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Final Report
Green Jobs for Displaced Manufacturing, Construction and Construction-Related Service Workers

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Executive Summary

Green Jobs for Displaced

Manufacturing, Construction and Construction-Related Service Workers

The recent "Great Recession" impacted all parts of the country and the economy. But, selected industries and regions were especially hard-hit, as is true in many recessions. In terms of regions, the western and mountain regions of the United States, the industrial Midwest and the state of Florida were impacted most. Among industries, the manufacturing industry was hard hit, as is typically the case during recession. For example, in the State of Nebraska, net jobs losses in the manufacturing industry accounted for 9,400 (33%) of the total 28,300 net job loss between December 2007 and December 2009. But, one unusual aspect of the Great Recession was the collapse of the housing sector. This lead to substantial job losses in construction and in portions of the service sector closely tied to the housing market such as finance, real estate, legal service, architecture and engineering. We note that construction accounted for another 4,200 (15%) of the 28,300 net job loss in Nebraska between December 2007 and December 2009.

Given these patterns, the University of Nebraska-Lincoln Bureau of Business Research (BBR) conducted a special study for the Northern Plains and Rocky Mountain Consortium, which is composed of the Departments of Labor in the states of Iowa, Nebraska, South Dakota, Montana, Utah, and Wyoming. This study examines re-employment opportunities in green occupations for displaced workers in the construction, manufacturing, and construction-related services industries. The first part of the research examines the potential "match" in theory between green occupations and the occupations of displaced manufacturing, construction, and construction-related service workers in each consortium state. The second part of the research examines the actual re-employment patterns for a set of displaced workers around the nation

identified by the *Current Population Survey* of the U.S. Department of Labor. In the third task, we develop a brief synopsis regarding re-employment opportunities in green occupations for each state. These synopses could be distributed to displaced workers. All three sections of the research project are summarized below.

Potential Match among Occupations

The first section of the study addresses the following question: can green occupations be expected to provide re-employment opportunities for displaced manufacturing, construction, and construction-related service workers? To answer this question: the research team developed an occupational profile of displaced workers in each state, and compared that profile with a list of green occupations. The profile was estimated by examining job losses in individual industries within construction, manufacturing, and finance in each state as well as job losses in the real estate, legal services, and architecture and engineering industries. Those job losses by industry were combined with staffing patterns for each industry from the National Industry-Occupation Employment Matrix to predict job losses by occupation in each state. The research team then examined the "match" between these high-displacement occupations in each state and 51 green occupations. These green occupations had been identified in a separate survey of business by consortium member states. A "match" was determined to occur whenever high displacement occupations and green occupations were "related occupations," as identified by Occupational Information Network (O*Net) system of the U.S. Department of Labor. The finding was that approximately 40% of the high displacement construction occupations were related to one of the 51 green occupations in consortium states, as were approximately 35% of high displacement manufacturing occupations. However, few of the high displacement occupations from the

finance, real estate, law, or architecture and engineering industries were found to be related to the green occupations.

Observed Match among Occupations: Factors Influencing the Probability of a Match

The second approach in the research was to examine actual re-employment patterns among displaced workers, including how worker attributes influence the probability of re-employment within green occupations. To identify re-employment patterns, we utilized data from two January 2010 surveys: (1) the Current Population Survey (CPS) and (2) the Displaced Workers Survey (DWS). The January 2010 CPS and the supplemental DWS enable us to identify the former occupations of specific individuals displaced in the last three years, as well as the current occupation of individuals who had found new employment by the time of the January 2010 survey. We then examined which attributes influence the probability of re-employment in a green occupation. In this case, we utilized a national definition of green occupations identified by the U.S. Department of Labor. This analysis found that displaced workers from manufacturing, construction and construction-related industries all had as high or a higher likelihood of re-employment in a green occupation than displaced workers from other industries. There were four other principal findings. First, displaced men with family attachments were more likely than single men without children to become re- employed in green occupations. Whether or not they started in a green job in the first place, men with family obligations were noticeably more likely to find green jobs. Evidently these obligations encouraged flexibility in their job search behavior. Second, regardless of marital or parental status, women were not more likely to end up in green jobs than men. Third, workers displaced from construction jobs were more likely than job losers from manufacturing to regain employment in green collar work. Fourth, displaced

college graduates were more likely than displaced high school graduates (and those with less than a high school diploma) to become re-employed in green collar work, whether or not they started in green jobs. Evidently, college education is a significant factor in finding/switching into green employment

Description of Re-employment Opportunities in Each State

The third component of the study was to develop outreach information on employment opportunities in green occupations. Specifically, utilizing the results of this research, we develop a short text for potential use in outreach documents for displaced manufacturing, construction, and construction-related service workers. These write-ups are designed so that they can be provided to displaced workers at convenient locations; for example, at a One-Stop Center located in a consortium state. The two-page write-ups are provided for each state.

Table of Contents

List of Tables

I. Introduction

As in most recessions, the manufacturing industry was hard hit during the "Great Recession" of 2008. For example, in the State of Nebraska, net jobs losses in the manufacturing industry accounted for 9,400 (33%) of the total 28,300 net job losses between December 2007 and December 2009. Further, given the severity of the recession it may take 3 to 4 years for employment opportunities to normalize in the manufacturing sector. This is because net growth in manufacturing employment is weak even in a strong economic climate (due to strong growth in manufacturing productivity). Further, many recent manufacturing job losses will be permanent due to industry restructuring that took place during the recession.

The construction sector was especially hard-hit during the recent recession, given the substantial decline that occurred in the housing sector. Construction accounted for another 4,200 (15%) of the 28,300 net job loss in Nebraska. Construction employment grows in most years, and typically bounces back sharply as an economy recovers from recession. However, in the context of the recent recession, there is currently a large inventory of unsold homes and many more foreclosures are expected. As a result, housing construction activity has not bounced back even as the economy has begun to recover, and new home construction is not expected to recover for a number of years. In fact, the contraction in the real estate sector has been so severe that significant job losses ensued in related services industries such as finance, real estate, legal services, architecture and engineering.

For these reasons, it is highly unlikely that sufficient new job opportunities will be created within the manufacturing and construction industries to meet the needs of these industries' displaced workers, at least for the foreseeable future. Alternative employment opportunities will need to be created in growing and emerging industries and occupations. This

study examines the potential for displaced manufacturing, construction, and construction-related service workers to find re-employment opportunities within one such alternative: green occupations.

The research specifically evaluates opportunities in the six consortium states but also examines the issue at the national level. The first part of the analysis examines the potential match between green occupations and hard-hit manufacturing, construction, and construction-related service occupations in the six consortium states, utilizing a list of green occupations specifically identified for the consortium states. The second part of the analysis examines the actual re-employment rates of displaced workers into green occupations, and how worker attributes influence the probability of re-employment in a green collar job. This part of the research examines workers nationwide utilizing a national definition of green occupations developed by the U.S. Department of Labor. In the third section, we develop a short document for each consortium state to explain the re-employment opportunities in green occupations for displaced manufacturing, construction, and construction-related service industry workers.

II: Potential Match among Occupations

     This chapter examines the potential match between displaced workers from hard-hit industries and green occupations. The approach is to determine if there is a match in theory between green occupations and the occupations of displaced manufacturing, construction, and construction-related service workers. The first step in this process is to identify the specific manufacturing, construction, and construction-related service industry occupations which lost the most employment during the recent recession. These hard-hit occupations then can be compared with green occupations. Specifically, for each consortium state, we identify the hardest hit occupations in the manufacturing, construction, and construction-related services industries using of an industry-occupation employment matrix. This matrix contains an occupation profile of workers in each industry in each state. By applying this matrix to estimates of job loss in each manufacturing, construction, and construction-related service industry, we develop an estimate of job loss by occupation for each state.

     The analysis begins by assessing whether there are particular segments of the manufacturing or construction industry in each state that experienced especially heavy job losses during the recent recession. This information is critical in assessing the occupation mix of displaced workers. In particular, if an industry experienced heavy job losses, then the key occupations within that industry also would experience severe job losses.

     We identified hard-hit industries within manufacturing and construction by comparing industry growth rates with the aggregate growth rate for manufacturing and construction. In particular, we were interested in identifying manufacturing industries with a job loss rate that was more than one standard deviation above the aggregate job loss rate for manufacturing overall. This was our criteria for identifying a hard-hit manufacturing industry. Comparisons

would be made for the year with largest percentage job loss in the 2007 to 2009 period. A similar approach would be used to identify hard-hit construction industries.[1]

Table II.1 shows the criteria for each industry in each state, and whether each detailed construction and manufacturing industry meets the criteria. Analysis focuses only on those construction and manufacturing industries in each state with enough employment and establishments to be reported in the Current Employment Statistics of the Bureau of Labor Statistics, U.S. Department of Labor. This data is not available for a significant number of smaller industries. However, our approach is still preferable given that there would be limited value in a separate occupation analysis of small manufacturing industries with limited employment.

The number of individual industries reported, and the results vary significantly by state. However, two primary patterns are evident. First, construction job losses were much more severe in the rocky mountain states than in the northern plains states. This is consistent with the notion that rocky mountain and other western states were more involved in the national construction boom and bust than plains states. Second, most hard-hit manufacturing industries were durable goods manufacturers. This is typical in recessions.

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[1] It was unnecessary to perform this analysis for the construction-related service industries. As will be seen later, there were only 3 detailed industries within finance, and no detailed industries within real estate, legal services, and architecture and engineering.

Table II.1:

Construction and Manufacturing Industries with Especially Severe Job Loss

	Iowa		Montana		Nebraska		South Dakota		Utah		Wyoming	
	Largest Annual Loss	Meet Criteria?	Largest Annual Loss	Meet Criteria?	Largest Annual Loss	Meet Criteria?	Largest Annual Loss	Meet Criteria?	Largest Annual Loss	Meet Criteria?	Largest Annual Loss	Meet Criteria?
Criteria for Construction	-16.9%		-31.9%		-11.2%		-10.8%		-37.8%		-28.8%	
Construction of Buildings			-24.1%	No	**-11.9%**	**Yes**			-23.9%	No	-10.2%	No
Heavy Construction			-10.9%	No	-8.8%	No			-14.6%	No	-22.1%	No
Specialty Trade Contractors			-19.6%	No	-4.5%	No			-22.9%	No	-11.7%	No
Building Equipment Contractors					-1.4%	No						
Criteria for Manufacturing	-16.6%		-20.5%		-12.7%		-19.2%		-17.4%		-13.7%	
Durable Goods												
Wood Products	**-18.3%**	**Yes**	**-27.5%**	**Yes**								
Fabricated Metal	**-17.3%**	**Yes**			**-14.1%**	**Yes**						
Machinery Manufacturing	-12.3%	No			**-14.2%**	**Yes**			-10.3%	No		
Computers and Electronics					**-13.5%**	**Yes**			-3.0%	No		
Transportation Equipment	**-21.5%**	**Yes**			**-17.8%**	**Yes**			-12.0%	No		
Misc. Manufacturing					-3.9%	No						
Non-Durable Goods												
Food Products	0.0%	No			-1.2%	No						
Printing					-7.8%	No						
Plastics and Rubber					-9.6%	No						

Source: U.S. Bureau of Labor Statistics Current Employment Statistics and author's calculations.

Looking at state specific results, several Iowa manufacturing industries met the criteria of a hard-hit industry. The durable goods industries of wood products, fabricated metal, and transportation equipment met the criteria. There were similar findings in Nebraska. In Nebraska, durable goods industries such as fabricated metals, machinery, computers and electronics and transportation equipment were hard-hit while non-durable industries such as food products were not hard-hit. Construction of buildings was the only specific construction industries which met the criteria for being a hard-hit industry. No specific construction industries met the criteria in Montana. Little information was available for individual construction and manufacturing industries in Wyoming, and no information was available in South Dakota. Information on specific industries was available in Utah; however, job losses in Utah were consistent across individual construction and manufacturing industries. No industries were especially hard-hit.

Information in Table II.1 is used to inform estimates of displacement within individual construction and manufacturing industries. In particular, industries that met the criteria for identification as hard-hit hit were assumed to lose employment at their own, industry specific rate. All other construction and manufacturing industries were assumed to shed jobs at the same rate. Job losses rates were calculated based on the percentage decline in employment between December 2007 and December 2009. Table II.2 shows the rate of decline for each specific manufacturing, construction, and construction-related service industry in each consortium state. Percentage losses were applied to Current Employment Survey estimates of employment in each industry in each state as of December 2007. The result was an estimate of the total number of job losses in each industry in each state, as shown in Table II.3. Note that when employment levels were not provided by the Current Employment Survey, the level was estimated based on data from the March 2008 *County Business Patterns* data from the U.S. Department of Commerce.

Table II.2:
Employment Loss Rates by State by Industry

Industry	Iowa	Montana	Nebraska	South Dakota	Utah	Wyoming
Construction	-15.8%	-30.4%	-13.0%	-11.1%	-33.4%	-20.1%
Construction of Buildings	-15.8%	-30.4%	-17.6%	-11.1%	-33.4%	-20.1%
Heavy Construction	-15.8%	-30.4%	-11.7%	-11.1%	-33.4%	-20.1%
Specialty Trade Contractors	-15.8%	-30.4%	-11.7%	-11.1%	-33.4%	-20.1%
Manufacturing	-14.1%	-16.5%	-10.8%	-14.0%	-14.7%	-13.6%
Food Manufacturing	-11.0%	-11.6%	-7.1%	-14.0%	-14.7%	-13.6%
Beverage and Tobacco	-11.0%	-11.6%	-7.1%	-14.0%	-14.7%	-13.6%
Textile Mills	-11.0%	-11.6%	-7.1%	-14.0%	-14.7%	-13.6%
Textile Products Mills	-11.0%	-11.6%	-7.1%	-14.0%	-14.7%	-13.6%
Apparel	-11.0%	-11.6%	-7.1%	-14.0%	-14.7%	-13.6%
Leather and Allied Products	-11.0%	-11.6%	-7.1%	-14.0%	-14.7%	-13.6%
Wood Products	-27.5%	-35.7%	-7.1%	-14.0%	-14.7%	-13.6%
Paper	-11.0%	-11.6%	-7.1%	-14.0%	-14.7%	-13.6%
Printing	-11.0%	-11.6%	-7.1%	-14.0%	-14.7%	-13.6%
Petroleum and Coal	-11.0%	-11.6%	-7.1%	-14.0%	-14.7%	-13.6%
Chemicals	-11.0%	-11.6%	-7.1%	-14.0%	-14.7%	-13.6%
Plastics and Rubber	-11.0%	-11.6%	-7.1%	-14.0%	-14.7%	-13.6%
Nonmetallic Mineral Products	-11.0%	-11.6%	-7.1%	-14.0%	-14.7%	-13.6%
Primary Metals	-11.0%	-11.6%	-7.1%	-14.0%	-14.7%	-13.6%
Fabricated Metals	-22.9%	-11.6%	-20.5%	-14.0%	-14.7%	-13.6%
Machinery	-11.0%	-11.6%	-13.7%	-14.0%	-14.7%	-13.6%
Computers and Electronics	-11.0%	-11.6%	-17.0%	-14.0%	-14.7%	-13.6%
Electrical Equipment and Appliances	-11.0%	-11.6%	-7.1%	-14.0%	-14.7%	-13.6%
Transportation Equipment	-25.4%	-11.6%	-22.6%	-14.0%	-14.7%	-13.6%
Furniture	-11.0%	-11.6%	-7.1%	-14.0%	-14.7%	-13.6%
Miscellaneous Manufacturing	-11.0%	-11.6%	-7.1%	-14.0%	-14.7%	-13.6%
Finance	3.7%	3.1%	-1.1%	-4.2%	-7.0%	0.0%
Monetary Authorities	3.7%	3.1%	-1.1%	-4.2%	-7.0%	0.0%
Credit Intermediation	3.7%	3.1%	-1.1%	-4.2%	-7.0%	0.0%
Securities and Investments	3.7%	3.1%	-1.1%	-4.2%	-7.0%	0.0%
Real Estate	-2.9%	-11.3%	-5.3%	-4.2%	-8.4%	-11.4%
Legal Services	-2.1%	-4.1%	-0.9%	-4.3%	10.5%	-6.3%
Architecture and Engineering	-2.1%	-4.1%	-6.2%	-4.3%	-10.4%	-6.9%

Source: U.S. Bureau of Labor Statistics Current Employment Statistics and author's calculations.

Table II.3:
Employment Loss by State by Industry

Industry	Job Losses by Industry (1000s)					
	Iowa	Montana	Nebraska	S. Dakota	Utah	Wyoming
Construction	-11.3	-9.4	-6.4	-2.5	-33.3	-5.5
Construction of Buildings	-2.8	-3.0	-1.9	-0.7	-7.3	-1.0
Heavy Construction	-1.1	-1.6	-0.8	-0.2	-3.6	-1.9
Specialty Trade Contractors	-7.4	-4.9	-3.6	-1.5	-22.4	-2.6
Manufacturing	-32.6	-3.4	-11.1	-5.9	-19.2	-1.4
Food Manufacturing	-5.6	-0.3	-2.4	-1.1	-2.5	-0.1
Beverage and Tobacco	-0.1	-0.1	0.0	0.0	-0.1	0.0
Textile Mills	0.0	0.0	0.0	-0.1	0.0	0.0
Textile Products Mills	-0.2	0.0	0.0	-0.1	-0.2	0.0
Apparel	-0.2	0.0	0.0	0.0	-0.1	0.0
Leather and Allied Products	0.0	0.0	0.0	0.0	0.0	0.0
Wood Products	-3.3	-1.5	-0.2	-0.2	-0.4	-0.1
Paper	-0.5	-0.1	-0.1	-0.1	-0.4	0.0
Printing	-1.0	-0.1	-0.3	-0.2	-1.0	-0.1
Petroleum and Coal	-0.1	-0.1	0.0	0.0	-0.2	-0.1
Chemicals	-1.1	-0.1	-0.3	-0.2	-1.2	-0.3
Plastics and Rubber	-1.5	-0.1	-0.4	-0.2	-0.8	0.0
Nonmetallic Mineral Products	-0.7	-0.1	-0.2	-0.2	-0.7	-0.1
Primary Metals	-1.0	-0.1	-0.1	-0.1	-0.6	0.0
Fabricated Metals	-4.9	-0.2	-1.8	-0.6	-2.1	-0.2
Machinery	-4.2	-0.2	-1.4	-0.9	-1.0	-0.2
Computers and Electronics	-1.2	0.0	-0.9	-0.4	-1.9	0.0
Electrical Equipment and Appliances	-0.9	0.0	-0.2	-0.1	-0.3	0.0
Transportation Equipment	-4.7	-0.1	-2.1	-0.4	-2.1	-0.1
Furniture	-0.9	-0.1	-0.2	-0.3	-1.4	0.0
Miscellaneous Manufacturing	-0.5	-0.2	-0.4	-0.7	-2.3	0.0
Finance	0.0	0.0	-0.3	-0.9	-2.9	0.0
Monetary Authorities	0.0	0.0	0.0	0.0	0.0	0.0
Credit Intermediation	0.0	0.0	-0.3	-0.9	-2.5	0.0
Securities and Investments	0.0	0.0	0.0	0.0	-0.3	0.0
Real Estate	-0.4	-0.7	-0.5	-0.2	-1.1	-0.5
Legal Services	-0.2	-0.1	-0.1	-0.1	0.0	-0.1
Architecture and Engineering	-0.1	-0.2	-0.4	-0.1	-1.4	-0.2

Source: Current Employment Statistics and U.S. Bureau of Census, County Business Patterns.

Industry job losses would imply estimates of occupation job losses, depending on the types of occupations found in each industry. We utilized the National Industry-Occupation Employment Matrix that is developed by the Bureau of Labor Statistics, U.S. Department of Labor to estimate the occupation job losses associated with the industry job losses reported in Table II.3. Occupation job losses were summed for all industries listed in Table II.3. Table II.4a shows all occupations which accounted for at least 2% of all job losses in the construction industry in each state. Table II.4c shows all occupations which accounted for at least 2% of all job losses in construction-related service industries. Table II.4b shows all occupations which accounted for at least 1% of job losses in the manufacturing industry in each state. Occupations common to manufacturing such as production workers are presented in much greater detail in the SOC coding system, and therefore, it is much less likely that any one occupation would account for 2% or more of employment. Therefore, a 1% criterion was adopted instead.

Results in Table II4a through II.4c show a large number of hard-hit occupations in the construction, manufacturing, and construction-related services industries. One notable feature of the results is the relative consistency of the hard-hit occupations across states. This in part reflects the reality that some functions are common to most types of industries. For example, most industries require managers, bookkeepers, and office clerks.

There also were occupations common within construction, or within manufacturing, or within construction-related services. Looking at Table II4a, construction managers (11-9021) were a hard-hit occupation in all states, as were secretaries and administrative assistants (43-6014). Further, in the construction industry the same hard-hit trade occupations were found in most states. Carpenters (47-2031), cement masons and concrete finishers (47-2051), operating engineers (47-2073), electricians (47-2111), painters (47-2141), plumbers, pipefitters and

steamfitters (47-2152), and HVAC (49-9021) were hard-hit occupations in all consortium states. This occurred because the underlying structure of the construction industry was consistent across states. This can be seen with a quick review of Tables II.2 and II.3. Within each state, there was typically a common rate of job loss across the construction industries; and in most states, there was a similar employment structure, with around half to two-thirds of the job losses in the specialty trades.

Table II.4a
Occupations with the Largest Projected Losses within the Construction Industry

Industry	SOC Code	Hard-Hit Occupations within Construction					
		Iowa	Montana	Nebraska	South Dakota	Utah	Wyoming
General and Operations Managers	11-1021		X				
Construction Managers	11-9021	X	X	X	X	X	X
Bookkeeping, Accounting and Auditing Clerks	43-3031	X			X	X	
Secretaries and Administrative Assistants	43-6014	X	X	X	X	X	X
General Office Clerks	43-9061	X	X	X	X	X	X
First-line Supervisors of Construction Trades	47-1011	X	X	X	X	X	X
Carpenters	47-2031	X	X	X	X	X	X
Cement Masons and Concrete Finishers	47-2051	X	X	X	X	X	X
Construction Laborers	47-2061	X	X	X	X	X	X
Operating Engineers and Other Construction Equipment Operators	47-2073	X	X	X	X	X	X
Electricians	47-2111	X	X	X	X	X	X
Painters Construction and Maintenance	47-2141	X	X	X	X	X	X
Plumbers, Pipefitters and Steamfitters	47-2152	X	X	X	X	X	X
Heating, Air Conditioning and Refrigeration Mechanics and Installers	49-9021	X	X	X	X	X	X
Heavy and Tractor-Trailer Truck Drivers	53-3032						X

A number of occupations also are common to most or all manufacturing industries and therefore were identified for all states in Table II.4b. Most or all manufacturing industries rely on occupations such as industrial machinery mechanics (49-9041), general maintenance and repair workers (49-4071), team assemblers (51-2022), machinists (51-4041), welders, cutters, solderers, and brazers (51-4121), inspectors, testers, sorters, samplers, and weighers (51-9061), packaging and filling machine operators and tenders (51-9111), or helpers for production workers (51-9198). Most or all manufacturers also employ engineers (17-2112 or 17-2141), require a sales staff to work with wholesalers (41-4012) or utilize truck drivers (53-3032 or 53-7051).

However, there is also a great deal of variety within manufacturing. In particular, results reflect the types of industries that lost the most employment in each state and the unique occupational make-up within those industries. For example, wood products accounted for nearly half of the manufacturing job loss in Montana from December 2007 to December 2009 (see Table II.3) and we observe a number of sawmill occupations among the hardest-hit occupations in Montana. Food production occupations such as meat cutters and trimmers (51-3022) and slaughters and meatpackers (51-3023) were among the hard-hit occupations in states such as Iowa, Nebraska, South Dakota, and Utah. These state had significant job losses in food processing industries. .Woodworking occupations (51-7041 and 51-7042) were hard-hit in Montana, a state with a significant share of job losses in the wood products industry. At the same time, Wyoming was the only state with a significant share of its job losses in the petroleum and coal industry, and several related occupations appear in Table II.4b (51-9011, 51-8093 and 51-9023).

Table II.4b
Occupations with the Largest Projected Losses within the Manufacturing Industry

Industry	SOC Code	Hard-Hit Occupations within Manufacturing					
		Iowa	Montana	Nebraska	South Dakota	Utah	Wyoming
General and Operations Managers	11-1021	X	X	X	X	X	X
Industrial Production Managers	11-3051	X				X	X
Industrial Engineers	17-2112	X		X	X	X	
Mechanical Engineers	17-2141	X		X	X		
Sales Representatives, Wholesale and Manufacturing	41-4012	X	X	X	X	X	X
Bookkeeping, Accounting and Auditing Clerks	43-3031	X	X		X	X	X
Customer Service Representatives	43-4051				X		
Shipping Receiving and Traffic Clerks	43-5071	X	X	X	X	X	X
General Office Clerks	43-9061	X	X	X	X	X	X
Boilermakers	47-2011		X				
Industrial Machinery Mechanics	49-9041	X	X	X	X	X	X
General Maintenance and Repair Workers	49-9071	X	X	X	X	X	X
Helpers - Installation, Maintenance and Repair Workers	49-9098	X	X	X	X	X	
First-line Supervisors of Production and Operations Workers	51-1011	X	X	X	X	X	X
Electric and Electronic Equipment Assemblers	51-2022	X	X	X	X	X	
Structural Metal Fabricators and Fitters	51-2041	X		X	X	X	
Team Assemblers	51-2092	X	X	X	X	X	X
All Other Assemblers and Fabricators	51-2099	X	X	X	X	X	
Meat, Poultry, and Fish Cutters and Trimmers	51-3022	X		X	X	X	
Slaughters and Meatpackers	51-3023	X		X	X		
Food Batchmakers	51-3092			X	X		
Computer Controlled Machine Tool Operator Metal and Plastic	51-4011	X		X	X		
Cutting, Punching, and Press Machine Setters, Operators and Tenders Metal and Plastic	51-4031	X		X	X	X	X
Machinists	51-4041	X	X	X	X	X	X

Table II.4b (Continued)
Occupations with the Largest Projected Losses within the Manufacturing Industry

Industry	SOC Code	Iowa	Montana	Nebraska	South Dakota	Utah	Wyoming
			Hard-Hit Occupations within Manufacturing				
Welders, Cutters, Solderers and Brazers	51-4121	X	X	X	X	X	X
Printing Press Operator	51-5112					X	X
Fabric and Apparel Patternmakers	51-6092					X	
Sawing Machine Setters, Operators, and Tenders Wood	51-7041		X				
Woodworking Machine Setters, Operators, and Tenders	51-7042	X	X				
Petroleum Pump Systems Operator and Refinery Operations Gaugers	51-8093						X
Chemical Equipment Operators and Tenders	51-9011						X
Mixing and Blending Machine Operators and Tenders	51-9023						X
Inspectors, Testers, Sorters, Samplers, and Weighers	51-9061	X	X	X	X	X	X
Packaging and Filling Machine Operators and Tenders	51-9111	X	X	X	X	X	X
Helpers - Production Workers	51-9198	X	X	X	X	X	X
Production Workers All Other	51-9199	X	X	X	X	X	X
Heavy and Tractor-Trailer Truck Drivers	53-3032	X	X		X	X	X
Industrial Truck and Tractor Operators	53-7051	X	X	X	X	X	X
Laborers and Freight Stock and Material Movers Hand	53-7062	X	X	X	X	X	X
Machine Feeders and Offbearers	53-7063		X				
Packers and Packagers Hand	53-7064	X	X	X	X	X	X

There also was significant variety in the hard-hit occupations within the construction-related services industries, as seen in Table II.4c. As was seen in Table II.2, the finance industry only lost employment in Nebraska, South Dakota, and Utah. As a result, finance occupations such as loan officers (13-2072) tellers (43-3071), customer services representatives (43-4051),

and loan interviews and clerks (43-4131) were only identified as hard-hit in these states in Table II.4c. Similarly, lawyers (23-1011) were identified as hard-hit in every state except Utah, since Utah was the only state without net job losses for the legal services industry. Common occupations in the real estate and architecture and engineering industries were identified as hard-hit in most states since these industries lost jobs in every state. Examples of hard-hit occupations include real estate agents (41-9022) and civil engineers (17-2051)

Thinking about Tables II.4a, through II.4c, the question arises: which of these hard hit occupations are matched with green occupations? This question is answered in Table II.5. The table shows which hard-hit occupations were matched with a consortium state green occupation. These green occupations were defined as those occupations with at least 15% of the workforce involved in green activities. Each consortium state conducted a survey of businesses and asked about the number of workers involved in green activities. Specifically, the survey inquired how many employees "produce a product or service that improves energy efficiency, expands the use of renewable energy, or supports environmental sustainability."

The consortium developed a region-wide estimate of the share of workers in each occupation which are involved in green activities. We identified 61 occupations from the consortium list with at least 15% of employment in green activities and where data on total employment in that occupation was available (from the U.S. Department of Labor) for at least 4 states. Unfortunately, this data was not available for all states. Given such missing data, our research team conducted further analysis utilizing estimates of green employment by occupation from three consortium states where we had access to state-specific results (Iowa, Nebraska, and Utah). As a result of that further analysis, we narrowed the original list of 61 occupations to 51 occupations. The list of 51 occupations is provided in Appendix 1.

Table II.4c
Occupations with the Largest Projected Losses within
Construction-Related Service Industries

Industry	SOC Code	Hard-Hit Occupations within Construction-Related Services					
		Iowa	Montana	Nebraska	S. Dakota	Utah	Wyoming
General and Operations Managers	11-1021					X	
Financial Managers	11-3031				X	X	
Property Real Estate and Community Association Managers	11-9141	X	X	X		X	X
Loan Officers	13-2072			X	X	X	
Civil Engineers	17-2051		X	X		X	X
Lawyers	23-1011	X	X	X	X		X
Paralegals and Legal Assistants	23-2011	X					X
Janitors and Cleaners except Maids and Housekeepers	37-2011	X	X	X			X
Counter and Rental Clerks	41-2021	X	X	X			X
Securities Commodities and Financial Services Sales Agents	41-3031				X	X	
Real Estate Agents	41-9022	X	X	X			X
First-line Supervisors of Office and Administrative Support Workers	43-1011			X	X	X	
Bill and Account Collectors	43-3011				X		
Bookkeeping, Accounting and Auditing Clerks	43-3031	X	X	X	X	X	X
Tellers	43-3071			X	X	X	
Customer Service Representatives	43-4051			X	X	X	
Loan Interviewers and Clerks	43-4131				X	X	
Receptionists and Information Clerks	43-4171	X					
Executive Secretaries and Administrative Assistants	43-6011	X	X	X		X	X
Legal Secretaries	43-6012	X					X
Secretaries and Administrative Assistants, Except Legal, Medical and Executive	43-6014	X	X	X		X	X
Office Clerks General	43-9061	X	X	X	X	X	X
Maintenance and Repair Workers General	49-9071	X	X	X	X	X	X

The research team then compared the list of hard-hit occupations from Tables II.4a through II.4c with these 51 green occupations for consortium states. The comparison was meant to determine if each hard-hit occupation was "matched" to one of the 51 green occupations. Such a match could occur in one of two ways. First, some of the hard-hit occupations identified in Tables II.4a through II.4c were themselves on the list of 51 green occupations identified in the consortium state survey. These hard-hit occupations also were green occupations. While jobs are lost in older manufacturing industries, these same occupations could be gaining jobs in green industries. The second type of match could occur when a hard-hit occupation from a manufacturing, construction, or construction-related service industry was related to a green occupation. In other words, if there is a substantial possibility that a manufacturing, construction, or related services worker could switch into a green occupation due to similar skills and other job characteristics. For each of the 51 green occupations, we gathered the names of occupations declared to be "related occupations" by the U.S. Department of Labor as part of its O*Net system. We identified a "match" between a green occupation and a hard-hit occupation when that hard-hit occupation was listed as a related occupation by O*Net for one or more of the 51 green occupations.

Table II.5 lists the hard-hit occupations from Tables II.4a through 4c that had a match with one or more of the 51 green occupations identified by the consortium. Such a match was identified for around 35% and 40% of manufacturing and construction workers, respectively. In other words, we found substantial evidence that displaced construction and manufacturing industry workers have potential to find a new job in a green occupation. However, only 2 of the hard-hit construction-related services occupations were found to have match with one of the 51 green occupations.

16

Table II.5
Occupations with Largest Projected Job Loss That Match One or More Green Occupations

Industry Name	SOC Code	Hard-Hit Occupations That Match a Green Occupation					
		Iowa	Montana	Nebraska	South Dakota	Utah	Wyoming
Within Construction Industry							
Construction Managers	11-9021	X	X	X	X	X	X
First-line Supervisors of Construction Trades	47-1011	X	X	X	X	X	X
Operating Engineers and Other Construction Equipment Operators	47-2073	X	X	X	X	X	X
Electricians	47-2111	X	X	X	X	X	X
Heating, Air Conditioning and Refrigeration Mechanics and Installers	49-9021	X	X	X	X	X	X
Heavy and Tractor-Trailer Truck Drivers	53-3032						X
Within Manufacturing Industry							
Mechanical Engineers	17-2141	X		X	X		
Helpers - Installation, Maintenance and Repair Workers	49-9098	X	X	X	X	X	
First-line Supervisors of Production and Operations Workers	51-1011	X	X	X	X	X	X
Electric and Electronic Equipment Assemblers	51-2022	X	X	X	X	X	
Structural Metal Fabricators and Fitters	51-2041	X		X	X	X	
Computer Controlled Machine Tool Operator Metal and Plastic	51-4011	X		X	X		
Cutting, Punching, and Press Machine Setters, Operators and Tenders Metal and Plastic	51-4031	X		X	X	X	X
Welders, Cutters, Solderers and Brazers	51-4121	X	X	X	X	X	X

Table II.5 (Continued)
Occupations with Largest Projected Job Loss That Match One or More Green Occupations

Industry Name	SOC Code	Hard-Hit Occupations That Match a Green Occupation					
		Iowa	Montana	Nebraska	S. Dakota	Utah	Wyoming
Woodworking Machine Setters, Operators, and Tenders	51-7042	X	X				
Petroleum Pump Systems Operator and Refinery Operations Gaugers	51-8093						X
Chemical Equipment Operators and Tenders	51-9011						X
Production Workers All Other	51-9199	X	X	X	X	X	X
Heavy and Tractor-Trailer Truck Drivers	53-3032	X	X		X	X	X
Laborers and Freight Stock and Material Movers Hand	53-7062	X	X	X	X	X	X
Packers and Packagers Hand	53-7064	X	X	X	X	X	X
Within Construction-Related Services Industries							
Property Real Estate and Community Association Managers	11-9141	X	X	X		X	X
Civil Engineers	17-2051		X	X		X	X

Another natural question is: what are these matched green occupations? This issue is addressed in Table II.6, which shows the green occupations which were matched with at least 1 hard-hit occupation from the construction, manufacturing, or construction-related services industry. The number of occupations is larger than in Table II.5 since some hard-hit occupations are matched with more than one green occupation. As is evident in Table II.6, there are opportunities in a variety of professional and skilled trade occupations. Displaced workers from these industries may look for re-employment opportunities in these green occupations. In fact, in the summary chapter for this report we provide a brief write-up for each state listing the potential matched green occupations for displaced manufacturing, construction, or related services workers. However, before that, in the next chapter we discuss how the characteristics of

displaced workers from across the nation influence their ability to gain re-employment in green

occupations. Given this focus on workers nationwide, the next chapter utilizes a national

definition of green occupations developed by the U.S. Department of Labor.

Table II.6
Green Occupations for Displaced
Manufacturing, Construction, and Construction-Related Service Industry Workers

Industry Name	SOC Code	Matched Green Occupations					
		Iowa	Montana	Nebraska	South Dakota	Utah	Wyoming
Within Construction Industry							
Construction Managers	11-9021	X	X	X	X	X	X
Electricians	47-2111	X	X	X	X	X	X
Hazardous Materials Removal Workers	47-4041						X
Earth Drillers, Except Oil and Gas	47-5021	X	X	X	X	X	X
Bicycle Repairers	49-3091	X	X	X	X	X	X
Heating, Air Conditioning and Refrigeration Mechanics and Installers	49-9021	X	X	X	X	X	X
Home Appliance Repairers	49-9031	X	X	X	X	X	X
Within Manufacturing Industry							
Natural Sciences Managers	11-9121	X	X	X	X	X	X
Architects	17-1011	X		X	X		
Environmental Science and Protection Technicians, Including Health	19-4091						X
Pesticide Handlers, Sprayers, and Applicators, Vegetation	37-3012						X
Tree Trimmers and Pruners	37-3013	X	X	X	X	X	X
Farmworkers and Laborers, Crop, Nursery, and Greenhouse	45-2092	X	X	X	X	X	
Floor Layers, Except Carpet, Wood, and Hard Tiles	47-2042	X	X	X	X	X	X
Electricians	47-2111	X	X	X	X	X	
Glaziers	47-2120	X	X	X	X	X	X

Table II.6 (Continued)
Green Occupations for Displaced
Manufacturing, Construction, and Construction-Related Service Industry Workers

Industry Name	SOC Code	Matched Green Occupations					
		Iowa	Montana	Nebraska	S. Dakota	Utah	Wyoming
Helpers - Electricians	47-3031	X	X	X	X	X	X
Hazardous Material Removal Workers	47-4041	X	X		X	X	X
Riggers	49-9096	X	X	X	X	X	X
Coil Winders, Tapers, and Finishers	51-2021	X		X	X	X	X
Structural Metal Fabricators and Fitters	51-2041	X	X	X	X	X	X
Molding, Coremaking, and Casting Machine Setters, Operators, and Tenders, Metal and Plastic	51-4072	X	X	X	X	X	X
Water and Liquid Waste Treatment Plant and System Operators	51-8031						X
Separating, Filtering, Clarifying, Precipitating, and Still Machine Setters, Operators, and Tenders	51-9012	X		X	X	X	X
Production Workers All Other	51-9199	X	X	X	X	X	X
Within Construction-Related Services Industries							
Construction Managers	11-9021	X	X	X		X	X
Architects	17-1011		X	X		X	X
Civil Engineers	17-2051		X	X		X	X
Health and Safety Engineers, Except Mining Safety Engineers and Inspectors	17-2111		X	X		X	X

III. Observed Match among Occupations: Factors Influencing the Probability of a Match

This section looks for evidence of occupation switching – especially switching into green occupations – in the wake of the Great Recession of 2008. We begin by investigating whether displaced persons were able to find new employment in green occupations. Then we narrow the focus to examine the experiences of persons displaced from industries hit especially hard by the Great Recession, namely, manufacturing, construction, and services related to construction; the "related service" industries include (1) architecture & engineering, (2) finance, (3) real estate, and (4) legal services. How likely were persons displaced from these "recession" industries to find re-employment in green jobs?

To identify occupation switching behavior, we employed data from two January 2010 surveys: (1) the Current Population Survey (CPS) and (2) the Displaced Workers Survey (DWS). The CPS is a monthly survey of households conducted by the Bureau of Census for the Bureau of Labor Statistics (BLS). According to the BLS web site (www.bls.gov/cps) this monthly survey of the population provides a comprehensive body of data on persons in and out of the labor force, as well as comprehensive data on employment, hours of work, earnings, unemployment, and other demographic and labor force characteristics. The CPS asks respondents many detailed questions about their personal characteristics, labor force status, and thus for each month provides researchers with rich data on labor market performance.

Every other January the CPS is supplemented by a survey known as the Displaced Workers Survey (DWS). This survey focuses specifically on the circumstances and characteristics of job losers (see www.bls.gov/cps/lfcharacteristics.htm for details). Displaced workers are defined as persons aged 20 years of age and older who lost or left jobs because (1) their plant or company closed or moved, (2) there was insufficient work for them to do, or (3) their position or shift was abolished. The most recent DWS was conducted in January 2010,

with the results made available in September 2010. Thus, the most recent DWS provides the first opportunity to assess job losses occurring during the Great Recession.

All individuals surveyed for the January 2010 CPS also were eligible for the DWS as long as they met two criteria. First, they must have been at least 20 years of age. Second, respondents must have experienced an involuntary job loss between January 1, 2007 and January 1, 2010. If respondents met these criteria, then they were queried about their former employment and earnings.

The January 2010 CPS and the supplemental DWS enable us to identify the former occupations of specific individuals displaced in the last three years, as well as the current occupation of individuals who had found new employment by the time of the January 2010 survey.

For the January 2010 DWS, a grand total of 9099 individuals were surveyed. This population provided the basis for our sample. We omitted individuals who had dropped out of the labor force and were not seeking reemployment after their latest displacement. We also omitted individuals for which complete data were not reported. Specifically, we eliminated from the sample individuals for whom (1) no data were reported on the former occupation or (2) no year was reported for their job displacement. After eliminating individuals with missing data points, our sample for this investigation included 5,582 persons who had reported an involuntary job loss at some point between January 2007 and January 2010. Of those 5,582 displaced persons, 3,187 reported being employed in January 2010, meaning a reemployment rate of 57.1%.

Green Occupations

To proceed we also had to specify what exactly constitutes "green" employment. To identify "green" occupations objectively, we relied on the Occupational Information Network (O*Net) classification system developed by the U.S. Department of Labor. O*Net is the Federal Government's effort to analyze occupational structure and to provide a national occupational classification system (O*Net succeeded the *Dictionary of Occupational Titles*, for details see www.bls.gov/oco/oco2007.htm).

According to O*Net, the "green" economy involves economic activity related to (1) reducing the use of fossil fuels, (2) decreasing pollution and greenhouse gas emissions, (3) increasing the efficiency of energy usage, (4) recycling materials, or (5) developing and adopting renewable sources of energy (see www.onetcenter.org/green.html?p=2).

Because of green economy activities there may be increased demand for existing occupations, which O*Net classifies as "Green Increased Demand Occupations." In other words, the work context may become green but the tasks performed are not altered. Examples of such occupations include construction carpenters, engine and other machine assemblers, and industrial safety and health engineers.

Green activities also might require changes to the work or worker requirements of an existing occupation, which O*Net classifies as "Green Enhanced Skills Occupations." Put another way, the nature of the work remains the same but some task, skill, knowledge, or credential is altered by green activity. Examples of these enhanced skills occupations include civil engineers and electrical engineers, landscape architects, plumbers, roofers, sheet metal workers, heating and air conditioning mechanics and installers.

Finally, green activities may create new occupations altogether, which according to O*Net are "Green New and Emerging Occupations." Such occupations may be newly formed or spring from some previously existing occupation. These new occupations would include fuel cell engineers and wind energy engineers, weatherization installers and technicians, recycling and reclamation workers, and biomass plant technicians.

The O*Net web site reports a total of 217 occupations as green, out of 965 occupations overall. Because O*Net is the only nationally recognized system for identifying green occupations, we used the O*Net system to classify occupations.

Displaced Workers Who Found New Jobs: Displaced from Any Industry

Descriptive Statistics. For the January 2010 DWS, there are 5,582 workers who reported an involuntary job loss between January 1, 2007 and January 1, 2010 and for whom complete records are available. Of those job losers, 3,187 were re-employed again at the time of the January 2010 DWS. Descriptive statistics for these 3,187 job finders are presented in Table III.1.

The detailed CPS/DWS survey data allow us to control for much demographic information. For example, the average age of a displaced worker is 40.5 years. Most job losers (83%) were displaced from full-time jobs (35 or more hours/week). More than 36% of these displaced workers became re-employed in green occupations. Only 8% of the displaced workers moved to obtain re-employment.

Not only can we identify a person's gender, we can also identify marital status and whether or not the respondent had any children. Focusing on these particular demographic characteristics, the majority of the sample is male (60.2%). Most of those surveyed are married (55.5%). Roughly two-fifths of the sample had any children (39.8%). The most common group

Table III.1

Displaced Workers Who Found Jobs: Descriptive Statistics

	Number	Mean	Std. Dev.
Working in Green Occupation	1,158	.3634	.4810
Worked > 35hrs/wk in old job	2,646	.8302	.3755
Moved for Job	269	.0844	.2780
Single male no children	670	.2102	.4075
Single male with children	84	.0264	.1602
Married male no children	473	.1484	.3556
Married male with children	693	.2174	.4126
Single woman no children	484	.1519	.3589
Single woman with children	179	.0562	.2303
Married woman no children	291	.0913	.2881
Married woman with children	313	.0982	.2976
Age		40.5526	12.1094
Any Children	1,269	.3982	.4896
Less than High School	265	.0832	.2762
HS Grad or GED	942	.2956	.4564
Some College	651	.2043	.4032
Associate Degree	392	.1230	.3285
Bachelor Degree	670	.2102	.4075
Master Degree	200	.0628	.2426
Professional Degree	45	.0141	.1180
Doctoral Degree	22	.0069	.0828
Construction	422	.1324	.3390
Manufacturing	508	.1594	.3661
Finance	143	.0449	.2071
Real Estate	50	.0157	.1243
Architects & Engineers	53	.0166	.1279
Legal Services	49	.0154	.1231
Nebraska	43	.0135	.1154
Montana	42	.0132	.1141
Iowa	52	.0163	.1267
South Dakota	56	.0176	.1314
Utah	42	.0132	.1141
Wyoming	52	.0163	.1267
Observations	3,187		

is married men with children (693 observations) followed very closely by single men without children (670 observations). Among females, the most common group is single women without children (484 observations) followed by married women with children (313 observations).

Education is an important aspect of a person's human capital and determinant of employment. We are able to identify the highest level of educational attainment for the individuals in our sample. When it comes to schooling, Table 1 shows that there is a plurality of high school graduates in the sample (30.0%), followed by bachelor's degree college graduates (21.0%), people with some college but no degree (20.4%), and associate's degree community college graduates (12.3%). It is more common to observe someone with less than a high school diploma (8.3%) than a master's degree (6.3%), professional degree (1.4%), or doctoral degree (0.7%).

Landing in a green occupation may be influenced by where one had worked originally. Fortunately, the survey data allow us to identify the previous industry and occupations of every individual in the sample. Of the displaced workers, nearly 15.9% had lost jobs from the manufacturing sector, while 13.2% were displaced from construction. Only 4.5% of the job losers were from the financial industry and 1.6% from real estate. Turning to notable service industries, 1.7% of job losers were from the architectural/engineering sector, 1.5% from the legal services sector.

Finally, we are able to identify and control for a respondent's state of residence and the year in which displacement occurred. Controlling for the state of residence allows us to account for the heterogeneity of the national the labor market and control for varying unemployment rates across states. Of the 3,187 displaced workers/eventual job finders, 287 (9.0%) were from

the consortium states of Iowa, Montana, Nebraska, South Dakota, Utah, and Wyoming.

Controlling for the year of layoff also allows us to capture any relevant time trend.

The descriptive statistics indicate that 36.3% of the job losers/finders ended up in green occupations. What factors might have affected the likelihood of ending up in a green job?

Estimation Method. To begin, consider a simple linear representation:

(1) $$Y_i = X'_i \beta + \varepsilon_i, \qquad i = 1, \ldots, n,$$

where in this case Y is a binary variable equal to 1 if individual i (of the n individuals in the sample) was employed in a green occupation at the time of the DWS survey, equal to 0 otherwise; X_i is a matrix (k x n) of explanatory variables associated with person i; β is a vector (k x 1) of parameters we need to estimate; and ε_i is a disturbance term. Of course, by estimating β we would identify which factors affect the likelihood of landing in a green occupation; moreover, we would identify the magnitude of the impacts.

What sorts of variables can help explain whether or not a person lands in a green occupation? We included in our analysis those variables listed in Table III.1, to control for a person's age and past work situation, educational background, family situation, and control variables that include fixed effects for the state of residence and the year of job displacement.

In our analysis we do <u>not</u> assume a normally distributed random error. In fact, we assume that the error term, though random across observations, is not random within geographic areas. It is well known that labor market conditions vary from state to state. As such, the ε_i terms are subject to heteroskedasticity, that is, non-constant variance from state to state. Fortunately, this statistical problem can be circumvented, allowing us to obtain efficient

estimates of β. Specifically, we followed the technique described by Greene (2008, p. 188) to control for heteroskedasticity.[2]

To estimate the impact of the explanatory variables (X) on the likelihood of finding a green job (Y), the appropriate statistical method is to estimate a probit model, a non-linear maximum likelihood estimation technique. This technique estimates values for the β vector that maximize the likelihood of observing the outcomes in our survey data.

As explained above, we are interested in the probability of green employment given an individual's personal characteristics and employment history:

$$(2) \qquad\qquad P(Y = 1 \mid X'\beta) = \Phi(X'\beta),$$

where $\Phi(.)$ represents the standard normal distribution. The coefficients of interest are jointly normally distributed. Given this distribution we can specify a log likelihood function as follows:

$$(3) \qquad\qquad \ln L = \sum_{y_0} \ln\left(1 - \Phi(x_i'\beta)\right) + \sum_{y_i=1}^{n} \ln \Phi(x_i'\beta),$$

where the objective is to choose values for β that maximize $\ln L$, that is, values for the parameters to maximize the likelihood of obtaining the survey observations. Differentiating the log likelihood function with respect to β to maximize the function leads us to the parameter estimates.

Using the probit estimation method outlined above, we can estimate a baseline probability that an individual would have been employed in a green occupation at the time of the CPS/DWS survey in January 2010. This baseline probability is the value generated with the probit coefficient estimates when X is set equal to $\overline{X}$.

As is well known to statisticians, the coefficient estimates for β do not represent the marginal effects of the explanatory variables. In the probit framework, it is customary to

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[2] Greene, William H., 2008. *Econometric Analysis*, 6th edition. Upper Saddle River, New Jersey: Prentice Hall.

evaluate marginal effects using the mean values of all the explanatory variables. For example, in the case of a continuous explanatory variable, such as age, the marginal impact of the variable can be calculated as follows:

(4)
$$\frac{\partial E(y|x)}{\partial x} = \phi\left(\overline{x}'\beta\right)\beta,$$

where $\phi\left(\overline{x}'\beta\right)$ represents the probability density function evaluated at the mean values of the independent variables. However, in the case of discrete variables (like 0-1 indicator variables), the marginal impact can be calculated as follows:

(5)
$$Marginal\ effect = P[y = 1|\overline{x}, d = 1] - P[y = 1|\overline{x}, d = 0],$$

where d signifies the 0-1 dummy variable for which we would like to obtain the marginal impact. In other words, to determine the marginal impact of some indicator variable, such as having a bachelor's degree from college, hold the other variables fixed at their respective means and then find the probability of being employed in a green occupation when one has a college degree and also when one does not; we then take the difference between these two scenarios to gauge the marginal effect of having earned a bachelor's degree. A cautionary note, multiple effects cannot be calculated simultaneously. Each marginal effect is calculated while holding the other variables fixed at their mean values. Thus, it would be incorrect merely to sum the coefficients on multiple variables in order to determine the probability of being employed in a green occupation for any desired set of initial conditions.

 Results. Using the probit estimation method, we are able to calculate the probability that an employed person (at survey time) who reported a job loss between January 1, 2007 and January 1, 2010 had been reemployed in a green occupation. Using the probit coefficient estimates, we were able to compute the marginal impact of each explanatory variable, which are presented in Table III.2 below, in the column headed "Model (1)".

Table III.2
Probability of being Employed in a Green Occupation
(Currently Employed, All Industries)

Explanatory Variable	Model (1)[a] End Green	P-value	Model (2)[b] End Green	P-value
Worked > 35hrs / wk	0.0228	(0.311)	-0.0317*	(0.093)
Moved for Job	0.0103	(0.763)	-0.0217	(0.598)
Single male with children	-0.0721	(0.139)	-0.0327	(0.523)
Married male no children	0.0479	(0.149)	-0.0250	(0.456)
Married male with children	0.0843**	(0.020)	0.0183	(0.605)
Single woman no children	-0.1688***	(0.000)	-0.1185***	(0.000)
Single woman with children	-0.2462***	(0.000)	-0.1359***	(0.000)
Married woman no children	-0.2254***	(0.000)	-0.1168***	(0.000)
Married woman with children	-0.1839***	(0.000)	-0.0985***	(0.000)
Age	0.0170***	(0.010)	0.0048	(0.378)
Age^2	-0.0002**	(0.012)	-0.0001	(0.380)
Less than High School	0.0262	(0.478)	-0.0164	(0.690)
Some College	0.0152	(0.605)	0.0405	(0.247)
Associate Degree	0.0439	(0.184)	0.0173	(0.596)
Bachelor Degree	0.0938***	(0.001)	0.0786**	(0.038)
Master Degree	0.0816*	(0.081)	0.0574	(0.278)
Professional Degree	0.0650	(0.557)	-0.1061*	(0.077)
Doctoral Degree	0.3598**	(0.016)	0.2429	(0.239)
Construction	0.2814***	(0.000)	0.1536**	(0.031)
Manufacturing	0.1877***	(0.000)	0.1237***	(0.002)
Finance	0.0935	(0.101)	0.0900*	(0.097)
Real Estate	0.0187	(0.683)	0.0750*	(0.078)
Architects & Engineers	0.3706***	(0.000)	0.3717**	(0.037)
Legal Services	0.1579	(0.106)	0.0300	(0.764)
Baseline probability (at means)	.344		.178	
Controls				
State Fixed Effects	Yes		Yes	
Year of job loss	Yes		Yes	
Walt test (χ^2 df=24)	921.66	(0.000)	170.63	(0.000)
N	3,187		1,921	

Marginal effects; p-values in parentheses for discrete change of dummy variable from 0 to 1
* p < .1, ** p < .05, *** p < .01
[a]Probability that an employed person (at survey time) who reported a job loss between January 1, 2007 and January 1, 2010 had been re-employed in a green occupation.
[b]Same as Model (1), but only includes individuals who did not start in a green occupation.

To interpret the results presented in Table III.2, consider the following. The "baseline probability" figure (.344) means that holding all variables fixed at their means, someone previously employed had 34.4% probability of being employed in a green occupation at the time of the 2010 DWS survey, given that the individual was employed at the time of the survey. Holding all variables fixed at their means, someone previously employed in the construction industry had a 62.54% probability (.344 + .2814) of being employed in a green occupation, given that they were employed. And someone previously employed in manufacturing had a 53.17% probability (.344 + .1877) of being employed in a green occupation, given that they were employed. Finally, someone displaced from work in the architectural/engineering sector had a 71.46% probability (.344 + .3706) of being re-employed in a green-collar job.

Having been displaced from a full-time job had no significant impact on the likelihood of ending up in a green occupation. Likewise, moving to find work does not influence the likelihood of landing in a green job (see Table III.2).

To gauge the impact of age on the probability of finding a green job, we used both *Age* and Age^2, a quadratic formulation which allows the impact of age to vary between younger and older persons. According to our probit estimates, age increases the likelihood of landing in a green-collar job, but at a decreasing rate. In fact, for a person exhibiting the mean age of 40.55 years, the marginal impact of age is roughly zero. In other words, older displaced workers were not more likely than their younger counterparts to be re-employed in a green occupation.

Gender and family circumstances affect the probability of being re-employed in a green occupation. Compared to single displaced men without children (the base group), married displaced men with children are much more likely (8.4% more likely) to wind up in green work. If being married with children signals family responsibilities, then displaced men with those

responsibilities are more likely to become re-employed in green work than their unmarried, childless counterparts. Perhaps significant family responsibilities make displaced men less picky in their job search behavior, so that they are more willing to accept green types of work.

Compared to single men without children, women are less likely to be re-employed in green jobs, regardless of their marital or parental status.

Educational background also affects the likelihood of a displaced worker finding re-employment in a green job (see Table III.2). Compared to high school graduates (the base group), a bachelor's degree college graduate is much more likely (9.4% more likely) to become re-employed in a green job. The same holds true for holders of master's or doctoral degrees.

In contrast to college alumni, community college graduates are *not* more likely than high school graduates to land in a green job. Likewise, the re-employment prospects of (1) persons with some college experience (but no degree) and (2) persons without even a high school diploma are no different than those of high school graduates. Also note, for persons with a professional degree – that is, persons with advanced training for a specific profession – the probability of green re-employment is no different than for a high school graduate.

Putting the education effects in some perspective, having earned a 4-year college degree (or higher) instead of a high school diploma means a displaced worker is more likely to be re-employed in a green job. The only exception to this finding, perhaps not surprisingly, is for persons with professional degrees, who are trained to practice in a very specific profession. In contrast, having earned a 2-year community college degree instead of a high school diploma does *not* mean one is more likely to be re-situated in green work. Of course, our model cannot identify whether it is because college education (1) makes someone more willing to pursue green-collar work or (2) prepares one with "greener" job skills. Nevertheless, it is the case that

displaced college graduates who were subsequently re-employed were more likely to wind up in green-collar work than other displaced workers.

So far our analysis has focused on the national sample of 3,187 persons displaced from work who subsequently became re-employed. But many of those persons may have been displaced from green jobs in the first place. What about persons displaced from non-green jobs, hereafter referred to as "brown" jobs? Focusing only on persons displaced from brown jobs who subsequently became re-employed – which is a group of 1,921 persons – what is the likelihood of their being re-employed in green-collar work? Using the probit estimation method for this restricted sample, we computed the marginal impact of each explanatory variable, presented in Table III.2 below in the column headed "Model (2)".

Now the baseline figure (.178) means that holding all variables fixed at their means, someone displaced from a brown job had only a 17.8% probability of being employed in a green job, given that the individual was employed at the time of the DWS survey. Evaluating the explanatory variables at their means, someone previously employed in a brown construction job had a 33.16% probability (.178 + .1536) of being re-employed in a green job, given that they were employed. A person dislodged from a brown manufacturing occupation had only a 30.17% probability (.178 + .1237) of being employed in a green occupation, given that they were employed. Finally, someone thrown out of a brown job in the architectural/engineering sector had a 54.97% probability (.178 + .3717) of landing in a green-collar job.

Now focusing only on those displaced from brown-collar jobs, having worked full-time means one is somewhat less likely to land in a green occupation. It is still the case that moving to find work does not influence the likelihood of landing in a green job (see Table III.2, Model (2)). Compared to single men without children, it is still the case that women are less likely to be

re-employed in green work, regardless of their marital or parental status.

Regarding education, the findings are familiar. Having earned a 4-year college degree instead of a high school diploma means someone displaced from a brown job is more likely to become re-employed in a green job. Again there is an exception for persons with professional degrees. It is still the case that having earned a 2-year community college degree instead of a high school diploma does *not* mean one is more likely to be re-situated in green work. Focusing only on those displaced from brown occupations, it remains true that displaced college graduates are more likely to wind up in green-collar work than other displaced workers, including community college graduates.

Displaced Workers Who Found New Jobs: Displaced from Selected Industries of Interest

Descriptive Statistics. So far our analysis has focused on persons in the 2010 DWS survey who were displaced from work some time since 2007 and subsequently re-employed in 2010. Those persons could have been displaced from any industrial sector. But the Great Recession clobbered some industries particularly, like construction and manufacturing. Also hard hit were services related to building – services like finance, real estate, legal services, and architectural/engineering services. What would be the findings if we narrowed our focus to persons displaced from these particularly hard hit sectors? Would these job losers be more or less likely to be finders of green jobs?

In the 2010 DWS there are 1,225 workers displaced from construction, manufacturing, or related services who were re-employed again at the time of the survey. Descriptive statistics for these 1,225 job finders are presented in Table III.3 below. Only 36.3% of displaced workers were subsequently re-employed in green occupations (see Table III.1). In contrast, a majority of

job losers from construction, manufacturing, and related services was re-employed in green-collar work, albeit a slim majority of 50.9% (see Table III.3). Along with this difference between displaced workers in general and those displaced from the selected "clobbered" industries, there are some differences in demographic and educational characteristics.

The group displaced from selected industries is overwhelmingly male (73.9%) notably more male than the at-large sample. A familiar finding, most of this particular group is married (59.9%) with two-fifths of the sample (41.6% to be exact) having any children. As before, the most common group is married men with children (338 observations) followed closely by single men without children (287 observations). Also as before, among women the most common group is single females without children (123 observations) followed by married females with children (91 observations).

In other respects this targeted sample is similar to the broader, at-large sample. For example, of the 1,225 displaced workers/eventual job finders in this targeted sample, 113 (9.2%) were from the consortium states of Iowa, Montana, Nebraska, South Dakota, Utah, and Wyoming. This 9.2% share is nearly identical with the 9.0% share for the at-large sample.

When it comes to schooling, Table III.3 shows that it is still the case that there is a plurality of high school graduates in the sample (33.3%), followed by bachelor's degree college graduates (20.0%), and people with some college but no degree (18.8%). The share of the sample with less than a high school diploma (10.6%) is nearly identical to the share with an associate's degree from community college (10.5%). In a sample focused exclusively on displacement from construction, manufacturing, and related services, it is still uncommon to observe someone with a master's degree (4.9%), professional degree (1.4%), or doctoral degree (0.4%).

Table III.3

Displaced Workers from Selected Industries Who Found Jobs: Descriptive Statistics

	Number	Mean	Std. Dev.
Working in Green Occupation	624	.5094	.5001
Worked > 35hrs / wk	1,113	.9086	.2883
Moved for Job	115	.0939	.2918
Single male no children	287	.2343	.4237
Single male with children	43	.0351	.1841
Married male no children	237	.1935	.3952
Married male with children	338	.2759	.4472
Single woman no children	123	.1004	.3007
Single woman with children	38	.0310	.1734
Married woman no children	68	.0555	.2291
Married woman with children	91	.0743	.2623
Age		40.4865	11.6495
Any Children	510	.4163	.4932
Less than High School	130	.1061	.3081
HS Grad or GED	409	.3339	.4718
Some College	230	.1878	.3907
Associate Degree	129	.1053	.3071
Bachelor Degree	245	.2000	.4002
Master Degree	60	.0490	.2159
Professional Degree	17	.0139	.1170
Doctoral Degree	5	.0041	.0638
Construction	422	.3445	.4754
Manufacturing	508	.4147	.4929
Finance	143	.1167	.3212
Real Estate	50	.0408	.1979
Architects & Engineers	53	.0433	.2035
Legal Services	49	.0400	.1960
Nebraska	14	.0114	.1063
Montana	15	.0122	.1100
Iowa	20	.0163	.1268
South Dakota	28	.0229	.1495
Utah	21	.0171	.1299
Wyoming	15	.0122	.1100
Observations	1,225		

The descriptive statistics indicate that 50.9% of this group of job losers/finders ended up in green occupations. What factors affected the likelihood of ending up in a green job? To address this question, we again estimate a probit model.

Results. Using the probit estimation method, we are able to calculate the probability that an employed person (at survey time) who reported a job loss between January 1, 2007 and January 1, 2010 from one of the industries of interest had been reemployed in a green occupation. Using the probit coefficient estimates, we were able to compute the marginal impact of each explanatory variable, which are presented in Table III.4 below, in the column headed "Model (1)".

To interpret the results presented in Table III.4, consider the following. Recall that the "baseline probability" figure (.512) means that holding all variables fixed at their means, someone previously employed had 51.2% probability of being employed in a green occupation at the time of the 2010 DWS survey, given that the individual was employed at the time of the survey and was displaced from construction, manufacturing, or one of the related service sectors. Holding all variables fixed at their means, someone with a college degree had 58.45% (.512 + .0725) probability of being re-employed in a green collar job.

As for the at-large sample, having been displaced from a full-time job had no significant impact on the likelihood of ending up in a green occupation. Likewise, moving to find work does not influence the likelihood of landing in a green job. Unlike the at-large case, age has no significant impact either (see Table III.4).

The impacts of gender and family circumstances are familiar. Compared to single displaced men without children (the base group), married displaced men with children are more likely (11.1% more likely) to wind up in green work. Once again, if being married with children

Table III.4
Probability of Being Employed in a Green Occupation
(Currently Employed)
(Originally Employed in Construction, Manufacturing, or Related Services)

	Model (1)[a]		Model (2)[b]	
	End Green	P-value	End Green	P-value
Worked > 35hrs / wk	-0.0738	(0.257)	-0.1001	(0.270)
Moved for Job	0.0393	(0.622)	-0.0415	(0.753)
Single male with children	-0.1361	(0.102)	-0.0379	(0.808)
Married male no children	0.0669	(0.263)	0.1016	(0.341)
Married male with children	0.1105*	(0.055)	0.0512	(0.608)
Single woman no children	-0.0836	(0.278)	-0.0744	(0.395)
Single woman with children	-0.2131**	(0.035)	-0.1644	(0.152)
Married woman no children	-0.1854*	(0.052)	-0.0345	(0.791)
Married woman with children	-0.2226***	(0.002)	-0.1514*	(0.067)
Age	0.0077	(0.514)	-0.0004	(0.983)
Age Squared	-0.0001	(0.516)	-0.0001	(0.769)
Less than High School	0.0125	(0.849)	-0.0181	(0.866)
Some College	-0.0043	(0.933)	0.0609	(0.529)
Associate Degree	0.0338	(0.554)	-0.0080	(0.950)
Bachelor Degree	0.0725*	(0.069)	0.0709	(0.434)
Master Degree	0.1486*	(0.063)	0.0483	(0.736)
Professional Degree	0.3506**	(0.011)	0.6052***	(0.000)
Doctoral Degree[c]	…………omitted…………			
Construction	0.0998***	(0.005)	0.0008	(0.991)
Finance	-0.1178**	(0.046)	-0.0403	(0.527)
Real Estate	-0.2183***	(0.000)	-0.0951	(0.166)
Architects & Engineers	0.1689**	(0.050)	0.1792	(0.454)
Legal Services	-0.1078	(0.302)	-0.1325	(0.249)
Legal Services	-0.1294	(0.295)	-0.1325	(0.249)
Baseline probability (at means)	.512		.295	
Controls				
State Fixed Effects	Yes		Yes	
Year of job loss	Yes		Yes	
Walt test (χ^2 df=22)	293.81	(0.000)	74.79	(0.000)
N	1,225		430	

Marginal effects; *p*-values in parentheses for discrete change of dummy variable from 0 to 1
* $p < .1$, ** $p < .05$, *** $p < .01$
[a]Probability that an employed person (at survey time) who reported a job loss between January 1, 2007 and January 1, 2010 had been re-employed in a green occupation.
[b]Same as Model (1), but only includes individuals who did <u>not</u> start in a green occupation.
[c]The "doctoral" variable must be dropped due to problems arising because there are so few observations.

signals family responsibilities for a man, then displaced men with those responsibilities are more likely to become re-employed in green work than their unmarried, childless counterparts. This finding again supports the conjecture that significant family responsibilities make displaced men less picky in their job search behavior, so that they are more willing to accept green types of work. Also as before, compared to single men without children, women are less likely to be re-employed in green jobs, regardless of their marital or parental status.

The effects of educational background on the likelihood of finding re-employment in a green job are also familiar (see Table III.4). Compared to high school graduates (the base group), a bachelor's degree college graduate is more likely (7.3% more likely) to become re-employed in a green job. The results are even more striking for those few holders of master's or professional degrees.

Concentrating exclusively on persons displaced from construction, manufacturing, and related services industries, we again find that unlike 4-year college graduates, community college graduates are *not* more likely than high school graduates to land in a green job. Also as before, the re-employment prospects of (1) persons with some college experience (but no degree) and (2) persons without even a high school diploma are no different than those of high school graduates.

Once again we find that having earned a 4-year college degree (or higher) instead of a high school diploma means a displaced worker who is re-employed is more likely to be re-employed in a green job. In contrast, having earned a 2-year community college degree instead of a high school diploma does *not* mean one is more likely to be re-situated in green work. Although our analysis does not identify *why* it is the case, it is nevertheless true that college graduates who are re-employed are more likely to wind up in green-collar work than other displaced workers.

Compared to job losers from manufacturing, displaced construction workers were significantly more likely (10% more likely) to be re-employed in green collar work; persons displaced from the architectural/engineering sector were even more likely (16.9% more likely) to land in green occupations. But if a worker was dislodged from the financial sector or the real estate sector, (s)he was less likely than someone from manufacturing to become re-employed in green work.

So far our analysis has focused on the national sample of 1,225 persons displaced from work in construction, manufacturing, or related services who subsequently became re-employed. But many of those persons could have been displaced from green collar work in the first place. What about persons displaced from brown jobs? Focusing only on persons displaced from brown jobs in the sectors of interest who subsequently became re-employed – which is a group of 430 persons – what is the likelihood of their being re-employed in green-collar work? Using the probit estimation method for this restricted sample, we computed the marginal impact of each explanatory variable, presented in Table III.4 below, in the column headed "Model (2)".

For this group displaced from brown jobs, the baseline figure (.295) means that holding all variables fixed at their means, someone displaced from a brown job had a 29.5% probability of being employed in a green job, given that the individual was employed at the time of the DWS survey. For this comparatively small group of displaced workers, the marginal effects of the explanatory variables are largely insignificant.

Displaced Workers – Job Finders and Failures: Displaced from Any Industry

Descriptive Statistics. In the analysis above we focused on displaced workers who subsequently became re-employed. But what if we consider the entire sample, both the job

finders and the failures, that is, the entire sample of 5,582 displaced workers? Would any of our

findings change? Descriptive statistics for the entire sample of 5,582 displaced workers are

presented in Table III.5 below.

Now that the sample is expanded to include both successful and unsuccessful job finders,

we see that only 20.8% of displaced workers found work in green occupations. Many of the

demographic characteristics are similar, however. For example, the sample is mostly male

(62.6%) and mostly married (52.5%), with nearly two-fifths of the sample (37.7%) having any

children. But now that the sample is expanded to include both successful and unsuccessful job

finders, some of the demographics change. Now the most common group is single men with no

children (1,357) followed by married men with children (1,103) and married men without

children (849). For females, it is still the case that the most common group is single women

without children (773), only now the next most common group is married women with no

children (501). The expanded sample is different in other respects too. Of the 5,582 displaced

workers in the entire sample, only 7.4% were from the consortium states (meaning consortium

state individuals are slightly over-represented among the successful job finders).

When it comes to schooling, expanding the sample also makes a difference. Table III.5

shows that it is still the case that high school graduates are observed most commonly (33.5%),

only now the next largest group is the one with some college (20.1%), followed by bachelor's

degree college graduates (17.9%). The share of the sample with less than a high school diploma

(10.9%) is now larger (somewhat) than the share with an associate's degree from community

college (10.5%). Once failed job searchers are included the sample, it is less common to observe

someone with a master's degree (share falls to 5.4%), professional degree (share falls to 1.0%),

or doctoral degree (share falls to 0.5%). So once failed job searchers are included in the sample,

Table III.5

Displaced Workers, Job Finders and Failures: Descriptive Statistics

	Number	Mean	Std. Dev.
End Green	1,158	.2075	.4055
Worked > 35hrs / wk	4,726	.8466	.3604
Moved for Job	376	.0674	.2507
Single male no children	1,357	.2431	.4290
Single male with children	186	.0333	.1795
Married male no children	849	.1521	.3591
Married male with children	1,103	.1976	.3982
Single woman no children	773	.1385	.3454
Single woman with children	335	.0600	.2375
Married woman no children	501	.0898	.2859
Married woman with children	478	.0856	.2798
Age		41.2872	12.3452
Any Children	2,102	.3766	.4846
Less than High School	610	.1093	.3120
HS Grad or GED	1,872	.3354	.4722
Some College	1,124	.2014	.4011
Associate Degree	588	.1053	.3070
Bachelor Degree	1,001	.1793	.3837
Master Degree	302	.0541	.2262
Professional Degree	57	.0102	.1005
Doctoral Degree	28	.0050	.0707
Construction	866	.1551	.3621
Manufacturing	997	.1786	.3831
Finance	214	.0383	.1920
Real Estate	82	.0147	.1203
Architects & Engineers	85	.0152	.1225
Legal Services	75	.0134	.1151
Nebraska	62	.0111	.1048
Montana	53	.0095	.0970
Iowa	80	.0143	.1189
South Dakota	73	.01308	.1136
Utah	66	.01182	.1081
Wyoming	78	.0140	.1174
Observations	5,582		

the share of highly educated people falls. A sign that higher education is helpful in a successful job search?

The descriptive statistics indicate that 20.8% of the entire group of displaced workers became re-employed in green occupations. What factors affected the likelihood of ending up in a green job? To address this question, we again estimate a probit model. Using the probit coefficient estimates, we were able to compute the marginal impact of each explanatory variable, presented below in Table III.6, in the column headed "Model (1)".

Start with the "baseline probability" figure (.177), which means that holding all variables fixed at their means, a displaced worker had 17.7% probability of being employed in a green occupation at the time of the 2010 DWS survey. Holding all variables fixed at their means, someone dislodged from a construction job had a 29.94% probability (.177 + .1224) of being employed in a green occupation. Someone ejected from a manufacturing job had a 25.52% probability (.177 + .0782) of being employed in green collar work. Finally, someone displaced from work in the architectural/engineering sector had a 36.08% probability (.177 + .1838) of being re-employed in a green-collar job.

Having been displaced from a full-time job had no significant impact on the likelihood of ending up in a green occupation, but moving to search for work had a positive impact on the likelihood of landing in a green job (see Table III.6).

To gauge the impact of age on the probability of finding a green job, we again used both *Age* and *Age²*. Once again, we find that age increases the likelihood of landing in a green-collar job, but at a decreasing rate. In fact, for a person exhibiting the mean age of 41.29 years, the marginal impact of age is slightly negative. In other words, older displaced workers were less likely than their younger counterparts to be re-employed in green collar work.

Table III.6
Probability of Being Employed in a Green Occupation
(Currently Employed or Unemployed, All Industries)

	Model (1)[a] End Green	P-value	Model (2)[b] End Green	P-value
Worked > 35hrs / wk	-0.0249	(0.162)	-0.0348[**]	(0.014)
Moved for Job	0.0472[**]	(0.031)	0.0190	(0.523)
Single male with children	-0.0251	(0.318)	-0.0132	(0.647)
Married male no children	0.0767[***]	(0.000)	0.0018	(0.914)
Married male with children	0.1119[***]	(0.000)	0.0386[*]	(0.070)
Single woman no children	-0.0565[***]	(0.000)	-0.0470[***]	(0.000)
Single woman with children	-0.1232[***]	(0.000)	-0.0707[***]	(0.000)
Married woman no children	-0.0956[***]	(0.000)	-0.0484[**]	(0.031)
Married woman with children	-0.0685[***]	(0.000)	-0.0353[**]	(0.021)
Age	0.0077[**]	(0.043)	0.0020	(0.532)
Age Squared	-0.0001[**]	(0.015)	-0.0000	(0.350)
Less than High School	-0.0119	(0.627)	-0.0259	(0.214)
Some College	0.0276[*]	(0.096)	0.0290	(0.174)
Associate Degree	0.0623[**]	(0.020)	0.0249	(0.296)
Bachelor Degree	0.1070[***]	(0.000)	0.0697[**]	(0.022)
Master Degree	0.1174[***]	(0.000)	0.0649[*]	(0.062)
Professional Degree	0.1286	(0.161)	-0.0424	(0.370)
Doctoral Degree	0.4295[***]	(0.001)	0.2626	(0.143)
Construction	0.1224[***]	(0.000)	0.0651	(0.103)
Manufacturing	0.0782[***]	(0.000)	0.0405[*]	(0.056)
Finance	0.0648[*]	(0.068)	0.0483	(0.143)
Real Estate	-0.0071	(0.848)	0.0370	(0.234)
Architects & Engineers	0.1838[***]	(0.000)	0.0901	(0.282)
Legal Services	0.1014	(0.210)	0.0291	(0.644)
Baseline probability (at means)	.177		.0965	
Controls				
State Fixed Effects	Yes		Yes	
Year of job loss	Yes		Yes	
Walt test (χ^2 df=24)	2804.57	(0.000)	300.11	(0.000)
N	5,582		3,249	

Marginal effects; *p*-values in parentheses for discrete change of dummy variable from 0 to 1
[*] $p < .1$, [**] $p < .05$, [***] $p < .01$
[a]Probability that a displaced person is employed in a green occupation at survey time.
[b]Same as Model (1), but only includes individuals who did not start in a green occupation.

Gender and family circumstances affect the probability of being re-employed in a green occupation. Compared to single displaced men without children (the base group), married men – with or without children – are significantly more likely to wind up in green work. Once again we find that men with family responsibilities are more likely to become re-employed in green work than their unmarried, childless counterparts. Again, it appears that significant family responsibilities make displaced men less picky in their job search behavior, so that they are more willing to accept green types of work. In another familiar finding, compared to single men without children, women are less likely to be re-employed in green jobs, regardless of their marital or parental status.

Educational background still affects the likelihood of a displaced worker finding re-employment in a green job (see Table III.6). Compared to the holder of a high school diploma, the holder of a bachelor's degree is much more likely (10.7% more likely) to become re-employed in a green job; likewise, the holder of a master's degree is more likely to land in green work (11.7% more likely), as is the holder of a doctoral degree (43.0% more likely).

Once the sample is expanded to include both successful and unsuccessful job finders, it can be seen that the holder of a community college associate's degree is now more likely to find green collar work than a high school graduate (6.2% more likely); even someone with only some college experience is more likely to find green work than a high school graduate (albeit, only 2.8% more likely). In contrast, the re-employment prospects of someone without a high school diploma are no different than those of high school graduates.

Putting these education impacts in perspective, having earned a 4-year college degree (or higher) instead of a high school diploma means a displaced worker is more likely to be re-employed in a green job. Further, having earned a 2-year community college degree instead of a

high school diploma means a displaced worker is more likely to find a green collar job. So having some education beyond high school makes it more likely for a displaced worker to land in a green occupation.

What about workers who were displaced from brown jobs, a group of 3,249 persons? Using the probit estimation method for this restricted sample, we computed the marginal impact of each explanatory variable, shown below in Table III.6 in the column headed "Model (2)".

The findings are similar to those for the entire sample. Having earned a 4-year college degree – or a master's degree – instead of a high school diploma means someone displaced from a brown job is more likely to land in a green occupation. Only now the community college effect goes away. A displaced community college graduate is not more likely than a displaced high school graduate to make the jump from brown work to green work. Evidently community college graduates landing in green jobs tended to start in green jobs in the first place.

Displaced Workers – Job Finders and Failures: Displaced from Selected Industries of Interest

Descriptive Statistics. To close our analysis we now consider displaced workers – both job finders and failures – who were thrown of construction or manufacturing jobs, or jobs from related service industries. How are the findings affected by concentrating only on these clobbered industries? Would these displaced workers be more or less likely to be finders of green jobs? In the 2010 DWS there are 2,319 workers displaced from construction, manufacturing, or related services. Descriptive statistics for these persons are below in Table III.7. The demographics are familiar by now. This group is mostly male and mostly married, with nearly two-fifths having children.

46

Table III.7

Displaced Workers from Selected Industries, Job Finders and Failures:

Descriptive Statistics

	Number	Mean	Std. Dev.
End Green	624	.2691	.4436
Worked > 35hrs / wk	2,127	.9172	.2756
Moved for Job	170	.0733	.2607
Single male no children	634	.2734	.4458
Single male with children	97	.0418	.2002
Married male no children	450	.1940	.3956
Married male with children	558	.2406	.4276
Single woman no children	207	.0893	.2852
Single woman with children	78	.0336	.1803
Married woman no children	143	.0617	.2406
Married woman with children	152	.0655	.2475
Age		41.6861	11.9420
Any Children	885	.3816	.4859
Less than High School	309	.1332	.3399
HS Grad or GED	865	.3730	.4837
Some College	430	.1854	.3887
Associate Degree	214	.0923	.2895
Bachelor Degree	372	.1604	.3671
Master Degree	99	.0427	.2022
Professional Degree	24	.0103	.1012
Doctoral Degree	6	.0026	.0508
Construction	866	.3734	.4838
Manufacturing	997	.4299	.4952
Finance	214	.0923	.2895
Real Estate	82	.0354	.1847
Architects & Engineers	85	.0367	.1880
Legal Services	75	.0323	.1769
Nebraska	25	.0108	.1033
Montana	22	.0095	.0970
Iowa	29	.0125	.1112
South Dakota	39	.0168	.1286
Utah	32	.0138	.1167
Wyoming	24	.0103	.1012
Observations	2,319		

As for the at-large sample, the group displaced from the selected industries was most represented by high school graduates (37.3%) and those with some college (18.5%), followed by bachelor's degree holders (16.0%). Among job losers from the clobbered industries, it is noticeably more common to observe someone with less than a high school diploma (13.3%) than with a community college associate's degree (9.2%). Advanced degrees are comparatively rare.

The descriptive statistics indicate that 26.9% of this group of displaced workers ended up in green occupations. What factors affected the likelihood of ending up in a green job? Once again, we estimate a probit model.

Results. Using the probit estimation method, we are able to calculate the probability that a person displaced from one of the industries of interest had been reemployed in a green occupation. Using the probit coefficient estimates, we were able to compute the marginal impact of each explanatory variable, shown below in Table III.8 in the column headed "Model (1)".

The impacts on men of family circumstances are consistent. Compared to single displaced men without children (the base group), married men – with or without children – are more likely to land in green jobs. As seen throughout this report, displaced men with family responsibilities are more likely to become re-employed in green work than their single counterparts.

The effects of educational background are habitual (see Table III.8). Compared to a displaced high school graduate, a displaced bachelor's degree college graduate is significantly more likely (13.1% more likely) to become re-employed in a green job. Again, the results are even more striking for those few holders of master's or professional degrees. Also notice again, when the sample includes both successful and unsuccessful job finders, a dislodged community college graduate is more likely than a high school graduate (7.1% more likely) to

48

Table III.8
Probability of Being Employed in a Green Occupation
(Currently Employed or Unemployed)
(Originally Employed in Construction, Manufacturing, Related Services)

	Model (1)[a] End Green	P-value	Model (2)[b] End Green	P-value
Worked > 35hrs / wk	-0.1154**	(0.025)	-0.0972*	(0.080)
Moved for Job	0.0954*	(0.059)	0.0289	(0.714)
Single male with children	-0.0222	(0.577)	0.0324	(0.702)
Married male no children	0.1369***	(0.003)	0.1024*	(0.089)
Married male with children	0.1707***	(0.000)	0.0765	(0.110)
Single woman no children	0.0334	(0.401)	0.0215	(0.668)
Single woman with children	-0.0817	(0.133)	-0.0603	(0.263)
Married woman no children	-0.0338	(0.508)	0.0368	(0.638)
Married woman with children	-0.0744**	(0.022)	-0.0327	(0.334)
Age	0.0006	(0.925)	-0.0029	(0.774)
Age Squared	-0.0001	(0.494)	-0.0000	(0.847)
Less than High School	-0.0111	(0.795)	-0.0143	(0.765)
Some College	0.0361	(0.243)	0.0212	(0.667)
Associate Degree	0.0706*	(0.061)	0.0102	(0.886)
Bachelor Degree	0.1314***	(0.000)	0.0692	(0.271)
Master Degree	0.2250***	(0.000)	0.0670	(0.399)
Professional Degree	0.3529*	(0.053)	0.0578	(0.836)
Doctoral Degree[c]	0.6741***	(0.000)	omitted	
Construction	0.0460*	(0.053)	-0.0023	(0.955)
Finance	-0.0458	(0.198)	-0.0051	(0.886)
Real Estate	-0.1120***	(0.000)	-0.0235	(0.554)
Architects & Engineers	0.0695	(0.148)	0.0257	(0.785)
Legal Services	-0.0462	(0.591)	-0.0340	(0.620)
Baseline probability (at means)	.239		.132	
Controls				
State Fixed Effects	Yes		Yes	
Year of Job Loss	Yes		Yes	
Walt test ($\chi 2$ df=23)	728.43	(0.000)		
Walt test ($\chi 2$ df=22)			188.97	(0.000)
N	2319		806	

Marginal effects; p-values in parentheses for discrete change of dummy variable from 0 to 1
* $p < .1$, ** $p < .05$, *** $p < .01$
[a]Probability that a displaced person is employed in a green occupation at survey time.
[b]Same as Model (1), but only includes individuals who did not start in a green occupation.
[c]The "doctoral" variable must be dropped due to problems arising because there are so few observations.

find green employment. Also as before, the re-employment prospects of persons without even a high school diploma are no different than those of high school graduates.

In another familiar finding, compared to job losers from manufacturing, displaced construction workers were significantly more likely (4.6% more likely) to be re-employed in green collar work.

What about people from the selected industries who were displaced from brown jobs, a group of 806 persons? Using the probit estimation method for this restricted sample, we computed the marginal impact of each explanatory variable, shown below in Table 8 in the column headed "Model (2)". As before, for this comparatively small, restricted group of displaced workers, the marginal effects of the explanatory variables are largely insignificant.

Summary of Findings

Given the myriad results presented and discussed above, which results stand out? No matter which sample we studied, four findings were observed repeatedly. First, displaced men with family attachments were more likely than single men without children to become re-employed in green occupations. Whether or not they started in a green job in the first place, men with family obligations were noticeably more likely to find green jobs. Evidently these obligations encouraged flexibility in their job search behavior.

Second, regardless of marital or parental status, women were not more likely to end up in green jobs than men.

Third, workers displaced from construction jobs were more likely than job losers from manufacturing to regain employment in green collar work.

Fourth, displaced college graduates were more likely than displaced high school graduates (and those with less than a high school diploma) to become re-employed in green collar work, whether or not they started in green jobs. Evidently, college education is a significant factor in finding/switching into green employment

When the sample of displaced workers included both successful and unsuccessful job finders, it is even the case that community college graduates were more likely than high school graduates to land green jobs, but not to switch into green jobs from brown jobs in the first place. Again, it appears that education beyond high school is a key factor in obtaining green employment.

IV. Summary

This report examined the potential opportunities for displaced manufacturing, construction and construction-related service industry workers in green industry occupations. The goal was to examine the potential for the emerging green economy to re-employ these displaced workers. We began by estimating job losses within particular manufacturing, construction, and construction-related industries in each consortium state. We then estimated an occupation profile of displaced workers implied by these industry job losses, and whether these high-displacement occupations were well matched to a list of green occupations. These green occupations had been identified for consortium states by a survey of businesses conducted by consortium partners in each state. Based on that analysis, we predicted that green occupations were better suited for displaced construction and manufacturing workers than for displaced workers from construction-related services industries. We identified dozens of potentially matched green occupations in each state.

The second approach in the research was to empirically identify how the skills and attributes of workers influenced the probability of re-employment within a green occupation. To identify this re-employment behavior, we employed data from two January 2010 surveys: (1) the Current Population Survey (CPS) and (2) the Displaced Workers Survey (DWS). The January 2010 CPS and the supplemental DWS enable us to identify the former occupations of specific individuals displaced in the last three years, as well as the current occupation of individuals who had found new employment by the time of the January 2010 survey. We then examined which attributes influenced the probability of re-employment in a green occupation. In this case, we utilized a national definition of green occupations identified by the U.S. Department of Labor. This analysis found that displaced workers from the manufacturing, construction, and

construction-related services industries all had as high or a higher likelihood of re-employment in a green collar job than workers displaced from other industries. There were four other principal findings. First, displaced men with family attachments were more likely than single men without children to become re- employed in green occupations. Whether or not they started in a green job in the first place, men with family obligations were noticeably more likely to find green collar jobs. Evidently these obligations encouraged flexibility in their job search behavior. Second, regardless of marital or parental status, women were not more likely to end up in green jobs than men. Third, workers displaced from construction jobs were more likely than job losers from manufacturing to regain employment in green collar work. Fourth, displaced college graduates were more likely than displaced high school graduates (and those with less than a high school diploma) to become re-employed in green collar work, whether or not they started in green jobs. Evidently, college education is a significant factor in finding/switching into green employment

Utilizing the results of this research, we also developed a short document for each consortium state to explain the re-employment opportunities in green occupations for displaced manufacturing, construction, and construction-related service industry workers. These write-ups are designed so that they can be provided to displaced workers at convenient locations; for example, at a One-Stop Center located in a consortium state. The two-page write-ups are provided for each state in the pages that follow.

Opportunities for Employment in Green Occupations in Iowa

The state of Iowa has sustained heavy job losses in manufacturing, construction, and construction-related services industries (real estate, legal services, and architects and engineers) in recent years. While a recovery is underway in the manufacturing industry, many jobs may not return. Iowans need new opportunities in growing sectors of the economy. This flier examines opportunities in one potential growing sector: green occupations. Green occupations contain a significant number of workers who "produce a product or service that improves energy efficiency, expands the use of renewable energy, or supports environmental sustainability."

 Comparisons between the skills and requirements of occupations suggest that jobs in green occupations might be especially well-suited for displaced construction and manufacturing workers. However, analysis of actual job changing behavior by displaced workers finds that displaced manufacturing, construction, and construction-related services workers are all well-suited to find a new job in a green occupation. Workers in these industries are more likely to find new jobs in a green occupation than workers in other industries.

Researchers also found that displaced workers with a college degree or a Masters' degree are more likely to find a new job in a green occupation than other workers. However, there was no difference in the likelihood of finding a new green job between workers with high school degree, an associate's degree or several years of college.

The Table on the next page shows the green occupations potentially suited for Iowa's displaced manufacturing, construction, and construction-related services industry workers.

Potential Matched Green Occupations for Iowa

Architects

Bicycle Repairers

Coil Winders, Tapers, and Finishers

Construction Managers

Earth Drillers, Except Oil and Gas

Electricians

Farmworkers and Laborers, Crop, Nursery, and Greenhouse

Floor Layers, Except Carpet, Wood, and Hard Tiles

Glaziers

Hazardous Material Removal Workers

Hazardous Materials Removal Workers

Heating, Air Conditioning and Refrigeration Mechanics and Installers

Helpers – Electricians

Home Appliance Repairers

Molding, Coremaking, and Casting Machine Setters, Operators, and Tenders, Metal and Plastic

Natural Sciences Managers

Production Workers All Other

Riggers

Separating, Filtering, Clarifying, Precipitating, and Still Machine Setters, Operators, and Tenders

Structural Metal Fabricators and Fitters

Tree Trimmers and Pruners

Opportunities for Employment in Green Occupations in Montana

The state of Montana has sustained heavy job losses in manufacturing, construction, and construction-related services industries (real estate, legal services, and architects and engineers) in recent years. While a recovery is underway in the manufacturing industry, many jobs may not return. Montanans need new opportunities in growing sectors of the economy. This flier examines opportunities in one potential growing sector: green occupations. Green occupations contain a significant number of workers who "produce a product or service that improves energy efficiency, expands the use of renewable energy, or supports environmental sustainability."

Comparisons between the skills and requirements of occupations suggest that jobs in green occupations might be especially well-suited for displaced construction and manufacturing workers. However, analysis of actual job changing behavior by displaced workers finds that displaced manufacturing, construction, and construction-related services workers are all well-suited to find a new job in a green occupation. Workers in these industries are more likely to find new jobs in a green occupation than workers in other industries.

Researchers also found that displaced workers with a college degree or a Masters' degree were are likely to find a new job in a green occupation than other workers. However, there was no difference in the likelihood of finding a new green job between workers with high school degree, an associate's degree or several years of college.

The Table on the next page shows the green occupations potentially suited for Montana's displaced manufacturing, construction, and construction-related services industry workers.

Potential Matched Green Occupations for Montana

Architects
Bicycle Repairers
Civil Engineers
Coil Winders, Tapers, and Finishers
Construction Managers
Earth Drillers, Except Oil and Gas
Electricians
Farmworkers and Laborers, Crop, Nursery, and Greenhouse
Floor Layers, Except Carpet, Wood, and Hard Tiles
Glaziers
Hazardous Material Removal Workers
Heating, Air Conditioning and Refrigeration Mechanics and Installers
Helpers – Electricians
Home Appliance Repairers
Molding, Coremaking, and Casting Machine Setters, Operators, and Tenders, Metal and Plastic
Natural Sciences Managers
Production Workers All Other
Riggers
Structural Metal Fabricators and Fitters
Tree Trimmers and Pruners

Opportunities for Employment in Green Occupations in Nebraska

The state of Nebraska has sustained heavy job losses in manufacturing, construction, and construction-related services industries (finance, real estate, legal services, and architects and engineers) in recent years. While a recovery is underway in the manufacturing industry, many jobs may not return. Nebraskans need new opportunities in growing sectors of the economy. This flier examines opportunities in one potential growing sector: green occupations. Green occupations contain a significant number of workers who "produce a product or service that improves energy efficiency, expands the use of renewable energy, or supports environmental sustainability."

Comparisons between the skills and requirements of occupations suggest that jobs in green occupations might be especially well-suited for displaced construction and manufacturing workers. However, analysis of actual job changing behavior by displaced workers finds that displaced manufacturing, construction, and construction-related services workers are all well-suited to find a new job in a green occupation. Workers in these industries are more likely to find new jobs in a green occupation than workers in other industries.

Researchers also found that displaced workers with a college degree or a Masters' degree are more likely to find a new job in a green occupation than other workers. However, there was no difference in the likelihood of finding a new green job between workers with high school degree, an associate's degree or several years of college.

The Table on the next page shows the green occupations potentially suited for Nebraska's displaced manufacturing, construction, and construction-related services industry workers.

Potential Matched Green Occupations for Nebraska

Architects

Bicycle Repairers

Civil Engineers

Coil Winders, Tapers, and Finishers

Construction Managers

Earth Drillers, Except Oil and Gas

Electricians

Farmworkers and Laborers, Crop, Nursery, and Greenhouse

Floor Layers, Except Carpet, Wood, and Hard Tiles

Glaziers

Health and Safety Engineers, Except Mining Safety Engineers and Inspectors

Heating, Air Conditioning and Refrigeration Mechanics and Installers

Helpers – Electricians

Home Appliance Repairers

Molding, Coremaking, and Casting Machine Setters, Operators, and Tenders, Metal and Plastic

Natural Sciences Managers

Production Workers All Other

Riggers

Separating, Filtering, Clarifying, Precipitating, and Still Machine Setters, Operators, and Tenders

Structural Metal Fabricators and Fitters

Tree Trimmers and Pruners

Opportunities for Employment in Green Occupations in South Dakota

The state of South Dakota has sustained heavy job losses in manufacturing, construction, and construction-related services industries (finance, real estate, legal services, and architects and engineers) in recent years. While a recovery is underway in the manufacturing industry, many jobs may not return. South Dakotans need new opportunities in growing sectors of the economy. This flier examines opportunities in one potential growing sector: green occupations. Green occupations contain a significant number of workers who "produce a product or service that improves energy efficiency, expands the use of renewable energy, or supports environmental sustainability."

Comparisons between the skills and requirements of occupations suggest that jobs in green occupations might be especially well-suited for displaced construction and manufacturing workers. However, analysis of actual job changing behavior by displaced workers finds that displaced manufacturing, construction, and construction-related services workers are all well-suited to find a new job in a green occupation. Workers in these industries are more likely to find new jobs in a green occupation than workers in other industries.

Researchers also found that displaced workers with a college degree or a Masters' degree are more likely to find a new job in a green occupation than other workers. However, there was no difference in the likelihood of finding a new green job between workers with high school degree, an associate's degree or several years of college.

The Table on the next page shows the green occupations potentially suited for South Dakota's displaced manufacturing, construction, and construction-related services industry workers.

Potential Matched Green Occupations for South Dakota

Architects

Bicycle Repairers

Coil Winders, Tapers, and Finishers

Construction Managers

Earth Drillers, Except Oil and Gas

Electricians

Farmworkers and Laborers, Crop, Nursery, and Greenhouse

Floor Layers, Except Carpet, Wood, and Hard Tiles

Glaziers

Hazardous Material Removal Workers

Heating, Air Condtioning and Refridgeration Mechanics and Installers

Helpers – Electricians

Home Appliance Repairers

Molding, Coremaking, and Casting Machine Setters, Operators, and Tenders, Metal and Plastic

Natural Sciences Managers

Production Workers All Other

Riggers

Separating, Filtering, Clarifying, Precipitating, and Still Machine Setters, Operators, and Tenders

Structural Metal Fabricators and Fitters

Tree Trimmers and Pruners

Opportunities for Employment in Green Occupations in Utah

The state of Utah has sustained heavy job losses in manufacturing, construction, and construction-related services industries (finance, real estate, and architects and engineers) in recent years. While a recovery is underway in the manufacturing industry, many jobs may not return. Utah residents need new opportunities in growing sectors of the economy. This flier examines opportunities in one potential growing sector: green occupations. Green occupations contain a significant number of workers who "produce a product or service that improves energy efficiency, expands the use of renewable energy, or supports environmental sustainability."

Comparisons between the skills and requirements of occupations suggest that jobs in green occupations might be especially well-suited for displaced construction and manufacturing workers. However, analysis of actual job changing behavior by displaced workers finds that displaced manufacturing, construction, and construction-related services workers are all well-suited to find a new job in a green occupation. Workers in these industries are more likely to find new jobs in a green occupation than workers in other industries.

Researchers also found that displaced workers with a college degree or a Masters' degree are more likely to find a new job in a green occupation than other workers. However, there was no difference in the likelihood of finding a new green job between workers with high school degree, an associate's degree or several years of college.

The Table on the next page shows the green occupations potentially suited for Utah's displaced manufacturing, construction, and construction-related services industry workers.

Potential Matched Green Occupations for Utah

Architects
Bicycle Repairers
Civil Engineers
Coil Winders, Tapers, and Finishers
Construction Managers
Earth Drillers, Except Oil and Gas
Electricians
Farmworkers and Laborers, Crop, Nursery, and Greenhouse
Floor Layers, Except Carpet, Wood, and Hard Tiles
Glaziers
Hazardous Material Removal Workers
Health and Safety Engineers, Except Mining Safety Engineers and Inspectors
Heating, Air Conditioning and Refrigeration Mechanics and Installers
Helpers – Electricians
Home Appliance Repairers
Molding, Coremaking, and Casting Machine Setters, Operators, and Tenders, Metal and Plastic
Natural Sciences Managers
Production Workers All Other
Riggers
Separating, Filtering, Clarifying, Precipitating, and Still Machine Setters, Operators, and Tenders
Structural Metal Fabricators and Fitters
Tree Trimmers and Pruners

Opportunities for Employment in Green Occupations in Wyoming

The state of Wyoming has sustained heavy job losses in manufacturing, construction, and construction-related services industries (real estate, legal services, and architects and engineers) in recent years. While a recovery is underway in the manufacturing industry, many jobs may not return. Wyoming residents need new opportunities in growing sectors of the economy. This flier examines opportunities in one potential growing sector: green occupations. Green occupations contain a significant number of workers who "produce a product or service that improves energy efficiency, expands the use of renewable energy, or supports environmental sustainability."

Comparisons between the skills and requirements of occupations suggest that jobs in green occupations might be especially well-suited for displaced construction and manufacturing workers. However, analysis of actual job changing behavior by displaced workers finds that displaced manufacturing, construction, and construction-related services workers are all well-suited to find a new job in a green occupation. Workers in these industries are more likely to find new jobs in a green occupation than workers in other industries.

Researchers also found that displaced workers with a college degree or a Masters' degree are more likely to find a new job in a green occupation than other workers. However, there was no difference in the likelihood of finding a new green job between workers with high school degree, an associate's degree or several years of college.

The Table on the next page shows the green occupations potentially suited for Wyoming's displaced manufacturing, construction, and construction-related services industry workers.

Potential Matched Green Occupations for Wyoming

Architects

Bicycle Repairers

Civil Engineers

Coil Winders, Tapers, and Finishers

Construction Managers

Earth Drillers, Except Oil and Gas

Electricians

Environmental Science and Protection Technicians, Including Health

Floor Layers, Except Carpet, Wood, and Hard Tiles

Glaziers

Hazardous Material Removal Workers

Health and Safety Engineers, Except Mining Safety Engineers and Inspectors

Heating, Air Conditioning and Refrigeration Mechanics and Installers

Helpers – Electricians

Home Appliance Repairers

Molding, Coremaking, and Casting Machine Setters, Operators, and Tenders, Metal and Plastic

Natural Sciences Managers

Pesticide Handlers, Sprayers, and Applicators, Vegetation

Production Workers All Other

Riggers

Separating, Filtering, Clarifying, Precipitating, and Still Machine Setters, Operators, and Tenders

Structural Metal Fabricators and Fitters

Tree Trimmers and Pruners

Water and Liquid Waste Treatment Plant and System Operators

Appendix 1

List of 51 Green Occupations for Consortium States

Industry	SOC Code
Construction Managers	11-9021
Natural Sciences Managers	11-9121
Architects, Except Landscape and Naval	17-1011
Landscape Architects	17-1012
Civil Engineers	17-2051
Environmental Engineers	17-2081
Health and Safety Engineers, Except Mining Safety Engineers and Inspectors	17-2111
Engineers, All Other	17-2199
Environmental Engineering Technicians	17-3025
Soil and Plant Scientists	19-1013
Zoologists and Wildlife Biologists	19-1023
Conservation Scientists	19-1031
Foresters	19-1032
Environmental Scientists and Specialists, Including Health	19-2041
Hydrologists	19-2043
Environmental Science and Protection Technicians, Including Health	19-4091
Forest and Conservation Technicians	19-4093
Forest and Conservation Technicians	27-1021
Fish and Game Wardens	33-3031
Cooks, All Other	35-2019
Pesticide Handlers, Sprayers, and Applicators, Vegetation	37-3012
Tree Trimmers and Pruners	37-3013
Sales and Related Workers, All Other	41-9099
First-Line Supervisors/Managers of Farming, Fishing, and Forestry Workers	45-1011
Farmworkers and Laborers, Crop, Nursery, and Greenhouse	45-2092
Floor Layers, Except Carpet, Wood, and Hard Tiles	47-2042
Electricians	47-2111
Glaziers	47-2121
Insulation Workers, Floor, Ceiling, and Wall	47-2131
Insulation Workers, Mechanical	47-2132
Helpers – Electricians	47-3031
Hazardous Material Removal Workers	47-4041
Septic Tank Servicers and Sewer Pipe Cleaners	47-4071
Construction and Related Workers, All Other	47-4099
Earth Drillers, Except Oil and Gas	47-5021
Roustabouts, Oil and Gas	47-5071
Heating, Air Conditioning, and Refrigeration Mechanics and Installers	49-9021

List of 51 Green Occupations for Consortium States

Industry	SOC Code
Bicycle Repairers	49-3091
Home Appliance Repairers	49-9031
Riggers	49-9096
Installation, Maintenance, and Repair Workers, All Other	49-9099
Coil Winders, Tapers, and Finishers	51-2021
Structural Metal Fabricators and Fitters	51-2041
Molding, Coremaking, and Casting Machine Setters, Operators, and Tenders, Metal	51-4072
Upholsterers	51-6093
Water and Liquid Waste Treatment Plant and System Operators	51-8031
Plant and System Operators, All Other	51-8099
Separating, Filtering, Clarifying, Precipitating, and Still Machine Setters, Ope	51-9012
Crushing, Grinding, and Polishing Machine Setters, Operators, and Tenders	51-9021
Production Workers, All Other	51-9199
Refuse and Recyclable Material Collectors	53-7081