not. When coded to an appropriate NAICS level, this becomes an important ratio in any analysis as to what percent of the establishments within a NAICS classification produce “green” output. It also may allow internal analysis at a more detailed NAICS level than can be published to better determine which type of establishment is most engaged in the green economy. The questionnaire must clearly ask and encourage respondents who answer “no” to the screening question to return the survey.

**Figure 3.2 Qualifying Questions on State Surveys**

State	Question	If No
WA	Has firm produced green products or services in the core area during the past three months?	Survey collects information on total employees and whether firm produces goods or services in green core areas (outside timeframe).
MI	Does firm produce products or services in a green core area?	Survey collects contact information only.
OR	Is working in one of the green categories essential to any job in 2008?	Survey collects total number of jobs only.
CA	Does firm provide green products or services?	Survey collects total employment, type of firm, and information on general green-related issues.

2. Survey Items on Number Employed in Green Jobs: Although slight variations exist, each state collects data on the number employed in green jobs. As such, there are commonalities among survey items related to the number of employed in green jobs. All four surveys:

- Collect the **total** number of employees in the establishment. This is important since the percentage of green jobs in an establishment or industry is a basic measure for analysis.
- Distinguish how strongly the work relates to a green activity to be included as green.
- Focus on collecting detail on direct green jobs. Michigan is the only survey to include a question on support jobs for green-related activities; the request is for a single figure of the total number of support jobs for the firm.
- Use green jobs as the unit of observation. However, the ultimate presentation of information is by SOC and NAICS. And in the case of Washington and Michigan, SOC and NAICS estimates can be analyzed in the context of the green economic activity

categories. See Appendix 3, Exhibit 3.2 for an example of a table showing SOC level occupations by green economic activity categories from the Washington report.

- Collect information on the number of employees by green job titles and employment by the particular green economic activity categories. The Washington and Michigan surveys also collected the number of workers by job title for each green category. Collecting data at this level provides a perspective on the relationships of occupations to green economic activities. This level of detail also requires the respondent to make distinctions by core area.

Several key variations in data collection also exist:

- Oregon did not collect job titles by green activity categories. However, Oregon did collect wage data for green job titles.
- Oregon used an output-driven green jobs definition (provide products and services), but allowed respondent to include employees who further green practices within a company. However it is not possible to distinguish between the two “types” of jobs in the results.
- California collected data by obtaining estimates of total “green” employees and employees working 50 percent or more of their time in the five green categories. Total green jobs, but not job titles are broken out by green categories.

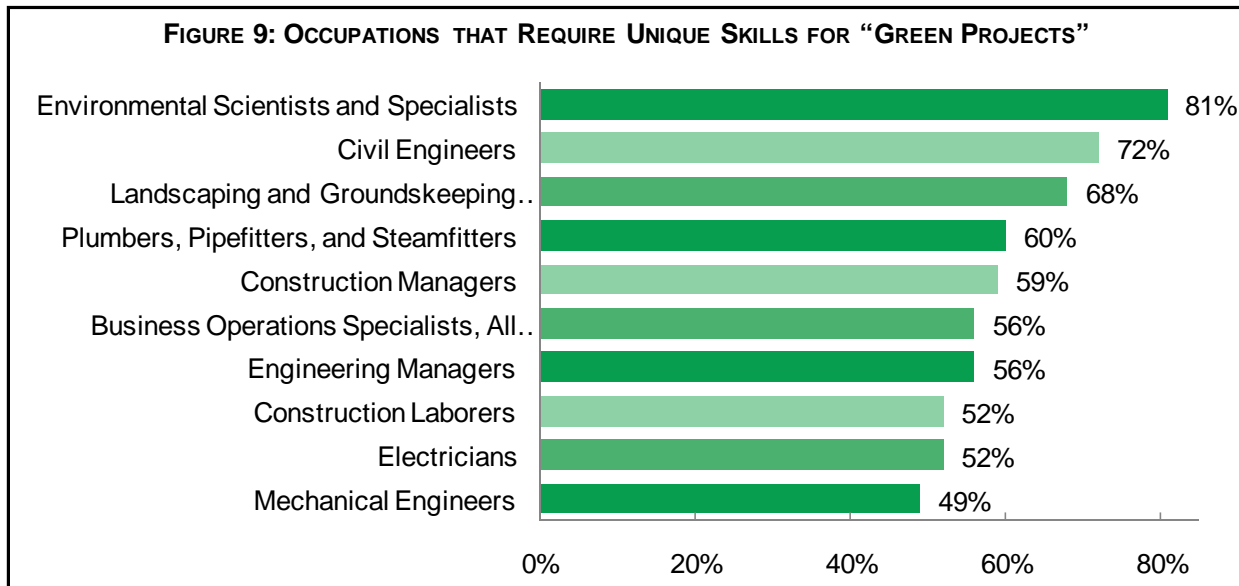
3. Survey Items Related to Green Job Duties, Skills, or Wages: each of the state LMI surveys collected some additional information related to green jobs.

- Oregon requested job titles and a brief description of duties (for use in SOC coding) related to green activities, and collected information for seven wage intervals.
- The California survey collected information at the establishment level on seven skills (and other items) to perform green activities. While not at the occupational level, it will be interesting to review the California results and the degree to which this question provides a broad indication of skill needs.
- Michigan included an element on whether an occupation required unique skills. This was a simple yes-no question, so no specific skills are identified as shown in Figure 3.3.
- Even such basic information can serve as an important guide to future action to identify unique skills needs. However, rather than attempt to collect skills information through the survey, the survey results can be used to identify occupations that might be candidates for future study.

4. Survey Items Related to Education Requirements, Training Needs, and Hiring Concerns:

Information on current and anticipated education and training requirements is of great interest to education, business, and government. While many studies indicate that the majority of green-related jobs do not require significantly different skills, many require some OJT or modest skills training. It is unlikely that such information can or should be collected in detail through an ongoing green jobs survey, but establishing some baseline information for future study, similar to the unique skills discussion above, could be useful.

**Figure 3.3 Occupations Requiring Unique Skills (from the Michigan Report)**  
 (Percent of Responding Employers Indicating an Occupation Requires Unique Skills When Working On a Green Project)



5. California Survey Items on Green-Related Issues: The California questionnaire probed into green business practices, barriers, technical assistance needs, and other related items. An interesting aspect of the California survey was that all firms in the sample were asked to respond to these items, even if they do not have green employment. The California results and response success should be examined when the data are released. Much might be learned on whether other business related questions could be collected successfully while obtaining a good response rate and reliable data.

**Survey Design**

A summary of the basic survey population, sample, and stratification is highlighted in Figure 3.4. All states did some pre-testing of the instrument.

Noteworthy elements of the different approaches used in the survey design include:

- Washington pre-identified 74 green-related industries using expert staff judgment and then conducted a Phase 1 survey of a sample of 7,500 of 120,000 firms **not** in the 74 pre-selected industries. The survey identified 36 additional industries that were added to the 74 for a total of 110 green industries that were included in the main sample. Potentially, this allows for greater detail since sample is not drawn from the larger universe. Oregon and Michigan surveyed all industries (with a few exceptions).

**Figure 3.4 Survey Design Including Population, Sample, and Stratification**

State Survey	Sample/Population	Stratification
California	51,129 of 837,206 private and public establishments, a subset of the 1.3 million employers in CA. Excluded employers in private households (NAICS 814110) and units coded as foreign locations or out of state.	All industries at the 2-digit level and 23 industries at the 3-digit level, <sup>4</sup> for a total of 42 NAICS.
Michigan	13,303 of 121,279 private establishments in 691 6-digit NAICS.	3-digit NAICS, 7 MI regions, and 7 employment size classes. Establishments with 250 or more employment selected with certainty.
Oregon	10,436 of 68,564 private and public establishments.	15 broad industry groups. Two groups were created. Certainty sample for employers thought green in industries with few employers.
Washington	17,000 of 27,000 private establishments in 110 pre-defined green-related industries.	29 Workforce Development Areas and 29 3-digit NAICS industries. Establishments with 200 or more employment were sampled with certainty.

- The stratification approaches varied. Michigan and Washington stratified samples by 3-digit NAICS with 7 geographical areas in Michigan and 29 workforce development areas in Washington with larger firms sampled with certainty. Oregon sampled across all industries stratified by establishment size, but also included a certainty sample of establishments in industries thought to have significant green products/services but with few employers. Oregon’s weighting methods accounted for this adjustment when estimates were developed.
- California included all two-digit industries, but within those industries selected 23 3-digit industries to insure that green businesses would be included in the sample.

**Survey Response Rates, Follow-up, and Estimating Procedures**

Figure 3.5 provides a summary of response rates for the three states that have completed surveys.

Each state used mail and phone follow-up and interviews. Oregon and California offered Web-based online input. Washington conducted a non-response bias test. For more details on individual state survey procedures, see the report from the Study Group work session.

<sup>4</sup> NAICS 3-digit industries included: 236, 237, 238, 321, 322, 323, 324, 325, 326, 327, 331, 332, 333, 334, 335, 336, 337, 339, 561, 562, 811, 812, and 813.



**Figure 3.5: Response Rates**

State	Number in Sample	Total Responses	Response Rate	Follow-up and Non-response Bias Testing
Michigan	13,132	6,434	49.0%	Firms not responding to the mailing were called and responses taken over the phone.
Oregon	10,436	4,708	45.1%	Non-respondents to first mailing sent second survey. Phone calls made to random selection of non-responding employers in industries with low response rates.
Washington	15,649	9,562	61.1%	Washington undertook intensive follow-up and most responses were provided through phone responses.  Washington conducted a non-response bias survey randomly selecting 363 firms that did not respond to the Phase 2 survey. Washington concluded that there was no significant response bias.

**Summary Comparison of State Green Jobs as Percent of Employment**

Figure 3.6 below provides a comparison of the aggregate result of each survey—green jobs as a percent of employment. Generally, the overall percentages in Michigan and Oregon are comparable. The lower figure in Washington may in part be due to a difference in definition and scope of the survey, though there is no definitive information on the differences. Over time, it will be useful to compare state and national survey results.

**Figure 3.6: Green Jobs as Percent of Employment**

	Green Jobs	Total Wage and Salary Employment	Green Jobs As % Employment
Oregon	51,402	1,686,524	3.0%
OR Private Only	46,339	1,438,475	3.2%
Michigan	96,767	3,200,000	3.0%
MI Direct and Support	109,067	3,200,000	3.4%
Washington	47,194	2,974,524	1.6%



## **Chapter 4: Analytical and Qualitative Methods to Study Green-Related Employment**

This chapter uses examples from Connecticut, New York, and Michigan to examine innovative analytical ways to study employment in the greening economy.

As discussed in Chapter 3, surveys are likely the best method to estimate and track trends in green employment. However, before undertaking a survey it is important for researchers to review existing LMI and to identify the scope and purpose of their study to determine what data will need to be collected. States that are not positioned to implement surveys to respond to requests for information about green jobs and employment will need to rely upon alternative research methods to understand the green economy. Alternative research methods include the analysis of existing LMI data combined with information mined from reports produced by associations, business Web sites, and public agencies.

Earlier in the report, strategies states have used to develop surveys about green jobs are described; this chapter explores several innovative approaches for tapping existing information resources to explore today's green economy. It offers an overview of how three states, Connecticut, New York, and Michigan, approached the task of studying green jobs and the green economy as evidenced in three reports:

- *How Green Is Connecticut's Economy?* (December 2008)
- *New York State's Clean Energy Industry: Labor Market and Workforce Intelligence* (May 2009)
- *Michigan Green Jobs Report, Occupations and Employment in the New Green Economy* (May 2009)

Connecticut, New York and Michigan used public and private data sources and LMI links to develop pictures of their greening economies and a means of tracking trends. Their replicable methods provided insights into industries and occupations expected to have a high concentration of green jobs. Moreover, they were able to project the outlook, wages, and to a more limited degree, the skill and training required for those green jobs.

As with surveys, when the states began their LMI work, they defined the purpose(s) and scope of the research before undertaking their analyses. The purpose and scope determined the nature, approach, and data used in the analyses. The following points clarify the purpose of each state's study:

1. Connecticut undertook a study "to *quantify* the number of green jobs in the state's economy and forecast how the numbers will fare over time."
2. The New York study analyzed LMI to determine the range of occupations and the labor market characteristics in selected green-related economic sectors to inform investment in green-related jobs.
3. Michigan used a three-pronged approach to provide insights into workforce issues and develop a comprehensive view of industry and occupational trends: survey, focus group, and analysis of LMI.

All three reports defined “green.” Their green definitions informed their approach and helped determine how the LMI was used. Finally, they considered the potential of their available resources for providing insights to support goals. These resources included:

- SOC Manual
- NAICS Manual
- QCEW data
- OES employment and wage data
- Occupational Projections data
- Industry/Occupation Matrix
- Occupational Outlook Handbook
- Occupational Information Network (O\*NET)
- Other research reports conducted outside of the LMI unit that assist in providing an analytical context

### **A View from Connecticut**

The Connecticut study was conducted to support state investment in “Green Collar” training. The report discusses what constitutes green job activity and concludes that it is not possible to count green *jobs* using occupation or industry data since the standard classification categories provide no means to differentiate green workers from traditional ones. Despite that limitation, the report goes on to say, “Even though there is some ambiguity regarding what is or is not ‘green,’ there are certain occupations and industries that will undoubtedly be affected by this movement towards greater environmental sustainability” (Jolly, 2008, p.2). It is therefore worthwhile to analyze existing data.

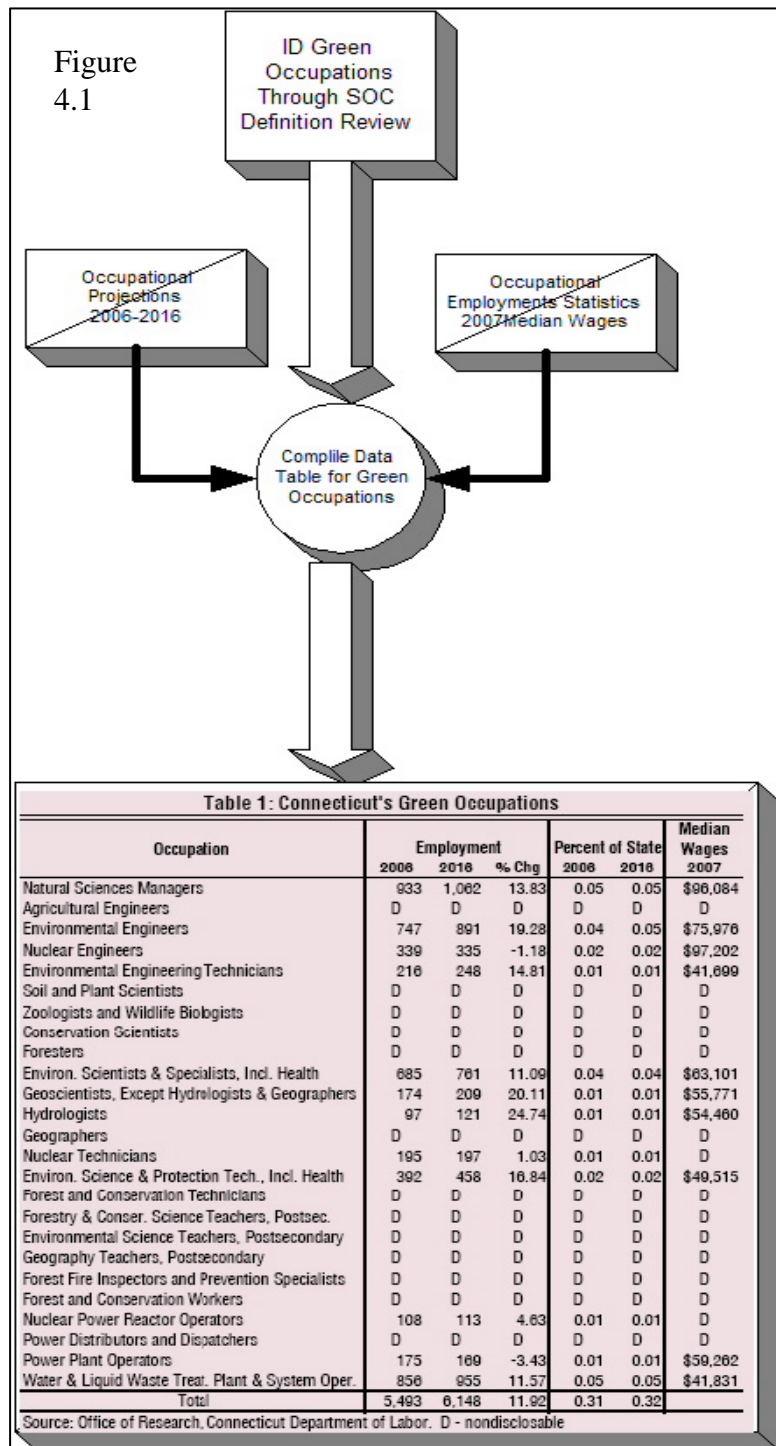
The Connecticut report proposes three ways to use LMI to help analyze occupations and industries in the greening economy. The approaches are not complete models, but demonstrate the potential and limitations of using existent LMI to analyze green employment. Each method provides different “estimates” of green employment, while showing some consistencies (such as growth trends) and providing a preliminary basis for tracking trends.

The first method, illustrated in Figure 4.1, identifies occupations that may contribute to the green economy. Occupations were chosen based on an analysis of the SOC definition to determine green work activity such as “preserving and protecting the environment.” After defining the set of occupations, two core elements of labor market information, the state occupational projections and the OES wage data, were used to develop a table displayed at the bottom of the figure. An analysis of the data reveals that total employment in Connecticut for these green occupations was 5,493 in 2006 and projected to be 6,148 in 2016—nearly a 12 percent growth rate. This rate is higher than the 8.3 percent rate projected for all occupations in Connecticut. Implication: green occupations are growing faster than the average. Similarly, wage data for green occupations could be compared to other occupations.

The report estimates green occupational employment to be about 0.31 percent of the 2006 Connecticut total employment. This is viewed as a very conservative estimate and considered a lower limit of possible green jobs. This approach assumes that all of the employment in these occupations is green.

The second method described in the Connecticut report focuses on an industry view and parallels the first approach. NAICS definitions are used to identify possible green industries. An industry that was defined as “producing a product or service that contributed directly to preserving and enhancing the quality of the environment” was identified as a green industry. The resulting industry list was associated with the 2007 employment and wage data. The result included 19 green industries with a total employment of 22,373, or 1.33 percent of the 2007 Connecticut employment. The top three industries were Waste Management and Remediation Services (7,168), Research and Development in Biotechnology (2,452), and Research and Development in the Physical, Engineering, and Life Sciences (2,369).

The third method combines both occupational and industry data. It is a method similar to one used by BLS to estimate high technology employment (Hecker, 2005). The result provides insights into those industries that have the highest concentration of green occupations, as well as, projected growth (or possible decline) in employment. See Figure 4.2.



**Figure 4.2**

Industry	Industry Emp		Green Emp		Percent Green	
	2006	2016	2006	2016	2006	2016
Mgmt, Scientific, & Tech. Consulting Serv.	11,460	14,640	530	683	4.6%	4.7%
Pharmaceutical & Medicine Mfg.	9,383	10,760	436	508	4.6%	4.7%
Architectural, Engineering, & Related Serv.	12,668	14,760	667	844	5.3%	5.7%
Waste Treatment and Disposal	544	580	35	37	6.4%	6.4%
Elec. Power Gen., Trans. & Distribution	4,955	4,480	676	653	13.6%	14.6%
Water, Sewage and Other Systems	910	1,000	243	287	26.7%	28.7%
Forestry and Logging	19	12	8	5	42.1%	41.7%
<b>Total</b>	<b>39,939</b>	<b>46,232</b>	<b>2,595</b>	<b>3,017</b>	<b>6.5%</b>	<b>6.5%</b>
All industry average is 2.24%		Twice the average is 4.48%				

This methodology produced the smallest of the employment estimates of the three methods, but the projected growth rate of the green occupations in these six industries is nearly 16.3 percent.

The NAICS and SOC classification systems help identify potential green-related industries and occupation as the means of organizing data. They also make it possible to extract data from existing LMI data sources. The OES wage data and state occupational projections play a key role in exploring some of the characteristics and projected trends for the selected occupations. There is consistency in the growth trends in all three approaches and all show green employment as a relatively small percentage of Connecticut employment. The limitation to these methods is that not all employment within the industry or occupational classification is likely to be green, nor do they capture the green employment in other industry and occupational classifications not considered for the study. As previously indicated, the Connecticut examples are not intended as complete models. Yet, their general approaches reveal the potential role of labor market information in analyzing green economic employment.

### **Clean Energy New York: Analyzing Market Needs and Training Capabilities**

The New York analysis of the clean energy industry is in direct response to a mandate to “immediately undertake an inventory of existing workforce training programs and streamline such efforts to utilize existing resources in the most optimal manner” (New York State Department of Labor [NYSDOL], 2009, p. I). This mandate provides the focus of the study and affords an example of why states must have some flexibility in defining the concepts and approaches they use to respond to specific state needs and initiatives. New York’s report analyzes a targeted industry sector. It addresses three important elements: labor market characterization, workforce development and training, and state-level collaboration.

The methods used by New York to develop information on green-related employment and labor market activities do not attempt to measure overall green employment or gather new data. Instead, New York supplies innovative ways to use LMI to paint a picture to support planning and decision-making on clean energy initiatives and workforce preparation. The clean energy sectors identified include: solar manufacturing and installation, wind turbine manufacturing and

installation, weatherization, and energy service companies. Sixteen NAICS codes (6-digit) were identified as relating to the six clean energy sectors with only one—Plumbing, Heating, AC Contractor appearing in two sectors: Weatherization and Solar Installation.

Figure 4.3 provides a schematic of the New York study approach. The analysis relied heavily on NAICS and SOC definitions. The first step of the process (1A-1C in the figure) was to identify businesses in New York in the clean energy sectors. Information from associations, companies, organization Web sites, and information on renewable energy projects funded by New York were used to identify likely candidates for the study. NAICS codes were assigned to the businesses.

Next, the businesses were mapped to the identified clean energy sectors using the NAICS codes. LMI data were compiled from the QCEW, OES, and projections programs (2C and 2D) for each of the selected codes. QCEW data was used to show trends in employment, and provided a geographic mapping of employers. OES data was used to determine primary occupations, wages, and staffing patterns, and projections provided job outlook within the identified sectors. The key point in New York's approach was the use of business-related data combined with LMI to develop reasonable industry green sector relationships for the study.

Item 3A, *Occupational Analysis and Labor Market Characteristics*, in Figure 4.3 depicts the type of information analyzed and the resulting reports produced (3B-3G). In developing the *Labor Market Characteristics* reports, New York used employment and wage data for the industries mapped to each sector. For each clean energy sector, New York identified occupations likely to have a tight labor supply using projected annual openings data from the projections program, along with entry-wage data and training requirements. The data are for the entire occupation and not for a “green” proportion of the occupations

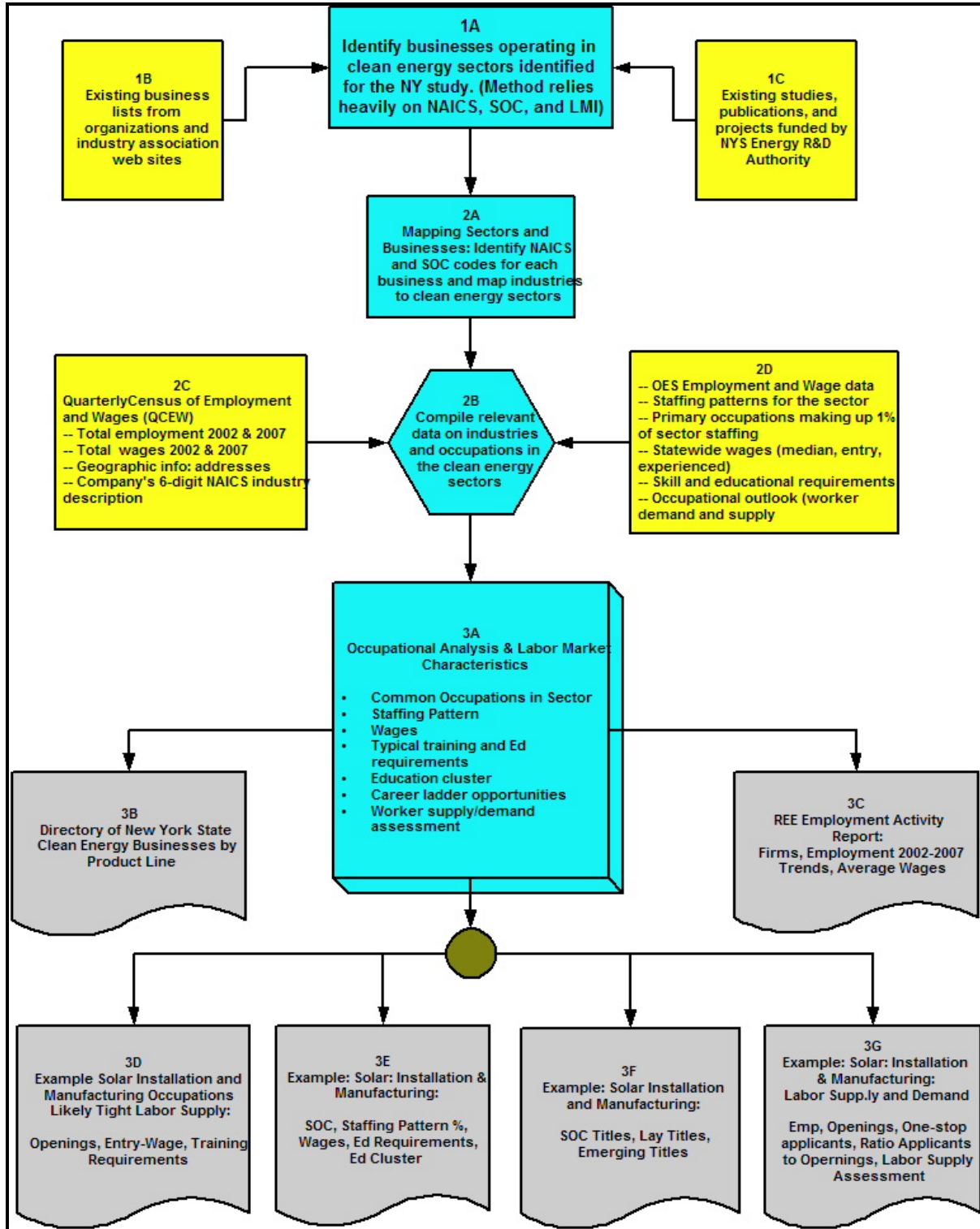
Three levels of wage data are displayed for each occupation using the OES wage data intervals:

- Median
- Entry—the mean of the bottom third of wages in an occupation
- Experienced—the mean of the top two-thirds of wages in an occupation

New York also matched projected annual openings to applicants by occupation in the New York one-stop system (for February 2009) as part of its means of assessing labor supply as tight or adequate (3G in the figure). This comprehensive approach provides a composite picture of employment.

***New York's approach is driven directly by the New York objective, looking at the jobs that exist, what they pay, and what type of education and training may be required.*** Although the New York study does not estimate the number of “green” electricians, it does identify electricians as constituting 22 percent of jobs in the industries matched to the Solar Installation sector. It suggests that the occupation is in tight supply, and training requires long-term OJT, with entry level wages at approximately \$37,000 and experienced electricians earning on average, \$79,000. The New York study demonstrates that a focused application of LMI and Web resources can be used in an analysis even without specific measures of green jobs. Although the report does not include job estimates, the combination of employment activity in firms and sectors identified as “green” provide a basic picture and better understanding of the green economy and green jobs.

**Figure 4.3. New York Clean Energy Analytical Model**



The examples shown in 3D-3G are only for the solar installation and manufacturing sector. The same tables were generated for the other clean energy sectors.



## Michigan Green Jobs Report: Occupations and Employment in the New Green Economy

Michigan conducted a survey and an analysis of existing LMI. The Michigan study provides a comprehensive example of using several approaches to get a better fix on the greening economy. The study “uses a three-pronged approach: 1) quantitative approach, 2) an analytical approach, and 3) a qualitative approach” (Michigan Department of Energy, Labor and Economic Growth, 2009, p.11). The quantitative component of the study (the survey) was reviewed in Chapter 3. Here attention is turned to the other elements of the study, with particular emphasis on what lessons might be learned from Michigan when survey and LMI data are used together. Michigan did not combine analysis of the job survey and LMI data, but intentionally analyzed data from the sources separately and reported each in individual chapters. Michigan staff indicated that if another study is undertaken, they might combine the analysis of green job survey data directly with other LMI.

Michigan staff made a conscious decision in the design of their survey to minimize burden on employers by collecting only data not currently available. Existing LMI supplied other desirable information as part of the overall analysis. The report specifies several issues intentionally not covered by the survey. These are repeated in Figure 4.4 from the Michigan report, because they are fundamental to the remaining analysis and approaches in the study. **Major lessons from the Michigan study are to plan the study carefully in advance; determine the specific items to collect from a survey; consider the questions and issues that can be addressed by other sources; and determine how these sets of information can be combined for a complete analysis.**

**Figure 4.4: Michigan Green Jobs Study: Issues Addressed Through Analysis of LMI**

<p><b><u>Industry Information</u></b></p> <ul style="list-style-type: none"><li>• Is there a way to shed light on recent employment trends among firms in the green economy or among industries that appear related to the green economy?</li><li>• Which broad green-related industry clusters provide the most total jobs, display competitive employment performance, or may have been more stable recently in terms of job trends?</li><li>• Which green-related industry sectors pay above average wages?</li></ul>
<p><b><u>Occupational Information</u></b></p> <ul style="list-style-type: none"><li>• Can a set of green-related occupations be identified? If so, what are the basic characteristics of these jobs?</li><li>• Which green-related occupations are large enough in Michigan to produce multiple annual job openings?</li><li>• What are examples of high-wage green-related occupations?</li><li>• Are there green-related job titles available in the Michigan economy for persons with differing educational/training backgrounds? Do career ladders exist in the green economy?</li><li>• What are some of the key skills and knowledge sets needed in certain green-related occupations?</li></ul> <p>Source: Michigan Green Jobs Report (2009)</p>

To address these issues, Michigan took the following approach to answer the questions not covered by the survey:

- Identified green-related industries and occupations using a variety of sources and then used LMI sources to examine employment trends, wages, education and training requirements,

and career ladders. 118 green-related industries and 105 green-related occupations were identified.

- Assigned the 118 green-related industries into seven clusters—the five green economic activity categories used in the survey and two additional clusters: *Miscellaneous green manufacturing cluster* and *Engineering, testing, and consulting services cluster*.
- Employed a variety of industry analysis techniques including location quotients and bubble charts to examine employment trends, employment concentration, competitive employment performance, and industry wages.
- Explored green-related occupations including forecasted growth and annual openings, relative wage rates, examples of selected potential career ladders, key skill and knowledge requirements (using O\*NET data), and educational and training requirements for certain green-related occupations.
- Analyzed QCEW data for 358 firms identified as green using information from associations, Web sites, and other sources to provide greater insight into green-related employment trends in Michigan.

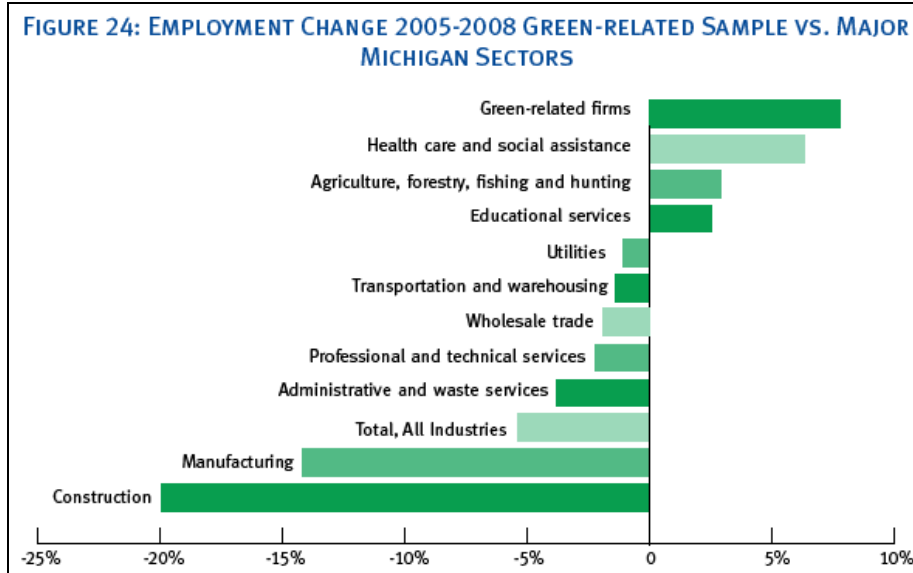
The industry analysis of the 358 green firms received a great deal of attention because it was thought to provide support that green job growth had occurred in Michigan. The 358 green-related firms in the sample showed a job growth rate of 7.7 percent from 2005-2008. Total Michigan jobs during this period fell by 5.4 percent. Although the firms studied do not represent a statistically valid sample, this methodology provides for a comparison of green firm employment activity to other industries. Figure 4.5 shows a comparison of the employment change for the period 2005-2008.

In spite of limitations and caveats, such analyses are promising adjuncts to use together with more standardized LMI to provide additional insight to market relationships. Michigan staff did note that some readers placed too much emphasis on this part of the report, so such focused analyses must be carefully presented in the context of other data.

The occupational analysis for identified green occupations was built into the study plan at the outset:

- Green-related occupation projected trends were analyzed for expected growth.
- Five career progression illustrations for the green categories were developed using OES wage data, projections, and educational requirements.
- Detailed wage and educational requirements were analyzed to identify high, moderate, and lower wage green occupations and relationships between wages and educational attainment by occupation.
- O\*NET data were used to demonstrate how critical skills and knowledge could be linked to green occupations as part of the analysis.

**Figure 4.5**



The Michigan report does provide an instance where survey data and LMI data are combined in a table.

*Figure 19 on page 39 of the report, shows the average weekly wage for 15 broad industries (3-digit NAICS) along with each industry's share of total green jobs (derived from the green jobs survey).*

While very basic, this simple analysis shows some of the potential of combining survey data with LMI. For example, 26.6 percent of the green jobs derived from the survey are in NAICS 336, Transportation Equipment Manufacturing, with an average weekly wage of \$1,421—over \$600 higher than the average weekly wage for all industries in Michigan. This type of information can be used to support Michigan's objectives to stimulate growth in green-related initiatives within the transportation sector.

The Michigan approach is instructive in several respects. It suggests an efficient approach to get a more complete understanding of the green economy and to measure green-related employment. Asking for less information on a survey form tends to improve response rates, and additional information can be derived from existing LMI. Neither approach taken alone provides the complete picture. Once again, this reinforces the need for careful upfront planning of any green job study.

Michigan also used focus groups to obtain qualitative information to supplement the survey data and existing LMI. Eight focus group sessions involving employers, industry experts, educators, and others engaged or knowledgeable in green economic activities provided information on workforce issues, such as identifying industry training needs, skill requirements, and locating skilled workers. For example, one finding from the focus groups is that “many green jobs are current jobs with an additional green focus; far fewer green jobs are a full new set of knowledge and skills.” Employees may require some additional training in the workplace or through formal

educational channels, but the new skills were incremental to the larger set of basic skills needed for many of the green jobs. The Michigan experience provides an illustration of using focus groups as part of a larger toolkit to gain a sounder grasp on green jobs and economic activity.

### **Lessons Learned from Review of State Analytical and Qualitative Methods to Study Green-Related Employment**

A review of the state analytical studies and observations from discussants at the Green Jobs Study Group work session on July 16-17 offer a number of the strategies and potential steps to consider when charged with studying the greening of today's economy including:

- Review the purpose of the study.
- What questions must be answered?
- What data are available to answer the questions?
- Define the scope of the study. Will it focus on a few sectors?
- Define green and green activity for both industries and occupations.
- During the planning phase, determine what can be gathered from existing sources rather than collecting the information from a survey.
- Consider the budget. The discussants at the Green Jobs Study Group July 16-17 work session provided insights that budget limitations and time constraints must be factored into the plan.
- Consider both LMI sources directly available as well as other potential sources of information like business directories, Web searches, and published reports.
- Consider how data can be combined and displayed.
- Determine how the information will be conveyed—printed and/or Web document.

The lessons learned from the discussants and the state reports offer detailed information and experience that can serve as a starting point for others to help analyze green jobs.

## **Chapter 5: Labor Market Information for a Green Economy**

This chapter provides ideas for future work toward developing labor market information for the greening economy.

### **Considerations for Development of Nationwide Information on Green-Related Employment**

The demand for labor market information to measure green economic activity is ever-increasing. State LMI units and BLS are and will be expected to provide information and analysis on green economic activities that can be used to support planning and policy development by private and public organizations and individuals. The challenge now is to build from the experience of early state efforts to measure green jobs to conceptualize and plan how a nationwide employment statistics system can incorporate and measure green employment as part of its output.

To measure and track green employment requires clear and rigorous thinking on how information is collected and used. Any nationwide system to measure and analyze green must be viewed as a part of the overall LMI system; green is simply one aspect of the larger system. It requires special attention, however, because it is crosscutting among products and services, jobs, and industries.

### **Survey Considerations**

Establishing a benchmark or foundation of green job employment and subsequent tracking will require survey-based data. Design of a national survey rests with BLS. There are, however, items to consider in the planning of any survey of green jobs.

### ***Sampling***

Among issues that might be considered is whether over sampling pre-determined green-related industries is useful to maximize data on green jobs. While a survey of all industries would seem appropriate for any initial national survey effort, there is much information available from the four state green job surveys and other research that could pinpoint industries likely to have larger shares of green jobs. Some stratification or over sampling might be considered.

### ***Desirable Outcomes***

- Ideally green jobs estimates would be developed through a nationwide survey with data produced at the state and sub-state level.

- States have a strong interest in an industry-based measurement of green jobs providing as much geographical detail as is possible.
    - The planned BLS industry initiative, if funded, may generate considerable geographic detail, as it will be coded to the universe of QCEW establishments in selected sectors.
    - However, an occupational survey would be sample based and not large enough to present very much geographic detail.
  - Measurement of green jobs by occupation (the second proposed BLS survey) should provide as much SOC and NAICS detail as possible.
  - States are interested in whether any sub-national green occupational data can be developed.
- State and national surveys should complement and not duplicate information collected from existing surveys.
  - Survey items should be carefully considered in terms of their value-added relative to other sources.
  - Information from green studies should be used to inform possible revisions of the NAICS and SOC and inform potential additions to the O\*NET lay title file and emerging occupations research.

### ***Frequency of Survey***

No matter how tight the definitions and instructions are in a survey, there may be some variations based on response bias that impact measuring year-to-year changes. Until some nationwide survey results are available, it will not be clear as to what degree annual surveys can pick up year-to-year changes in green jobs. However, an annual industry-based estimate of green jobs (without occupational detail) would seem an essential feature of a nationwide system to measure year-to-year changes and trends over several years. A national survey to generate occupational detail might be modeled after the OES survey with data collected over 2-3 years to develop green-related occupational estimates to ensure sufficient occupational/industry detail, and if possible, some sub-national estimates. States will have to evaluate whether it is cost effective to undertake surveys annually or biennially.

### **Related Issues for Additional Study, Research, or Action**

Several other efforts and issues might be considered for future study.

#### ***Understanding Occupation and Industry Relationships***

Developing information on industry-occupation relationships in key green economic activities, including supply-chain relationships, green products and services, and potential impacts of large public or private initiatives on employment, may help inform analysis of survey data. Understanding relationships between industries also will help illustrate what the potential magnitude in employment growth is and whether more detailed coding may be needed for some

industries. It also may help establish upper bounds on what growth might be expected or is realistic. It may be useful to examine the existing Department of Energy *Job and Economic Development Impact Models* available from: [http://www.nrel.gov/analysis/jedi/about\\_jedi.html](http://www.nrel.gov/analysis/jedi/about_jedi.html).

Until survey data are available, consideration might be given to developing a green industry-occupation matrix by combining the occupation and industry worksheets. This would be a subset of the national industry-occupation matrix, including only occupations and industries that have been pre-determined—informed by the completed state surveys—as likely green candidates.

### ***Tracking Green Businesses and New Green Jobs***

Some thought might be given to identifying and tracking a sample of green businesses—businesses that are strongly related to the green economy. A BLS QCEW-type green jobs survey will allow for such tracking over time, once BLS has identified whether an establishment is producing green products or services.

It would also be useful for a nationwide system to track potential new occupations. None of the studies completed so far identified new green jobs suggestive of a new emerging occupation. Continued monitoring of new and emerging jobs, occupations, and skills may be part of the ongoing O\*NET activities or at least should be coordinated with the O\*NET program. Consideration should be given to a concerted effort to investigate the use of online job and employment listings to monitor new job titles, emerging skills, and possible new occupations. Information gleaned could be used to inform possible changes to the NAICS and SOC.

Collecting and deriving data on green-related company births would be valuable. The proposed BLS QCEW-type survey should make this possible. It would be useful to identify new companies with new products, as these may become significant sources of new job (and emerging occupations) creation.

### ***Monitoring Major Developments***

Efforts should be made to monitor private investments, major policy, and public initiatives in the energy and clean environment arenas for possible impact on future employment needs. For example, if a state establishes a new set of Renewable Energy Standards, it is important to understand what the implications to employment may be in meeting those standards.

Keeping informed on major private or public certifications related to green economic activity areas also is useful. For example, the impact of Energy Star on energy efficiency has been key to the reduction of energy intensity over the past 5-10 years. The combination of Energy Star ratings with gradual consumer recognition and changes in consumption behavior have played a major role in defining certain products and services as green, such as lighting, air conditioning, etc. Meeting or partnering with DOE, EPA, and other organizations to explore or model employment relationships to energy and clean environment initiatives may be useful.

These considerations outline only a few possible ideas that might be considered as the nationwide employment statistics and LMI system includes green employment measurements.

The purpose of introducing these elements is to encourage further dialogue and action toward conceptualizing and incorporating green designations into the existing LMI system. BLS, ETA, and state LMI agencies are facing some major issues with the greening of the American economy. They have begun the significant work needed for the nationwide labor market system to respond to the fundamental need for basic information to help us define and measure green jobs in our 21<sup>st</sup> century workplace. There will be no hard and fast solutions. This report is intended to provide input to future initiatives.



## **Chapter 6: Action Plan**

This chapter provides elements of a potential action plan for consideration of the WIC. No resources have been identified to implement items in the plan. The purpose is to encourage WIC members including the federal partners to identify potential resources if any of the proposed action items are of interest.

Since the establishment of the WIC Green Jobs Study Group, some key developments have occurred:

- The FY 2010 President's Budget proposes funding for BLS to initiate a survey to estimate green jobs by industry and in future years to implement a green jobs survey with data coded to the SOC level.
- BLS also is working through definitions and approaches that are specific to a national survey.
- States have undertaken studies as directed by their state officials.
- States have applied for state LMI improvement grants from ETA "to collect, analyze, and disseminate labor market information, and to enhance the labor exchange infrastructure for careers within the energy efficiency and renewable energy industries."

In light of these developments, the focus of the Study Group shifted from developing definitions and methodologies to identifying best practices and sharing information among states. The proposed plan of action is intended to support efforts to capture and share the experiences of BLS and the states resulting in learning that will be made available to all states and to BLS and ETA for use in future measurement efforts. The plan supports the goals to:

- Share information on green jobs study methods and results among states and federal partners.
- Establish a process to identify technical assistance needs of states and subsequently provide technical assistance on those needs.
- Continue work on developing definitions, concepts, and technical issues to foster a convergence of definitions to facilitate the sharing of methods and comparable results among states.

The Action Plan items are for consideration of the WIC. No resources have been identified to implement any of the suggestions in the plan. If there were interest to pursue any of the elements in the Action Plan it would be necessary to solicit interest and resources from members including the federal partners.

## **1. Share information and methods**

- a. Engage business and the workforce community to help them fully understand the context of the green economy and the relevance of the information to be collected and analyzed.
- b. Disseminate the WIC Green Jobs Study Group Report via the Web with notification to all state LMI units of its availability.
- c. Establish a Web site for states and BLS to voluntarily share information on studies in progress as well as results.
  - i. Leverage existing Web sites.
  - ii. Determine if the public would have access to the information.
  - iii. Develop a template of meta-data to be completed about the study, e.g. objectives of the study, the planned methodology, scope of the green economy covered by the study, items to be collected and measured, and type of data and information to be produced by the study.
  - iv. Encourage states to share the proposals as well as studies in progress.
  - v. Establish the Web site quickly.
- d. Conduct an analysis of the ETA-funded grants and any other planned initiatives in the next year, including any BLS plans or initiatives, to identify common aspects and differences in the studies relating to definitions, scope, methods, and other elements.
- e. Conduct a Webinar on lessons learned in green job measurement and BLS plans for all interested state LMI units. One goal of the session would be to encourage some degree of convergence and consistency, as applicable, on definitions and concepts.
- f. Include information sharing sessions at future LMI conferences.
- g. Include information sharing sessions through annual or semi-annual Webinars to keep states informed.

## **2. Establish a process to identify the technical assistance needs of states and subsequently provide technical assistance on those needs**

- a. Provide a means for states to indicate possible technical assistance needs based on the proposals submitted to ETA and other planned studies. Needs identification could be handled as an open-ended questionnaire or as a series of possible TA interventions listed in a check box format.
- b. Identify existing tools that may assist states in surveys or analyses of green jobs and consider possible modifications. Two examples:
  - i. States indicated that it would be useful to modify the JVS software to include probability proportional to size (PPS) sampling capability.
  - ii. In addition, providing information on tools available for coding jobs to occupations, along with any documentation on accuracy would also be useful.
- c. Based on a review of state-identified technical assistance needs, determine items that can be addressed and methods of delivering support.

- d. Examples of some areas that may require technical support:
    - i. Survey instrument design and testing, including cognitive review
    - ii. Sampling
    - iii. Response modes, including online and telephone responses
    - iv. Data editing
    - v. Estimation methods
    - vi. Effective analytical, presentation, and dissemination methods
  - e. Methods of providing technical assistance:
    - i. Written guidelines
    - ii. Voluntary technical support from state or federal partners
    - iii. Host Webinars on technical assistance needs common to many states.
- 3. Continue work on definitions, concepts, and technical issues to encourage convergence of definitions to facilitate the sharing of methods and comparable results among states**
- a. Share BLS lists on green-related industries and occupations
    - i. Analyze survey data (micro-data if available) from Washington, Oregon, and Michigan, and California to inform a “final” set of BLS lists.
    - ii. Once matrices have been vetted, share matrices along with suggestions on how matrices might inform state efforts.
  - b. Refine green economic activities and green-related definitions, as appropriate, based on new research and a review of state planned activities.
  - c. Provide guidance to states on the value of using the working definitions from the Study Group report as a starting point; also document any differences in state definitions and scope to facilitate the sharing of information and methods among states.
  - d. Share BLS definitions, once finalized; over time these may become de facto standards in future surveys.
  - e. Research supply chain relationships and ways of capturing green job information in key components of the supply chain.
    - i. Explore existing Department of Energy models, particularly the Job and Economic Development Impact (JEDI) models available at: <http://www.nrel.gov/analysis/jedi/>.
    - ii. Examine available research on supply chains in areas such as renewable energy and energy efficiency.
  - f. Explore approaches to capture information effectively on jobs within establishments that are essential for internal green processes, regardless of whether the establishment produces green products and services. California used this approach.

## References

- American Recovery and Reinvestment Act of 2009; Notice of Availability of Funds and Solicitation for Grant Applications for State Labor Market Information Improvement Grants, 74 Fed. Reg. 30128 (June 24, 2009). Retrieved August 9, 2009, from <http://www.doleta.gov/grants/pdf/SGA-DFA-PY-08-17.pdf>
- Anderberg, M. (2008). *Green Collar Workers and Other Mythical Creatures* (Draft). Austin, TX: Labor Market and Career Information Department, Texas Workforce Commission. Retrieved July 29, 2009, from [http://www.lmci.state.tx.us/shared/PDFs/Green\\_Collar\\_Workers2.pdf](http://www.lmci.state.tx.us/shared/PDFs/Green_Collar_Workers2.pdf)
- Dierdorff, E.C., Norton, J.J., Drewes, D.W., Kroustalis, C.M., Rivkin, D, and Lewis, P. (2009). *Greening of the World of Work: Implications for O\*NET-SOC and New and Emerging Occupations*. Raleigh, NC: National Center for O\*NET Development. Retrieved July 30, 2009, from <http://www.onetcenter.org/reports/Green.html>
- Global Insight, Inc. (2008). *U.S. Metro Economies – Current and Potential Green Jobs in the U.S. Economy*. The United States Conference of Mayors. Retrieved August 9, 2009, from <http://usmayors.org/pressreleases/uploads/GreenJobsReport.pdf>
- Goldberg, M., Sinclair, K, and Milligan, M. (2004). *Job and Economic Development Impact (JEDI) Model: A User Friendly Tool to Calculate Economic Impacts from Wind Projects*. National Renewable Energy Laboratory. Golden, CO. Retrieved August 9, 2009, from <http://www.nrel.gov/docs/fy04osti/35953.pdf>
- Hardcastle, A. (2009). *2008 Green Economy Jobs in Washington State*. WA. Retrieved July 28, 2009, from [http://www.workforceexplorer.com/admin/uploadedPublications/9463\\_Green\\_Jobs\\_Report\\_2008\\_WEXVersion.pdf](http://www.workforceexplorer.com/admin/uploadedPublications/9463_Green_Jobs_Report_2008_WEXVersion.pdf)
- Hecker, D. E. (2005, July). High-technology employment: a NAICS-based update. *Monthly Labor Review*, 57-72. Retrieved August 9, 2009, from <http://www.bls.gov/opub/mlr/2005/07/art6full.pdf>
- Jolly, N. A. (2008, December). How green is Connecticut's economy. *The Connecticut Economic Digest*, 13(12), 1-3, 5. Retrieved August 9, 2009, from <http://www.ctdol.state.ct.us/lmi/misc/ceddec08.pdf>
- Lantz, Eric (2009). *Economic Development from Wind Energy: Recent Analysis and Policy Consideration*. National Renewable Energy Laboratory. Retrieved August 9, 2009, from <http://mlui.org/downloads/windconimpctstudy.pdf>
- Michigan Department of Energy, Labor and Economic Growth. (2009). *Michigan Green Jobs Report 2009*. Detroit, MI: Author. Retrieved August 9, 2009, from [http://www.michigan.gov/documents/nwlb/GJC\\_GreenReport\\_Print\\_277833\\_7.pdf](http://www.michigan.gov/documents/nwlb/GJC_GreenReport_Print_277833_7.pdf)

- New York State Department of Labor. (2009). *New York State's Clean Energy Industry: Labor Market and Workforce Intelligence*. Retrieved July 28, 2009, from <http://www.labor.state.ny.us/workforcenypartners/PDFs/NYS%20Clean%20Energy%20Jobs%20Report%20FINAL%2006-09-09.pdf#page=1>
- Oregon Employment Department Workforce and Economic Research Division. (2009). *The Greening of Oregon's Workforce: Jobs, Wages, and Training*. Salem, OR: Author. Retrieved August 9, 2009, from <http://www.qualityinfo.org/pubs/green/greening.pdf>
- The PEW Charitable Trusts. (2009). *The Clean Energy Economy: Repowering Jobs, Businesses and Investments Across America*. Retrieved on July 28, 2009, from [http://www.pewcenteronthestates.org/uploadedFiles/Clean\\_Economy\\_Report\\_Web.pdf](http://www.pewcenteronthestates.org/uploadedFiles/Clean_Economy_Report_Web.pdf)
- United Nations Environment Programme. (2008). *Green Jobs: Towards decent work in a sustainable, low-carbon world*. Nairobi, Kenya: Author. Retrieved September 3, 2009, from: [http://www.unep.org/labour\\_environment/features/greenjobs.asp](http://www.unep.org/labour_environment/features/greenjobs.asp)
- U.S. Department of Energy, Energy Efficiency and Renewable Trends. (2008). *Energy Efficiency Trends in Residential and Commercial Buildings*. Retrieved July 28, 2009, from [http://apps1.eere.energy.gov/buildings/publications/pdfs/corporate/bt\\_stateindustry.pdf](http://apps1.eere.energy.gov/buildings/publications/pdfs/corporate/bt_stateindustry.pdf)
- Workforce Information Council. (2009). *Green Jobs Study Group Charter, March 12, 2009*. Retrieved July 29, 2009, from <http://www.workforceinfocouncil.org/GreenJobs.asp>
- Workforce Information Council Green Jobs Study Group. (2009). *Approach to Defining Green Jobs: Discussion Draft, April 20, 2009*.
- Workforce Information Council Green Jobs Study Group. (2009). *Measurement and Analysis of Green Job: Report of the WIC Green Jobs Study Group Work Session Discussion, Final Draft: July 26, 2009*. Retrieved August 9, 2009, from <http://www.workforceinfocouncil.org/GreenJobs.asp> . Download from link "Report on the July 16-17, 2009 Work Session."



## Appendix 1. Workforce Information Council Green Jobs Study Group Charter

March 12, 2009

**Objective:** To develop a proposal (or proposals) on how the employment statistics system can respond to the needs for information about the number, types, and characteristics of “green jobs.”

**Background:** The Workforce Information Council discussed the “green jobs” issue at its November 2008 meeting. A number of activities are underway at the State level, with Washington having completed the first “green jobs survey”; several other States having surveys distributed to businesses or under development, and a NASWA-sponsored group of State and federal participants communicating monthly, discussing concepts and definitions, and gathering and summarizing studies (posted on California’s Web site at <http://www.labormarketinfo.edd.ca.gov/?pageid=1032>)

Because of growing interest in this topic and Obama Administration policy priorities, the WIC wishes to develop proposals on how we might provide a consistent Federal-State approach to measure the number, types, and characteristics of “green jobs,” and what it would cost to implement these proposals.

To address these questions, the WIC is establishing a Green Jobs Study Group to accomplish three broad goals: (1) develop a measurable definition of “green jobs” and agree on a core set of items that need to be measured about these jobs, (2) develop alternatives for gathering and estimating this information on “green jobs”, and (3) develop a specific action plan to collect and publish this information. Activities to address these goals are outlined below.

*Goal 1. Define “green jobs” and describe what needs to be measured about them.*

- a. Develop an understanding of the issue and the various existing attempts at measurement. The California Web site, the experience of Washington and other States, insights from ETA, and a summary of the work of the existing NASWA-sponsored work group are sources of information for this task.
- b. Identify and examine the issues and questions surrounding the measurement “green jobs”, drawing on the work mentioned under (a) above. The following is an initial list of issues and questions:
  - i. What kind of data and information do policymakers and the public need about “green jobs”? What questions need to be answered?
  - ii. What is the definition (or alternative definitions) of “green jobs” for purposes of policy analysis and workforce and economic development? Can this definition become operational for purposes of measurement?
  - iii. Are “green jobs” concentrated in certain industry or occupational groups? If so, which ones?
  - iv. Are entire industries or occupations “green”? If so, what are they and are they identifiable within existing classification systems?
  - v. When are portions of jobs in certain industries or occupations “green”? Can this be measured?
  - vi. What are the educational and training requirements of “green jobs”? Are they similar to those of non-green jobs? Are certain certifications or licenses required specifically for “green jobs”?
  - vii. What are the wages paid by “green jobs”?
  - viii. What kinds of skills are required by “green jobs” and how are these similar to or different from skills required by other jobs? Are these skills obtained through relatively short-term training of workers in existing or related occupations, or do they require longer specific training?
  - ix. Are “green jobs” concentrated in certain areas of the country? If so, what types of jobs are concentrated in what areas?

*Goal 2. Develop alternatives for measuring “green jobs”, including estimating costs of measurement.*

- a. Develop proposals for providing the data and information policymakers and the public need about “green jobs.” These proposals should include:
  - i. Identifying what would be measured: the outputs or products.
  - ii. Identifying the measurement methods that could be used. Different measurement methods may be needed for different outputs or products.
  - iii. How frequently should measurement be conducted to measure trends?
  - iv. What criteria should be used in evaluating the measurement methods?
  - v. Estimating the approximate costs and time requirements for the data collection and analysis activities.

*Goal 3. Develop a specific action plan to collect and publish the information required by policy-makers.*

- a. Building on the information developed in Goals 1 and 2, identify and agree on:
  - i. The survey or other data collection approaches that are recommended for gathering the needed information.
  - ii. The types of analysis that should be conducted on the survey data, including listing the data items to be estimated.
  - iii. Recommended methods for publishing results.
- b. Develop a shared federal-State proposal for a “green jobs” information project.

### **Approach**

1. The WIC will identify members of the Green Jobs Study Group, which should include no more than 10 to 15 State, BLS, and ETA participants. State participants should be individuals who have been working on this topic, such as individuals who have played leading roles in the existing NASWA Green Jobs Work Group.
2. The WIC will identify federal and State co-chairs for the Study Group. The co-chairs will be responsible for planning meetings, reporting to the WIC on progress and issues, budgeting and managing the resources available to the Study Group, and generally ensuring progress toward the Study Group’s goals.
3. Convene the Study Group. The target date for the initial meeting is March 2009. To the extent possible, meetings should be held by conference call and other electronic means, given restrictions on both State and federal travel.
4. Any State travel expenses will be paid from WIC funding already available.
5. Prepare for the meetings by tasking certain individuals with producing materials for Study Group members to understand prior to the meeting. Materials might include a meta-analysis of the studies on the California Web site to depict how the studies answer the questions in 2 and 3 above. Existing federal initiatives should be summarized (these may or may not be on the California site).
6. At the meetings, hold presentations and facilitated discussions (e.g., brainstorming, critiques of proposals) to identify promising approaches to measuring “green jobs.”
7. From the meetings, prepare a report identifying the promising approaches for presentation to BLS and ETA leadership and to the State LMI directors. The report should equip BLS and ETA to respond to the Administration’s need for data and information about “green jobs” and assist the States in responding to needs of Governors and others.
8. Disseminate the report, including making presentations at relevant meetings and conferences (including the 2009 LMI Conference and Workforce Innovations).



9. Based on input and reaction to the report, develop a proposed federal-State project to conduct data collection, analysis, and publication relating to green jobs at the national and State levels, based on a consistent definition.
10. The Study Group may outline options for federal budget proposals.

### **Deliverables**

The Green Jobs Study Group will provide the following deliverables:

1. A report to the WIC describing the issues and questions surrounding the measurement of “green jobs”, a recommended measurable definition of “green jobs”, and recommended measurement approaches and their related costs. The report should be in a format suitable for nationwide dissemination.
2. Conduct presentations to BLS and ETA leadership and State LMI directors on the results of the Study Group’s analysis and its recommendations.

**Target Completion date:** June 30, 2009<sup>5</sup>

---

<sup>5</sup> Target date revised to September 30, 2009



## Appendix 2. Green Definition Exhibits

### Exhibit 2.1 Green Job Definition Terms from 22 Studies

Green Terminology	Occurrences
Environmental Conservation	12
Improve / Clean Up Environment	11
Reducing Emissions and GHG and Minimizing Carbon Footprint	9
Alternative/Renewable/Clean Energy	8
Energy Efficiency	8
Sustainability	3
Alternative Transportation and Fuels	3
Reduce Energy Consumption	2
High Performing Buildings	1
Education, Consultation	1

### Exhibit 2.2: Green Economy Definition Terms in 26 Studies

Green Terminology	Occurrences
Increase Energy Efficiency	16
Generate, Store, or Adopt Renewable Energy	13
Prevent or Reduce Pollution and GHG Emissions	13
Environmentally Friendly / Environmental Protection	9
Agriculture and Natural Resource Conservation	7
Water conservation and quality	6
Sustainability	5
Recycling Existing Materials	4
Clean Transportation and Fuels	4
Clean Energy / Clean Technology	3
Mitigate or Clean Up Pollution	2
Natural / Sustainable Product Manufacturing	2
Education, Compliance, Awareness	2
Waste Management	3
Reduce Fossil Fuels	2
Organic Products	2
Green Buildings	1
Fair Trade	1
Holistic Health	1
Peace and Justice	1
Social Conscience	1
Energy Independence	1
Energy Security	1

**Exhibit 2.3: Green Economic Activity Category Review of Seven Studies or Resources**

Source	Green Economic Activity Categories	Renewable Energy	Energy Efficiency	Natural, Sustainable Product Manufacturing	Nuclear Energy	Bio-science & Agriculture	Clean Transportation and Fuels	Education Compliance Awareness	Recycle & Waste Reduction	Pollution Reduction & Prevention	Pollution Cleanup & Mitigation	Greenhouse Gas Reduction	Other Green Activity	Green Construction	Govt & Regulatory Administration	Research, Design, and Consulting	Energy Trading	Energy and Carbon Capture	Manufacturing
California Report	Generating & storing renewable energy	X																	
	Recycling existing material								X										
	Energy efficient product manufacturing, distribution, construction		X																
	Education, compliance, & awareness Natural and sustainable product manufacturing					X		X											
Oregon Report	Increasing energy efficiency		X																
	Producing renewable energy	X																	
	Preventing, reducing, or mitigating environmental degradation									X	X								
	Cleaning up and restoring the natural environment										X								
	Providing education, consulting, policy promotion, accreditation, trading and offsets, or similar services							X								X	X		
Washington Report	Energy efficiency		X																
	Renewable energy	X																	
	Reducing pollution									X									
	Mitigation or pollution cleanup										X								
Michigan Report	Increasing energy efficiency	X	X																
	Renewable energy																		
	Pollution prevention and environmental									X	X								
	Clean transportation and fuels						X												
	Agriculture and natural resource conservation			X		X													
BLS Ind/Occup Worksheets	Renewable energy except nuclear	X																	
	Nuclear energy				X														
	Energy conservation		X																
	Greenhouse gas reduction removal										X	X							
	Recycling and waste reduction								X										
	Bioscience and agriculture					X													
	Education compliance & public awareness training							X											
	Other green activity												X						
ONET Green Occupations Project	Renewable Energy Generation	X																	
	Transportation						X												
	Energy Efficiency		X																
	Green Construction													X					
	Energy Trading																X		
	Energy and Carbon Capture																	X	
	Research, Design, and Consulting															X			
	Environment Protection									X	X	X							
	Agriculture and Forestry					X													
	Manufacturing			X															X
Recycling and Waste Reduction								X											
Administration														X					
PEW	Clean Energy	X																	
	Energy Efficiency		X																
	Environmentally Friendly Production					X													X
	Conservation and Pollution Mitigation									X	X								
Training and Support							X												
<b>Total References</b>		<b>7</b>	<b>7</b>	<b>3</b>	<b>1</b>	<b>4</b>	<b>2</b>	<b>4</b>	<b>3</b>	<b>6</b>	<b>7</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>2</b>

**Exhibit 2.4 Summary of Green Economic Activity Categories in Seven Studies**

<b>Green Economic Activity Category</b>	<b>Number of References</b>
Renewable Energy	7
Energy Efficiency	7
Pollution Cleanup and Mitigation	7
Pollution Reduction and Prevention	6
Bioscience and Agriculture	4
Education, Compliance, Awareness	4
Recycle and waste reduction	3
Natural, Sustainable product manufacturing	3
Clean Transportation and Fuels	2
Greenhouse Gas Reduction	2
Research, Design, and Consulting	2
Energy Trading	2
Manufacturing	2
Nuclear Energy	1
Other Green Activity	1
Green Construction	1
Governmental and Regulatory Administration	1
Energy and Carbon Capture	1



### Appendix 3. Comparison of Survey Items of Questions on Four State Green Jobs Surveys

The following figure provides a high level overview that compares data elements collected in the Washington, Michigan, Oregon, and California state LMI unit green job surveys. Areas highlighted in green indicate that an item is present in the survey. “No\*” indicates there is no explicit question for that item, but it can be calculated. The original surveys and state reports provide additional details.

**Exhibit 3.1 Comparison of Survey Items of Questions on Four State Green Jobs Surveys**

Item #	Survey Item or Question	WA 2008 Green Economy Jobs	MI Green Jobs Survey	Oregon Green Jobs Survey	California
1	<b>Basic Qualifying or Screening Question for Continuing Response</b>	Yes <sup>6</sup>	Yes <sup>7</sup>	Yes <sup>8</sup>	Yes <sup>9</sup>
<b>Survey Items Related to Number Employed</b>					
2	Total Number of Employees (whether green or not)	Yes	Yes	Yes	Yes
3	Total Employees by Full-time/part-time (whether green or not)	Yes	No	No	No
4	Jobs that provide products/services in core green area	No*	Yes	Yes	No*
5	Jobs where primary/essential function is green	Yes	Yes	Yes	Yes
6	Employees w support jobs for green activities	No	Yes	No	No
7	Non green-related employees	No*	Yes	No*	No*
8	Green Employees by Job Title	Yes	Yes	Yes	Yes
9	Green Employees by Green Economic Activity Category	Yes	Yes	No	Yes
10	Green Employees full/part time status	Yes	No	No	No
<b>Survey Items Related to Green Job Duties, Skills, or Wages</b>					
11	Green job duties	No	No	Yes	No
12	What skills do workers need to perform green activities	No	No	No	Yes
13	Any unique skills to work on green projects	No	Yes	No	No
14	# Green Employees wage information	No	No	Yes	No
<b>Survey Items Related to Education Requirements, Training Needs, Hiring Concerns</b>					
15	Education requirements for green jobs	No	No	Yes	Yes
16	Formal training expectations	No	Yes	No	No
17	Informal OJT expectations	No	Yes	No	No
18	Special Requirement such as certificates	Yes	No	Yes	No
19	Employer future employment expectation		Yes	Yes	No
20	Anticipate difficulty in hiring qualified workers	No	Yes	No	No

<sup>6</sup> (WA) If firm provided green product or service in last 3 months, complete survey

<sup>7</sup> (MI) If firm produces products or services in a core area, complete survey. If no, provide contact information.

<sup>8</sup> (OR) If working a green category was essential to any job in the organization, complete survey. If no, provide total employment only.

<sup>9</sup> (CA) If firm does not provide green products or services, employment questions are skipped, but respondent addresses business practices and issues related to “green.”

Item #	Survey Item or Question	WA 2008 Green Economy Jobs	MI Green Jobs Survey	Oregon Green Jobs Survey	California
<b>Additional Survey Items on Green-related Issues</b>					
21	What green products or services does firm <b>use</b>	No	No	No	Yes
22	In next 12 months, do you expect firm's green practices to decrease, the same, increase	No	No	No	Yes
23	What barriers to implement green practices	No	No	No	Yes
24	Largest benefit to firm to reduce greenhouse gas emissions	No	No	No	Yes
25	What resources would help reduce green house gas emissions	No	No	No	Yes
26	Indicate area of interest and state programs from which you would like information	No	No	No	Yes
27	Occupations declining due to green practices	No	No	No	Yes

### Exhibit 3.2 Top 25 Occupations by Green Core Area Employment and Percent of Total Green Jobs

Source: Washington State Green Jobs Survey, Employment Security Department, LMEA, 2008

SOC	OCCUPATIONAL TITLE	TOTAL GREEN JOBS				TOTAL EMPLOYMENT GREEN JOBS	PERCENT OF TOTAL GREEN JOBS
		ENERGY EFFICIENCY	RENEWABLE ENERGY	REDUCING POLLUTION	MITIGATION OR POLLUTION CLEANUP		
452092	Farmworkers and Laborers, Crop, Nursery, and Greenhouse	557	149	4,065	43	4,814	10.2%
472111	Electricians	3,651	84	17	32	3,784	8.0%
472061	Construction Laborers	2,050	21	651	217	3,136	6.6%
472031	Carpenters	2,394	38	208	34	2,674	5.7%
452099	Agricultural Workers, All Other	37	1	2,381	225	2,645	5.6%
499021	Heating, Air Cond., and Refrig. Mechanics and Installers	2,341	42	127	82	2,590	5.5%
172051	Civil Engineers	1,157	98	627	197	2,085	4.4%
472152	Plumbers, Pipefitters, and Steamfitters	1,675	6	176	19	1,875	4.0%
171011	Architects, Except Landscape and Naval	1,433	83	176	12	1,702	3.6%
172141	Mechanical Engineers	610	71	127	235	1,047	2.2%
472121	Glaziers	831	-	8	-	838	1.8%
472181	Roofers	658	33	75	56	821	1.7%
519199	Production Workers, All Other	406	35	234	71	747	1.6%
537081	Refuse and Recyclable Material Collectors	220	8	299	218	745	1.6%
533032	Truck Drivers, Heavy and Tractor-Trailer	30	14	416	282	744	1.6%
119021	Construction Managers	498	22	97	32	648	1.4%
471011	First-Line Sprvrs./Mgns. of Const. Trades and Extraction Wrkrs.	560	-	42	14	616	1.3%
472131	Insulation Workers, Floor, Ceiling, and Wall	533	10	16	10	569	1.2%
452041	Graders and Sorters, Agricultural Products	-	-	518	3	521	1.1%
172071	Electrical Engineers	378	31	17	30	458	1.0%
474041	Hazardous Materials Removal Workers	6	-	63	380	449	1.0%
192041	Environmental Scientists and Specialists, Including Health	24	14	149	222	409	0.9%
472211	Sheet Metal Workers	370	-	22	9	401	0.8%
119199	Managers, All Other	228	24	90	52	396	0.8%
537062	Laborers and Freight, Stock, and Material Movers, Hand	126	5	205	47	383	0.8%
	<b>TOTAL</b>	<b>20,772</b>	<b>985</b>	<b>10,806</b>	<b>2,520</b>	<b>35,088</b>	<b>74.4%</b>
	Total of All Green Jobs by Core Areas*	24,878	2,027	15,676	4,483	47,184	100.0%