

# **ARRA Labor Market Dynamics**

## **An Overview of the American Recovery and Reinvestment Act of 2009 as it Pertains to the Wyoming Department of Employment Research & Planning Section and the Rocky Mountain and Northern Plains Consortium**

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## **An Overview of the American Recovery and Reinvestment Act of 2009 as it Pertains to the Wyoming Department of Employment Research & Planning Section and the Rocky Mountain and Northern Plains Consortium**

### **Introduction: Definition and Purpose of Labor Market Information and ARRA Grant of 2009**

Within each state in the U.S., a Labor Market Information (LMI) office exists, although the name and organizational structure varies.

"Labor Market Information (LMI) is an applied science; it is the systematic collection and analysis of data which describes and predicts the relationship between labor demand and supply." (ICESA, 1995, p. 7.)

These offices are tasked with providing information regarding the dynamics of the labor market within each state. One function of this task is to forecast and plan for future labor market demand (e.g. how many registered nurses will be required statewide by 2015?), so as to provide educational institutions in the state lead time for preparing curriculum, etc. While this is true for traditional occupations, it is also important for emerging occupations (e.g. wind energy technician).

Many factors can influence labor markets including (but not limited to) changes in: legislation and regulation; technology; population and demographic characteristics; and relative prices of various market products.

Given the dynamic nature of these markets it is imperative that LMI offices remain informed regarding possible changes in the economic/political landscape that will substantially impact the labor market. Given this directive, the Rocky Mountain and Northern Plains Consortium (Iowa, Montana, Nebraska, South Dakota, Utah, and Wyoming) applied for and was awarded funding provided by the American Recovery and Reinvestment Act (ARRA) of 2009. This funding was provided to examine the impact of employment in energy efficiency, pollution reduction, sustainable management practices, etc. In previous studies these jobs are often labeled "green" jobs. A more detailed definition of these occupations and industries will be discussed in Chapter 1. The American Recovery and Reinvestment Act (ARRA) of 2009 funded a wide array of projects nationwide. Generally, the purpose of ARRA was

to provide “supplemental appropriations for job preservation and creation, infrastructure investment, energy efficiency and science, assistance to the unemployed, and State and local fiscal stabilization.”

Components of the consortium’s study include:

- Chapter 1. A more formal definition of “green” jobs and what definitions have been utilized in previous research.
- Chapter 2. A discussion of new and emerging industries and technologies that would drive the demand for employees, along with a review of state level legislation and the regulatory impacts and changes that would be required to establish and monitor these new industries and technologies.
- Chapter 3. A review of the state level legislation that would impact these new industries and technologies.
- Chapter 4. A review of the regulatory impacts and changes that would be required to establish and monitor these new industries and technologies in Wyoming.
- Chapter 5. A baseline survey, the purpose of which is to determine how many jobs fit this description in each state and the region. This is important because these jobs are relatively new phenomena, and therefore, we need to “find out where we are before we can know where we are heading.” This is in contrast to more traditional employment sectors where researchers have current and past data for these occupations and can therefore forecast what the demand for those occupations will be in the near future. For these relatively new occupations forecasting demand in the future is dependent upon determining baseline levels of employment. Interestingly, the baseline survey (the Wyoming portion only) showed that it wasn’t so much that new occupations were being created as it was the demand for traditional occupations was increasing due to these projects. For example, the establishment of a new wind energy facility would require electricians.
- Chapter 6. Overview of the New Hires Survey, the purpose of which was to determine the occupations and skills of newly hired employees. This study will also track wage progression and retention over time using the administrative databases available to R&P.
- Chapter 7. Text Mining Project. Using the data obtained from the new hires survey, an analysis was conducted using text-mining software. The goal was to identify the prevalent job skills required of newly hired workers in Wyoming. This information could be then be used by

interested parties (e.g. policy makers, educators, etc.) to plan for changes in the characteristics employers are seeking in new employees.

- Chapter 8. Regional Impact Study Using IMPLAN Software. Each state in the consortium was charged with producing an economic impact analysis of an ARRA project in their respective states. Wyoming's analysis examined the impact of retro-fitting non-road diesel construction equipment that provides services to the natural gas fields in Sublette County to reduce pollution emissions. The analysis examined the direct and indirect economic impacts of the project.
- Appendix A. A listing of programs and training that Wyoming educational institutions offer regarding occupations and industries affected by the ARRA grant objectives (as described on page 3-4) and/or changes in the market demand for job skills and training. For example, Laramie County Community College offers an Associate's degree for wind turbine technician; a relatively new occupation. See Appendix D for a table of the available programs as of January 2011.

**A note of caution:** This research provides an overview of some of the conventional and alternative energy technologies currently being employed or that may become economically viable. Current legislation and regulatory rules are also discussed. However, fundamental changes in the economic and social landscape can render this research outdated as soon as the manuscript has been completed. For example, if one were to have published this research prior to March 11, 2011, the general consensus would have been that the U.S. had become somewhat more receptive to the use of nuclear power than had been the case in the 1970s. However, on that date, a natural disasters and subsequent malfunctions at several nuclear power plants occurred in Japan. This development has many around the world reconsidering their stance on nuclear power and/or the safeguards that should be imposed on the industry. While the results from this project may become outdated, the methodology employed will not. The current study's funding expires at the end of May 2011. Circumstances affecting the labor market fluctuate, so ideally research of this nature regarding labor market dynamics should be ongoing.

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## Chapter 1. Definition(s) of “Green” Jobs<sup>1</sup> (prepared October 2010)

What is a “green” job? There is no widely accepted definition. In the September 21, 2010, Federal Register, the Bureau of Labor Statistics published its final definition. That definition is:

Green jobs are either:

- A. Jobs in businesses that produce goods or provide services that benefit the environment or conserve natural resources. Green goods and services fall into one or more of five groups:
  - Category 1. Energy from renewable sources.
  - Category 2. Energy efficiency.
  - Category 3. Pollution reduction and removal, greenhouse gas reduction, and recycling and reuse.
  - Category 4. Natural resources conservation.
  - Category 5. Environmental compliance, education and training, and public awareness.
- B. Jobs in which workers’ duties involve making their establishment’s production processes more environmentally friendly or use fewer natural resources. These technologies and practices fall into one or more of four groups:
  - 1. Energy from renewable sources.
  - 2. Energy efficiency.
  - 3. Pollution reduction and removal, greenhouse gas reduction, and recycling and reuse.
  - 4. Natural resources conservation.

While most studies up until this point use the term “green jobs,” Research & Planning (R&P) took a slightly different approach. A non-scientific survey was conducted regarding the term “green jobs.” The majority of people polled had no idea as to the meaning of the term or had a grossly deviated definition compared to what R&P had in mind. Therefore, an alternate term was chosen for R&P’s surveys. R&P attempted to remove any ambiguity about the meaning. The term *EE jobs* was used; this could stand for “energy efficiency” or “environmentally enhancing.” R&P was careful to provide a detailed definition. As R&P’s analysis was conducted prior to the publication of BLS’s final definition of green job, this definition was based on the previous definition contained in the BLS’s Notice of Solicitation of Comments found in the Federal Register on March 16, 2010. This excerpt from the baseline survey chapter (Chapter 4) presents R&P’s definition:

*Definitions: EE employment, Output vs. Process employment*

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<sup>1</sup> “What is the difference between an occupation and a job? An occupation is a category of jobs that are similar with respect to the work performed and the skills possessed by the incumbents. A job is the specific set of tasks performed by an individual worker. “Turnpike toll collector” is an example of a job that corresponds to the occupation 41-2011 Cashiers.” (Office of Management and Budget, 2010).

Throughout this paper, the term *EE jobs* (or employment) was used to represent the jobs discussed. This term includes more than jobs that enhance energy efficiency. EE jobs include employment in the production/implementation/regulation of:

- Renewable energy and alternative fuels
- Manufacturing, construction, design, research, delivery, operation, storage or maintenance of wind, solar, biomass, hydro, alternative transportation fuels, geothermal, methane and waste incineration as a fuel source
- Energy efficiency and conservation
- Manufacturing, construction, or installation of energy efficient products, energy efficiency services, weatherization, building retrofitting/efficiency, energy efficient production processes, energy distribution improvements, and transportation technology
- Pollution, Waste, and greenhouse gas management; prevention, and reduction
- Activities related to controlling emissions and pollution. Includes controlling and reducing greenhouse gas emissions, waste water, and other pollutants
- Environmental cleanup and restoration and waster cleanup and mitigation
- Environmental restoration including the cleanup and disposal of pollution, waste, and hazardous materials; Superfund/Brownfield redevelopment; and landfill restoration
- Education, regulation, compliance, public awareness, and training and energy trading
- Activities that educate on energy efficiency, renewable energy, energy rating systems certifications, and more efficient energy consumption. Enforcement of compliance requirements and regulations, and training on effective use of energy related products and processes
- Sustainable agriculture and natural resource conservation
- Products and services to conserve, maintain and improve natural resources and environment, including low carbon and organic agriculture, land management, water management and conservation, wetlands restoration and environmental conservation.

The preceding six categories of EE employment are considered as *EE output employment* (i.e., these employees produce or in some way enhance an EE product or service).

There is also another method by which employment could be considered EE employment. This method is called *EE process employment*. This occurs when the firm does not produce an EE product or

service, but the employee(s) provide skills that result in a more energy efficient or environmentally beneficial outcome to the production process. For example, results from the baseline survey (see Chapter 5) found that a large construction contractor listed no EE products. However, the company employed an environmental engineer and a safety and occupational health manager that both provided energy efficiency benefits during the firm's production activities. These two jobs would be considered as EE process jobs.

Defining green jobs is not easy and is often not clear cut. For example, all of the states in the Rocky Mountain and Northern Plains Consortium (Montana, Wyoming, South Dakota, Nebraska and Iowa) employed the definition given above (although some states maintained the use of the term "green jobs"). However, there are still some differences of opinion. Some researchers stipulate for a job to be green, the employee must have a different set of knowledge, skills, and abilities than a person doing a similar job at a different firm. For example, firm 1 produces a green product, while firm 2 does not. Both firms employ an accountant and both accountants have very similar abilities. Does the accountant position at firm 1 (the one that produces a green product) count as a green job or not? According to the BLS definition it would be counted. However, other studies (including Utah and some other consortium studies; Talley, 2011) would not count it as a green job unless the accountant at the green firm had a substantially different set of skills. For the purposes of R&P's study, firms were allowed to decide what employment is "green" and what is not, based on the above definition. Regardless, most published studies have employed a definition roughly analogous to that of the consortium and the BLS final definition. (State of California; see Figure 1). Results may not be directly comparable across previous studies. It is expected that future research will tend to use a more standardized definition now that the BLS definition is available.

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## **Chapter 2. A Review of Alternative Energy and Environmental Enhancement Technologies**

*By Sylvia D. Jones. Prepared December 2010; edits/additions in January - April 2011. This chapter contains excerpts from Research & Planning's Review of Alternative Energy Sources in Wyoming, which can be found online at <http://doe.state.wy.us/LMI/energy.htm> as well as original material.*

Wyoming has long been associated with the development of energy through traditional fossil fuel sources such as oil, natural gas, and coal. Throughout the state's history, this development has brought relatively high-paying jobs, and helped to power an energy-hungry nation.

Oil, gas, and coal likely will continue to be a major factor in the state's economy for the foreseeable future. In addition to existing development methods, new technologies are emerging that allow more of these resources to be brought to the surface and used more cleanly than in the past. Oilfields that have been in use more than 100 years are finding new life, as companies pump carbon dioxide into rock, forcing out oil that was once out of reach. Another example of emerging technology is carbon capture and storage, in which coal-fired power plants capture carbon dioxide before it can be emitted and pump it into the ground.

A national energy strategy will include traditional and new fossil-fuel-based technologies, as well as development of alternative energy sources. As all of these technologies are further refined, new jobs will be created – jobs that are relatively high-paying and cannot be outsourced to other countries.

In 2009, Congress passed the American Recovery and Reinvestment Act (ARRA). One of the main goals of the legislation was the creation of jobs that have an environmental benefit or that reduce energy use. This chapter focuses on some of the alternative energy resources that are being studied and developed.

### *Solar*

Solar energy is clean and completely renewable, but its development for large-scale use presents substantial challenges. The problems are mostly related to the efficiency, or amount of solar energy that can be captured and converted into electricity. In the past this has been too low to allow the technology to replace a substantial portion of fossil fuels. Other issues almost as important are energy storage and delivery. In order for solar to be truly competitive with fossil fueled energy sources, a way must be developed to get the solar energy from where it is collected (in the warm, sunny areas of the world) to where it is needed. However, regardless of the difficulties in using solar energy in large-scale

applications, stand-alone solar is useful on a small scale. For instance, in rural and isolated locations where grid power is unavailable, solar cells offer an excellent source of power.

Cost and Intermittency are major factors limiting the use of photovoltaic cells for generating energy. Except in very specific situations, such as in rural areas where grid electricity is unavailable, solar power is not cost-competitive with fossil fuels. Residential use of solar power has been limited by front-end costs. An average set of rooftop panels is estimated to cost between \$20,000 and \$30,000. It would take 10-15 years to produce enough electricity to pay for itself. In essence, this means that solar power is about three times as expensive as the typical electricity produced by fossil fuels (Goffman, 2008).

The other major disadvantage of solar energy is intermittency. Because the sun does not shine at night and is diminished by overcast skies and storms, solar energy cannot be used for base load electricity. However, solar power is an excellent option for peak demand times. This is because solar energy tends to be most available during working hours. In the middle of the afternoon when the sun is at its peak and solar panels are producing at the optimum, demand and pricing for electricity also peaks (Goffman, 2008).

Although the industry requires significant government subsidies in order to be competitive, advocates argue that fossil fuels have long received government subsidies. The oil and natural gas industries continue to receive tax breaks for exploration, favorable terms for drilling leases on government land, and other incentives. Global governments currently provide about 10 times as much support for the fossil-fuel and nuclear industries as toward all renewable energy industries combined (Goffman, 2008).

Job creation is another argument often extended to justify investment in solar power. Like jobs in other renewable industries, jobs in solar energy cannot be exported. They are located where the systems are located, creating and maintaining jobs in the local economy. In addition, the jobs are relatively high paying, skilled jobs that will help sustain an educated population.

### *Biomass*

Biomass is technically defined as “organic non-fossil material of biological origin constituting a renewable energy source” (Wyoming State Forestry Division, 2007). Basically, it includes any biological material from recently living organisms that can be used as an energy source. Examples include: agricultural residue, animal waste, municipal solid waste, perennial grasses, and forestry products. The most common way of extracting energy from biomass is through burning it, but biomass

may also be used to produce goods such as fibers or chemicals that are then used in energy production or as other activities. For example, livestock waste can be used to extract methane gas, which then can be used as a fuel source.

Biomass is unique in that it the only renewable energy resource that can be converted to liquid transportation fuel (U.S. DOE, 2010a).

According to the Pew Center on Global Climate Change, increased use of renewable fuels such as ethanol provides the best option for reducing greenhouse gas emissions from the transportation sector (Pew Center, 2009). However, to be successful in the marketplace, biomass-derived products must perform as well or better than the fossil-energy-based products. In addition, the cost must be comparable in order for the products to become truly competitive.

In 2004 the Western Governors' Association started the Western Regional Biomass Energy Program, which focuses on increasing the use of bioenergy and bio-based products. From this, the Wyoming Bioenergy Partnership was developed; it aims to expand the production and use of biomass energy sources specifically within Wyoming.

Biomass is capable of supplying a constant and renewable energy supply that can be used without adding additional strain to existing transmission lines. In addition, biomass provides other environmental benefits such as reduced risk of destructive wildfires, reduced consumption of landfill capacity, and air quality benefits due to reduced open burning of agricultural and forest residues.

The Wyoming State Forestry Division in 2007 estimated that the available biomass produced in 2006 would have been enough to support more than half of the Wyoming households with energy for one year.

#### Examples of biomass-related businesses in Wyoming:

A cellulosic ethanol plant using waste wood as a feedstock is in operation near Upton, WY (Deutscher, 2008). The company, KL Process Design, is using proprietary technologies and newly developed enzymes to release fermentable sugars hidden within wood without using environmentally unfriendly acids. It is expected to produce 1.5 million gallons of ethanol annually using the company's unique process. If the demonstration facility is successful at perfecting the process, ethanol may become more economical and therefore more competitive in the marketplace.

In Torrington, Heartland Biocomposites, LLC, is manufacturing fencing materials from local wheat straw (McElroy, 2007). While the material is not used for energy production, it positively affects the environment by making use of agricultural residues that otherwise would go unused.

River Basin Energy, Inc., in Laramie produces torrefied biomass from pine chips (Western Research Institute, 2010). Torrefaction, which is a roasting technique, is used to improve the biomass fuel properties such as grindability, energy density, and dryness. The product is hoped to minimize the up-front costs associated with using biomass.

### *Geothermal*

Geothermal energy is extracted from heat stored in the earth. This geothermal energy originates from both radioactive decay of minerals that make up the Earth itself and from solar energy absorbed at the surface. Geothermal power is relatively clean, cost-effective, reliable, and sustainable. However, until recently it was limited to areas near tectonic plate boundaries. Recent technological advances have increased access to viable resources, especially for applications such as home heating. The Earth's geothermal resources are more than capable of supplying energy for the nations of the world but as of yet only a very small fraction may be profitably utilized (Goffman, 2009). Unfortunately, most geothermal resources are currently not recoverable. This fact may change as technology advances. Because geothermal wells release significantly fewer greenhouse gases than fossil fuels, geothermal power has the potential to help mitigate the effects of climate change. Currently, geothermal power is online in more than 20 countries (Goffman, 2009).

There are two basic forms of geothermal energy use – one for electrical generation and one for home heating and cooling. Electrical generation requires a geothermal resource located close to the Earth's surface. These resources are typically found on the edges of tectonic plates like the hot spots that form a ring around Yellowstone National Park. The most common direct use of geothermal energy is for heating buildings through district heating systems, which pipe hot water near the Earth's surface directly into buildings for heat.

Currently, geothermal power is only a small portion of the nation's renewable energy portfolio. As of 2009, geothermal power accounted for 5 percent of renewable power generation (U.S. DOE, 2010b).

ARRA has committed up to \$350 million in funding for geothermal energy research. In addition to power generation, it provides significant investment for the deployment of ground-source heat pumps, up to \$50 million, which can be used to make buildings more energy efficient. The Western

Governors' Association expects the creation of 10,000 jobs if planned projects proceed as expected (Federal Interagency Geothermal Activities, 2010).

### *Wind*

Wind turbines, like aircraft propeller blades, turn in the moving air and power an electric generator that supplies an electric current. Modern wind turbines are of the horizontal-axis variety, like the traditional farm windmills used for pumping water. Wind turbines are often grouped together into a single power plant, also known as a wind farm and generate bulk electric power.

Wind energy is unlimited in supply. Wind turbines do not use combustion to generate electricity, and therefore do not produce air emissions or greenhouse gases. No water is used in the generation of electricity and the only potentially toxic or hazardous materials are the small amounts of lubricating oils and hydraulic and insulating fluids. Therefore, contamination of soils or groundwater is highly unlikely.

The major challenge to using wind as a source of power is that it is intermittent and does not always blow when electricity is needed. Wind cannot be stored and not all winds can be harnessed to meet the timing of electricity demands. Further, good wind sites are often located in remote locations far from areas of electric power demand. Wind resource development may compete with other land uses and those uses may be more highly valued than electricity generation.

In addition to environmental benefits, wind projects have many economic benefits to the area in which they are located. Projects generate ad valorem/property taxes for the county and other taxing jurisdictions in which facilities are located. The local businesses in the community realize economic benefits in the form of sales revenues for businesses and sales, and use and lodging taxes for businesses serving construction crews and the operating work force following construction. Anticipated scale and multi-year construction programs for the project may encourage out-of-state employment that may establish residency in the area. Additionally, the scale of the project could provide the basis for other local job training and other wind power related education opportunities. Completion of the project is likely to be tied to investments in transmission line capacity in the surrounding area. The construction and subsequent operation of the transmission lines would also result in ad valorem taxes, sales taxes, and use and lodging tax revenues within the region. In addition lease payments are made to surface land owners that are likely to be fed back into the local community as well.

Jobs associated with wind energy may include such job titles as wind generator installer, wind technician, project manager, wind power project engineer, wind farm estimator, wind resource analyst, renewable energy communication specialist, site manager of wind farms, and wind turbine sales manager. Laramie County Community College currently offers a wind turbine technician training program which trains individuals to do general maintenance, operations and inspections on wind turbines and related facilities. The program results in an associate's of science degree in wind energy.

Today, Wyoming has wind power plants in many locations throughout the state. The most recent data available show that wind power in Wyoming generated approximately 2.4 million megawatt-hours in the first 10 months of 2010 (U.S. DOE, 2011). That's roughly enough to supply the electricity use for 216,000 average homes in the United States for a year. (U.S. DOE, n.d.).

### *Smart Grid*

The power grid in the United States is over a century old and consists of more than 9,200 electrical generating units with more than 1 million megawatts of generating capacity connected to more than 300,000 miles of transmission lines, according to the U.S. Department of Energy (U.S. DOE, 2008). The system is complex and involves regional power plants connected with high-voltage transmission lines to load centers, where the power is then directed over lower-voltage distribution lines to houses and businesses.

Despite all the time and finances invested in cleaner energy alternatives, the fact remains that the fastest and cheapest way to cut emissions is to use less energy. According to some sources, improving the efficiency of the national electricity grid by 5% would reduce overall energy consumption reducing the associated carbon emissions the equivalent of 53 million cars (U.S. DOE, 2008). Because of the vast potential for environmental impact, President Obama made modernizing the nation's power network a priority when establishing the goals of the economic stimulus. Without modernization of the grid, the use of low-carbon energy sources such as wind and solar are not as efficient as they could be. The plan for modernization calls for the installation of thousands of miles of new transmission lines necessary to carrying renewable energy from the power source to the population centers where the energy is needed. It also calls for about 40 billion smart electric meters, which would be used to help consumers reduce their energy consumption, to be installed in homes (Davidson, 2009). These savings could lead to increased competitiveness for U.S. businesses in the global marketplace, as well as lower prices for U.S. goods and increased job creation.

Another benefit of a modernized grid is improved resistance to organized attacks and an improved ability to withstand natural disasters. In 2005, approximately 1.7 million people lost power due to Hurricane Katrina, and many of those were not in the New Orleans area (NOAA, 2005). With a more modern system, damage to the grid from hurricanes, floods, or other catastrophic events could more easily be localized, with power re-routed more effectively.

If implemented properly, the smart grid has the potential to positively affect both the environment and economy. It has the ability to improve the efficiency of delivering existing electricity generation capacity, for example from conventional fossil fuel sources, and also enhance the incorporation of decentralized energy sources such as that generated from renewable power sources. Both achievements would help reduce fossil fuel energy use and carbon emissions. Such an investment would create jobs in engineering, construction, and computer fields and have indirect effects on manufacturing and component assembling employment.

Smart-grid investments are already under way in Wyoming: Two electric utilities in the state were selected to receive federal grants to aid in modernizing their infrastructure. Cheyenne Light, Fuel, and Power received about \$5 million to update its communication system and install 38,000 smart meters in the homes of its residential customers. Sundance-based Powder River Energy received about \$2.5 million to install automatic readers on its power substations and in customers' homes (Pelzer, 2009).

### *Carbon Capture and Sequestration*

In 2008, energy-related emissions dominated total greenhouse gas (GHG) emissions. Greenhouse gases include carbon dioxide (CO<sub>2</sub>), methane, nitrous oxide, and other global warming potential (GWP) gases. After petroleum (41.9 %), coal produces the most carbon dioxide (36.5%) of any source (U.S. DOE, 2009). As of 2009, the United States produces more energy from coal than any other single source (U.S. DOE, 2010c). Wyoming produces more coal than any other state (EIA, 2010d). Because of this, any policies, legislation, or market factors that influence the demand for coal will also affect the Wyoming labor market. There is some disagreement as to whether or not anthropogenic GHG emissions (emissions caused by mankind's activities) have an effect on climate change. Regardless, several bills have been introduced at the federal level addressing constraints on GHG emissions although none have become law. Some states have taken action and have implemented long-term plans, such as California. They have implemented strategies with a goal toward a reduction in GHG emissions by nearly 20% by 2020 (CARB, 2008).



The lack of a national energy policy is causing uncertainty among investors in coal-fired power plants (Bleizeffer, 2010). The uncertainty stems from not knowing what policies, if any, will be enacted, and what the repercussions would be. Therefore, “that uncertainty compels investors and utilities to hang on to capital, and it's the reason that some 87 gigawatts of proposed coal-based power generation has been canceled in recent years” (Bleizeffer, 2010)

One technology that would greatly affect Wyoming's economy if implemented would be the capture and subsequent sequestration of carbon dioxide. The basic idea behind carbon capture sequestration is to sequester carbon in underground geologic formations or in biomass (trees, grasses, etc.) and the soils in which they grow. In Wyoming, geologic sequestration is the most likely scenario. Wyoming has been pinpointed as having substantial storage space (DOE, 2010e) and much of the legislation needed to address liability and property rights issues has been addressed (Nobel, 2010).

From the article in the Cowboy Free Press, “Carbon Capture Law Could Be Big Boost to Wyo,” Dr. Mark Northam, Director of the University of Wyoming School of Energy Resources had several quotes regarding carbon capture sequestration technology use in Wyoming including: “With the funding we have from the state and the Department of Energy we are preparing for a large-scale injection for 3 million tons of carbon dioxide in the Rock Springs Up-lift. We have a couple of years to do this large-scale demonstration.” Also, “Carbon capture and storage is so expensive that the only way it becomes economically viable is if there is an economic incentive to pollute less. If a global price, or tax or a cap or some sort of value is placed on the carbon we emit then it will justify the massive investment.” (Noble, 2010).

The overall impact of legislation that would require carbon capture sequestration on Wyoming's economy is unclear. On one hand, it would put the use of coal for power generation at a disadvantage compared to less carbon-emission intensive fuels (e.g. natural gas, nuclear, solar, and wind), thereby reducing the demand for coal. On the other hand, if carbon capture sequestration is undertaken at a commercial scale in Wyoming, this would produce jobs as would the need for construction of additional pipeline capacity to transport the CO<sub>2</sub>. Additionally, for consumers, this would increase the utility rates for electricity, which would most likely be looked upon unfavorably.

### *First Generation Biofuels and Beyond*

First generation biofuels are alternative fuels such as corn-based ethanol production and fats and oils-based production of biodiesel. The production of ethanol is a contentious issue to say the least. Those with an interest in alternative fuel technologies will find many examples of this in scientific literature,

popular press articles and Internet discussion groups. Biodiesel is less contentious by comparison. However, one of the main issues raised with both first generation ethanol and biodiesel production is that agricultural crops are being switched from food production to fuel production. Many find this unacceptable as it can lead to higher food prices. An additional issue raised with first generation ethanol production is that it exhibits a net energy ratio of somewhere around 1 (depending on the analysis examined). This means that the energy used to grow and harvest corn and then produce ethanol from it is almost equal to the energy contained in the resultant ethanol. Second-generation biofuels would use feedstocks that do not compete with food production. Two examples of second-generation biofuels are the attempt to convert cellulosic material (e.g. crop residue, perennial grasses, or wood processing waste) to ethanol or the conversion of algal-derived oils to biodiesel.

### *Near-Term Feasibility of Alternative Energy Projects*

It should be noted that the alternative energy technologies discussed in this paper tend to fall into two categories: those that are currently being used commercially (e.g. solar, wind, etc.) and those that may be commercially viable in the near future (e.g. biomass, geothermal, etc.). That is not to say that geothermal heat/energy production is not used commercially. It is not currently being used on a wide scale in the U.S. For in-depth review of current and emerging technologies see “Researching the Green Economy” prepared for the consortium by the Montana Manufacturing Extension Center (MMEC, 2011).

### *Externalities and the cost of energy generation*

Much of the discussion regarding which (and to what extent) alternative energy sources will supplement and/or replace conventional methods of energy production focuses on the issue of cost. Table 1 indicates the cost of energy generation from various technologies for plants entering service in 2016 (U.S. DOE, 2010f). However, these estimates are derived using estimates of fixed and variable operation and maintenance expenses. Therefore they do include the full cost of energy generation. The impacts of pollution caused by energy generation are not taken into account (e.g. increased incidence of respiratory illnesses). Thus, an *externality* exists, a cost not accounted for in the price of the commodity. Ideally, the full cost of producing a good is accounted for in the market price of that good. When it is not, a *market failure* exists. A study titled, “Hidden Costs of Energy Production and Use” conducted by the National Academy of Sciences found that external damages averaged \$32 per megawatt-hour (mwh) in 2005 from coal-fired plants and \$1.6 per mwh from natural gas plants (NAS, 2009). The study did not estimate damages from nuclear or renewable energy generation. It should be noted that all of these technologies have some external costs associated with them. For example, wind

turbines may have an impact on wildlife habitat and the production of solar panels emits pollution. The idea of externalities is mentioned to remind the reader that the cost of power generation may contains elements that are not included in the market price.

Table 1. Estimated Levelized Cost of New Generation Resources, 2016. From the EIA Annual Energy Outlook 2011.

Plant Type	U.S. Average Levelized Costs (2009 \$/megawatthour) for Plants Entering Service in 2016					
	Capacity Factor (%)	Levelized Capital Cost	Fixed O&M	Variable O&M (including fuel)	Transmission Investment	Total System Levelized Cost
Conventional Coal	85	65.3	3.9	24.3	1.2	94.8
Advanced Coal	85	74.6	7.9	25.7	1.2	109.4
Advanced Coal with CCS	85	92.7	9.2	33.1	1.2	136.2
Natural Gas-fired						
Conventional Combined Cycle	87	17.5	1.9	45.6	1.2	66.1
Advanced Combined Cycle	87	17.9	1.9	42.1	1.2	63.1
Advanced CC with CCS	87	34.6	3.9	49.6	1.2	89.3
Conventional Combustion Turbine	30	45.8	3.7	71.5	3.5	124.5
Advanced Combustion Turbine	30	31.6	5.5	62.9	3.5	103.5
Advanced Nuclear	90	90.1	11.1	11.7	1	113.9
Wind	34	83.9	9.6	0	3.5	97
Wind – Offshore	34	209.3	28.1	0	5.9	243.2
Solar PV1	25	194.6	12.1	0	4	210.7
Solar Thermal	18	259.4	46.6	0	5.8	311.8
Geothermal	92	79.3	11.9	9.5	1	101.7
Biomass	83	55.3	13.7	42.3	1.3	112.5
Hydro	52	74.5	3.8	6.3	1.9	86.4

[http://www.eia.doe.gov/oiaf/aeo/electricity\\_generation.html](http://www.eia.doe.gov/oiaf/aeo/electricity_generation.html)

Forthcoming Alternative Energy or Environmental Remediation Projects in Wyoming:

### **Waste-to-Energy**

A 35 megawatt waste-to-energy plant is scheduled to go online in 2012. Company representatives said the plant will run off a combination of garbage from area communities, as well as agricultural waste. The plant should employ about 70 people. (Lacock, 2010)

### **Manufacturing of Wind Power Equipment**

In mid-February 2011, Wyoming Gov. Matt Mead announced that Gestamp Worthington Wind Steel ,LLC, will build a new wind tower manufacturing plant in Cheyenne. It is expected to manufacture more than 300 commercial wind towers a year and is expected to create 150 jobs. In addition to the

direct job creation, this will be a boost for Wyoming and the U.S. economy in that the growing wind power industry will have a major domestic supplier of required equipment (Curran, 2011).

### **Wastewater Remediation**

R360 Environmental Solutions Inc. has purchased the only oilfield wastewater facility in Southeastern Wyoming. The company intends to expand the capacity of the facility tenfold. The expanded facility will include recycling and disposal services for all exploration and production (E&P) waste streams. This is the company's fourth facility in Wyoming, and its 20<sup>th</sup> E&P waste management facility (Business Report Staff, 2011).

*Further Reading: Montana Manufacturing Extension Center's "Researching the Green Economy"*

For a more detailed analysis of the technologies discussed in this chapter (and some technologies that have not been addressed), please see the Montana Manufacturing Extension Center's final report titled "Researching the Green Economy." As an example of other technologies identified in this report, the following is an excerpt regarding *hybrid nuclear technology*:

"America possesses hundreds of years of low-cost coal resources that are becoming increasingly unpopular due to climate-change concerns. The high cost of conventional nuclear power greatly hampers the building of new such facilities, while the promise of the nuclear gas reactor also remains out-of-reach as a result of technical and competitiveness shortfalls.

An emerging hybrid-nuclear technology is a breakthrough energy solution that allows the US to utilize our most abundant resource, coal, while dramatically reducing air pollution as well as greenhouse gas emissions without resorting to problematic CO<sub>2</sub> sequestration. The hybrid is a significant efficiency improvement ideally suited for operation in high-altitude mountainous regions. The technology also handily supports intermittent wind and solar resources.

The hybrid is based on the integration of the existing, well-proven technologies of the combustion turbine, combined-cycle power plant and coal gasification as well as the maturing helium gas reactor being developed by the Department of Energy. The absolutely fail-safe nuclear reactor cannot melt and the hybrid is significantly safer than the current generation of nuclear power plants.

A strategic goal of the technology is to replace our existing fleet of coal plants with dramatically more efficient hybrid-nuclear/coal units while simultaneously appreciably extending the life of economically recoverable coal (and natural gas) reserves. Hybrid-nuclear energy also supports coal-to-liquids production of transportation fuels.

The components used by the hybrid technology can be readily manufactured in the US using our existing industrial base. The hybrid also seamlessly merges with our existing coal production and transportation infrastructures.

Deployment of hybrid-nuclear facilities can save thousands of jobs within the five states of the consortium while tens of thousands of new US jobs can be created by manufacturing, building and operating hybrid energy production facilities that are fueled by US resources.

The economic and environmental potential of hybrid-nuclear energy is dramatic for the US as a whole and the Consortium States in particular. Coal production can remain a major revenue source, electrical power can remain a reasonably priced commodity with greenhouse gas emissions dramatically reduced, and the otherwise inevitable massive job losses caused by phasing out the use of coal can be avoided.”

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### Chapter 3. State Level Legislation Regarding Energy Efficient Technologies

*(prepared January 2011 by Sara Saulcy, introduction by Patrick Manning)*

The previous chapter reviewed some of the alternative energy and environmental enhancement technologies currently available or in the design or pilot program stage. For these technologies to be introduced or expanded in an efficient and socially-responsible manner, the appropriate legislation must be in place to ensure they are implemented smoothly. For example, wind power generation in Wyoming has expanded greatly in recent years. If this is to continue, property rights must be established and maintained, siting requirements must be created and enforced, and habitat for protected species (e.g. sage grouse) must be maintained. The following sections discuss some of the legislation in Wyoming that will affect the implementation of these technologies.

In some areas, Wyoming may lag behind states such as California and Washington in the implementation of renewable energy and pollution abatement initiatives. However, Wyoming has been proactive in addressing some of the issues regarding carbon capture and sequestration and wind energy production in the state. For example, legislation from the 2008 session (Chapter 30 – Carbon Capture and Sequestration) authorizes surface or mineral owners to develop geologic sequestration sites provided that they protect against carbon dioxide escaping. The act also outlines geologic sequestration permit requirements. (<http://legisweb.state.wy.us/2008/SessionLaws2008.pdf>) p.48-52.

Chapter 52 from the 2010 session requires the Wyoming Department of Environmental Quality (DEQ) to adopt rules and regulations requiring bonding and financial assurances for geologic sequestration site permit holders. (<http://legisweb.state.wy.us/2010/Session%20Laws.pdf>) p.242-245). Regarding wind power generation, the construction of wind farms has sometimes led to conflicts regarding property rights issues. Chapter 47 from the 2010 Session expands the Industrial Siting Council's (ISC) authority to regulate wind farms with 30 or more towers (and to other energy facilities to which produce 160,000 volts or more). Thus a permitting process is required to assess potential environmental impacts and impacts on local employment (<http://legisweb.state.wy.us/2010/Session%20Laws.pdf> p.221-231). Chapter 97 - (County Regulation of Wind Energy Development) requires that a wind facility of 0.5 megawatts or greater be required to apply for a permit in a given county. Permit applications are to include information on waste management plans, emergency management plans, sufficient proof of legal access to the site, and project plans. The act also requires the ISC to adopt rules regarding the decommissioning and reclamation of wind energy facilities (<http://legisweb.state.wy.us/2010/Session%20Laws.pdf> p.498-508).

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## **Chapter 4. Legislation and Regulatory Landscape Regarding EE Technologies**

### Impacts on the Regulatory Environment (prepared November 2010 by Sylvia Jones)

The development of any of the previously discussed technologies and industries (Chapter 2), along with the legislation required to administer it (Chapter 3) will have a direct impact on the regulatory landscape. In Wyoming, the agency most affected by these changes is the Department of Environmental Quality (DEQ). In fact, several legislative measures that have been approved in Wyoming specifically include funding for reclassification and/or addition of positions to accomplish the regulatory tasks necessary. For example, from the 2010 legislative session, the act titled, “Carbon Sequestration-Financial Assurances and Regulation” authorizes the DEQ to reclassify a vacant computer technology support position to a principal accountant position “to assist the department in fulfilling its rulemaking duties relating to financial assurances pursuant to this act” (Ch 52, p. 245).

R&P conducted interviews with employees of the DEQ starting in September 2010 to gather information regarding changes they know will or perceive may happen due to the introduction (or expansion) of these new industries and technologies. Other states in the consortium also conducted interviews with their respective regulatory agencies. By doing so, R&P hopes to be able to better project employment based on regulatory change rather than relying solely on what happened during the past. We recognize that what we currently know about any particular industry may become obsolete very quickly because of rapid change in regulation, change in monitoring technology, and the introduction of new "green" technologies.

#### *Background Information on DEQ*

The Wyoming Department of Environmental Quality mission statement is: “To protect, conserve and enhance the quality of Wyoming’s environment for the benefit of current and future generations” (<http://deq.state.wy.us/mission.htm>). In general, the agency employs 268 individuals who collectively work to minimize environmental pollution while enabling responsible economic development within the state. There are six departments within DEQ, irrespective of administration, each charged with a separate specialty of oversight. They include: Air Quality, Water Quality, Land Quality, Industrial Siting, Solid Waste Management, and Abandoned Mine Reclamation. As a whole, DEQ serves approximately 5,000 businesses annually, approximately 20% of all business in Wyoming (Brennan, 2010) and over 30,000 individual facilities throughout the state. The department operated with a budget last biennium (2008-2010) of \$140 million, of which \$39 million came from the General Fund.

#### Air Quality

The purpose of the Air Quality program is to protect the public health and welfare from the harmful effects of air pollution. It works to ensure compliance with state and national ambient air quality standards and compliance with other requirements of the federal Clean Air Act in an effort to conserve and enhance the air resources of the state for public, agricultural, industrial, recreational, and other beneficial uses. Major program activities include:

Conducts permit reviews for all new emission sources or modifications of existing emission sources, to ensure that the source is built with Best Available Control Technology (BACT) to limit emissions to the lowest technically and economically achievable level to minimize impact to Wyoming's air resource.

Implements Wyoming's operating permit program, mandated by the Clean Air Act Amendments of 1990, to permit continued operation of major emission sources through development of state and federally enforceable permits that incorporate all state and federal regulatory requirements. These permits are issued for a term of five years and must be renewed and updated to incorporate current regulatory requirements.

Insures that permittees construct and operate their facilities in accordance with the requirements of their permits and all other applicable regulations through file reviews and on-site inspections. This activity is also involved in the resolution of issues related to citizen concerns about proper operation of those facilities.

Maintaining an inventory of actual and allowable air emissions from all air pollution sources in the state (used in air modeling for major permits), installing and operating ambient air quality monitoring systems to evaluate the quality of Wyoming's ambient air (that to which the general public is exposed), and working with federal land managers, industry and others to develop strategies to mitigate air pollution impacts from new and expanded energy projects.

The workload of the Air Quality Division has increased during recent years despite the recent economic downturn and is expected to continue to increase throughout the foreseeable future. Permit issuance is likely to increase due to natural gas facility development, and because most permits are issued for only five years at a time. At the end of the five-year period, permittees are required to reapply for permits and are required to address any new compliance monitoring requirements currently in place.

The Air Quality Division's compliance workload is expected to increase similarly. At the end of Fiscal Year 2009 there were more than 22,000 sources of air pollution in the state, many of which were subject to periodic testing and reporting of emission totals and other requirements. This process includes more than 300 physical inspections per year.

The division's planning workload is also expected to increase as large energy projects continue to be proposed. For example, Las Vegas-based American Renewable Energy Associates has proposed a power plant to be built in Wheatland that would run on a combination of garbage from area communities as well as agricultural wastes (Lacock, 2010). The plant is slated to begin construction sometime during 2011 and is expected to start accepting trash and agricultural waste by August. While the company claims the process is "a totally enclosed, clean process," the Air Quality Division will be involved throughout the project. It will provide oversight in the form of air emissions testing to ensure that the burning process does not pollute the ambient air.

In addition to the division's standard practice, it is also required to address unique air quality issues as they arise. For example, the Upper Green River Basin has elevated wintertime ambient ozone levels. The Air Quality Division is working to develop strategies to solve the problem and meet Clean Air Act requirements.

Furthermore, the Division is involved, in coordination with the Department of Transportation, with metropolitan planning organizations in an effort to establish transportation improvement plans (DEQ, 2010). The plans are aimed at increasing the efficiency of transportation routes so as to decrease the resulting air pollution.

### Water Quality

The purpose of the Water Quality program is to protect and restore the quality of Wyoming's surface water and groundwater resources so that they are available for existing and potential designated uses. It works to prevent water pollution in compliance with the Clean Water Act. It also helps fund the Groundwater Pollution Control Program and the Underground Injection Control program under the Safe Drinking Water Act.

The Division of Water Quality is able to attain these goals by engaging in the following activities:

- Permitting discharges and enforcement activities are the primary mechanisms for protecting surface and groundwater from pollution.

- Permitting the construction of public water distribution systems and treatment plants, and wastewater collection systems and treatment plants protects the public health and safety and the environment.
- Operator certification assures the technical competence of operators of public water supply systems and municipal wastewater systems.
- The Community Support Branch provides assistance to owners and operators of public water supply systems with an evaluation of their ability to meet the technical, managerial and financial requirements of these systems. This sections also manages the State Revolving Fund programs for the construction and upgrading of sewer and water systems.
- Subdivision application reviews result in recommendations to County Commissioners as to the safety and adequacy of proposed sewer and water systems for subdivisions.
- The Non-point Source Program provides matching grants to individuals, organizations, and local and state government agencies for education, technical assistance, and voluntary implementation of management practices to prevent and reduce water impacts from non point sources of pollution.
- The Water Quality Laboratory provides analytical support to the surface and groundwater permitting and enforcement programs and to the watershed ambient water quality monitoring program.

In 2010, the State of Wyoming started requiring drillers to list the ingredients of hydraulic fracturing fluids with their drill permit applications (Farquhar, 2010). Hydraulic fracturing, also known as *fracking*, is a technique used by the oil and gas industry, to either enhance or initiate the flow of oil and gas from rock formations. Using a combination of water, silica sand and chemicals, fracking fluid is pumped under high pressure into rock formations, causing the rock to fracture. The fractures are kept open with the particles of silica and sand, allowing oil and gas to emerge from tight, rock-like sandstones and shales. Some companies want to keep the specific ingredients a proprietary secret; however, because of the potential for the fracking fluids leaching into groundwater, the ingredients are required to be given to the Division of Water Quality.

The division is also involved in the new water reclamation facility in Wyoming's Red Desert. The facility aims to make water produced from oil and gas drilling reusable (Casper Star-Tribune, 2010). The plant plans to accept and treat about 20,000 barrels of produced water daily, from Oil and Gas operators within a 100-mile radius of the facility. Company officials said the reclamation plant will render the water clean enough for agricultural use. The process involves the use of chemical-free, low-

cost technology to clean large quantities of produced water to meet Environmental Protection Agency and Wyoming Department of Environmental Quality regulatory standards. Officials said the company plans to add additional facilities in Wyoming over the next 18 months. This places an additional burden on the Division of Water Quality to monitor the plans for the new facilities as well as monitor the output of the facilities for compliance.

The Water Quality Division also is inherently involved in carbon sequestration legislation. Wyoming leadership has recognized the potential of carbon sequestration to continue the state's dominance of carbon based resources (Carbon Sequestration Working Group, 2009). The workgroup appointed to investigate the feasibility of carbon sequestration in the state identified four phases: site characterization and permitting; operations including injection, monitoring and closure tasks; post-closure including monitoring until plume stabilization is confirmed; and long-term stewardship after bond release and permit termination, where the sequestration site still requires periodic monitoring to confirm it remains stable over an indefinite period of time. Because one of the key risks associated with the technology is contamination of underground sources of water, the Water Quality Division is required in the oversight process. Together with the Oil and Gas Conservation Commission, the division regulates all carbon sequestration projects in the state.

### Land Quality

The purpose of the Division of Land Quality is to ensure that mining and exploration for solid minerals is conducted in a manner that protects the public and the environment from harmful impacts. The program also ensures the land after mining is reclaimed to a condition that is equal to or better than it was prior to mining. The major program activities are as follows:

Issue permits for mining and exploration including reclamation, monitoring, and bonding to ensure reclamation of the mine in the event of operator failure.

Inspect all mining activities in the state to ensure compliance with the regulations and permit standards and to assist operators in achieving compliance.

### Solid and Hazardous Waste

The division regulates the storage, treatment, and disposal of municipal solid and hazardous waste to ensure that the activities cause no harm to people or the environment. In addition, the division operates both voluntary and non-voluntary remediation programs to oversee the cleanup of contaminated sites to ensure that future uses do not expose people to toxic conditions and to ensure that any harm to the environment is mitigated. The division also administers a program to regulate petroleum product or

hazardous substance storage tanks. It also works to remediate these sites at the state's expense should the facilities experience a release of a regulated substance.

### Abandoned Mine Reclamation

The purpose of the Abandoned Mine Land program is to eliminate health and safety hazards associated with abandoned mines and to mitigate impacts from coal and mineral mining through construction contracts for the reclamation of abandoned mine sites. To date, the program has reclaimed or contracted for reclamation over 900 abandoned mine sites, to include a total of more than 35,000 acres. More than 1,400 property owners, including several federal land management agencies, have benefited from the reclamation activities. In addition, the program has provided financial assistance to many mining-impacted Wyoming communities to mitigate health and safety concerns and to 35 different research projects aimed at improving the efficacy and efficiency of mine lands reclamation efforts.

### *Results from the Interview Process*

#### Identify and Quantify Skill and Competency Requirements

In addition to gaining knowledge of the DEQ's role in the regulatory environment, another objective of this research was to elicit responses from DEQ managers regarding the educational requirements, skills, and training necessary for workers in the regulatory environment. In general, the managers felt that finding applicants with the necessary educational requirements is not difficult; finding educated applicants with experience is far more challenging. In terms of necessary occupations, engineering was by far the most commonly mentioned. Some divisions felt strongly that the professional engineer certification was important for success while others felt it was of little importance. Geologists and groundwater scientists (e.g. groundwater hydrologist, groundwater modeler, and hydro chemist) were also mentioned frequently. Other disciplines mentioned include:

- Natural sciences: biology, botany, chemistry, soil science wildlife management, etc.
- Social Sciences: specifically statistics and archaeology
- Technical occupations: service technicians, wastewater plant operators, landfill operators.

In terms of the skills necessary for successful employment, all those interviewed mentioned oral and written communication is a necessary skill. Grant writing and contract writing were two specific forms of writing mentioned. Other than speaking and writing, other basic skills recited by DEQ managers included "reading comprehension," "critical thinking," "mathematics," "monitoring," and "science." "Reading comprehension," "critical thinking," "mathematics," and "science" were mentioned



specifically by name while “monitoring” was inferred from activities such as “comparing what you see to a checklist of what you should see.” Time management and project management were two resource management skills mentioned specifically. Social skills such as: coordination, instructing, negotiation, persuasion, service orientation, and social perceptiveness were mentioned by interviewees as important either directly or indirectly.

*Establish a Listing of Renewable Energy Businesses and Related Employment*

Based on DEQ rules and interviews, a list of regulated industries has been compiled. The list classified by North American Industrial Classification System (NAICS) code is shown in Table 1.

**Table 1: Regulated Industries by NAICS Code, as Referenced on DEQ Rules and Interviews****Air Quality Division**

<b>NAICS Code</b>	<b>Industry</b>
211111	Gas Processing Installations
213111	Drilling Oil and Gas Wells
213112	Support Activities for Oil and Gas Operations
213113	Support Activities for Coal Mining
221110	Electric Power Generation
221210	Natural Gas Distribution
311313	Beet Sugar Manufacturing
324110	Petroleum Refineries
325110	Petrochemical Manufacturing
424690	Chemical Wholesalers
424710	Petroleum Bulk Stations and Terminals
562910	Remediation Services
622000	Hospitals
921140	Metropolitan Planning Organizations
	Overlap with DOT

**Solid Waste Management — Hazardous Waste**

<b>NAICS Code</b>	<b>Industry</b>
211110	Oil and Gas Extraction
213112	Support Activities for Oil and Gas Operations
213113	Support Activities for Coal Mining
321114	Wood Preservation
324110	Petroleum Refining
324121	Asphalt Paving Mixture and Block Manufacturing
327320	Ready-mix Concrete Manufacturing
424710	Petroleum Storage Facilities (Underground)
484230	Specialized Freight Trucking, Long Distance
	Overlap with DOT
562112	Hazardous Waste Collection
562211	Hazardous Waste Treatment and Disposal
562212	Solid Waste Landfill
562910	Remediation Services

**Water Quality**

<b>NAICS Code</b>	<b>Industry</b>
112111	Beef Cattle Ranching and Farming
112210	Hog and Pig Farming
213111	Drilling Oil and Gas Wells
221320	Sewage Treatment Facilities
237110	Water and Sewer System Construction
311313	Beet Sugar Manufacturing
562991	Septic Tank and Related Services

Land Quality	
NAICS Code	Industry
112111	Beef Cattle Ranching and Farming
112210	Hog and Pig Farming
213111	Drilling Oil and Gas Wells
221320	Sewage Treatment Facilities
237110	Water and Sewer System Construction
311313	Sugar Beet Manufacturing
562991	Septic Tank and Related Services
Miscellaneous	
NAICS Code	Industry
212325	Clay and Ceramic and Refractory Minerals Mining, Bentonite
212391	Coal Mining, Potash, Soda, Borate Mineral Mining, Trona
237110	Geothermal Plants
324121	Asphalt Paving Mixture and Block Manufacturing
541380	Testing Laboratories
541620	Environmental Consulting Services
921140	Executive & Legislative Offices, Combined

### Anticipate Industry Growth

Industry projections for labor market use are typically produced using a base period of time (typically 10 years) to establish a trend line. They are useful for estimating employment change in a static environment but are less useful during times of dramatic economic change. They are unable, for instance, to predict significant economic downturns, or conversely, major regulatory changes that would increase employment requirements. Long-term industry and occupational projections are produced every two years by the Wyoming Department of Employment, Research & Planning (R&P) section (see <http://doe.state.wy.us/LMI/projections.htm>).

Information that affects industry employment projections includes an increased or decreased demand for the industry's product or service, a change in governmental involvement (regulation), and turnover. Traditional projections attempt to estimate changing demand.

### *Employee Turnover*

An important issue that was discussed with those interviewed was worker turnover. Each manager stated that when the economy is in a downturn, he or she has very few job openings because there are fewer opportunities available elsewhere. Furthermore, when openings do occur, they are easily filled (e.g. underemployed engineers and geologists). Conversely, a growing economy creates difficulty in

hiring and retaining qualified individuals in DEQ. This is due largely to the higher salary levels in private industry compared to what a state agency can pay for the same occupation/skill level.

An impending issue that confronts the agency is that 28.3% of DEQ's workforce is eligible to retire within 10 years (or are age 55 or older). Thus, succession planning appears to be an important concern. However, the managers interviewed stated that with a substantial workload currently, succession planning has not been addressed.

### Recognize Technological Applications Affecting Labor Requirements Unique to the Regulatory Environment

In general, those interviewed expected little change in labor requirements because of technological changes. Most stated there are few areas in their jobs that could be automated or altered by technology. For instance, one manager stated, "It is tough to automate much. You can't send robots out to do inspections." However, some mentioned changing technology in the areas they regulate and most mentioned changing legislation that would eventually affect staffing requirements. For instance, many of the oilfields in Wyoming were issued permits many years ago under a different, more lax set of regulations. In order to renew their permits, the oilfields are expected to comply with the new set of regulations. In addition to significant work on the part of the firm seeking the permit (attainability analysis, biological studies, etc), the change places additional workload on the DEQ staff who now have to review the vast amount of permitting information.

New technologies have the potential to increase or decrease the regulatory load. For example, in some industries the push to automate as many monitoring systems as possible may decrease the workload for DEQ staff. In contrast, the implementation of carbon sequestration and storage would require oversight by the Water Quality Division because of the risk of groundwater contamination. In some cases the technology may shift the burden from one regulatory division to another. For example, wind turbines, while considered clean energy, do have gear boxes that generate used oil every month. Its disposal must be monitored by the Solid and Hazardous Waste Division, thereby increasing the need for monitoring staff. However, if wind generation displaced some coal-generated power generation, this may ease the workload of the Air Quality Division.

In conclusion, the regulatory environment will certainly be a changing landscape in the next decade and beyond. Only time will tell what technologies will prove feasible and economically viable, thus becoming important factors in the economic activities of society, and which will fall by the wayside. Changes in legislation either of a regulatory nature or through the subsidization of certain technologies

at the expense of others will also shape the future of energy production, pollution control, and environmental remediation. This in turn will affect the nature of occupations and skills necessary in a changing industry mix.

More detailed information can be found in the paper, “A Change in Course: Jobs in the Regulatory Environment” ([http://doe.state.wy.us/LMI/energy/regulatory\\_jobs\\_2011.pdf](http://doe.state.wy.us/LMI/energy/regulatory_jobs_2011.pdf)).

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## Chapter 5. Results of the Baseline Survey

### Introduction

The United States is currently undergoing an unprecedented shift in economic activity. Many factors are contributing to this shift, including reducing the nation's dependence on foreign energy supplies, transitioning from nonrenewable to renewable energy sources, reducing greenhouse gas emissions, limiting pollution, and increasing energy efficiency.

Changes in national economic activity and national energy policy can have potentially large impacts on Wyoming's labor market. Currently, the U.S. derives approximately 45% of its energy supply from coal-fired power plants (U.S. EIA, 2009) and approximately 40% of that coal is mined in Wyoming. For example, the Powder River Basin is the largest coal-producing region in the country (U.S. EIA, 2011). Any policy that affects the production and use of coal nationally will have a substantial direct impact on Wyoming's labor market and tax revenues, with many indirect impacts as well.

Additionally, the increased interest in utilizing renewable energy technologies will also significantly impact Wyoming. The southern Wyoming corridor in particular is a favorable location for wind power development (U.S. EIA, 2011). A change in the demand for coal and the construction and operation of wind farms are just two examples of how Wyoming's economy can be effected by changes in national energy policies, as well as changes in national and global economic conditions.

The Research & Planning (R&P) section of the Wyoming Department of Employment has undertaken several projects to determine the effect of these economic changes on Wyoming's labor market. This particular project involved surveying Wyoming firms regarding their production activities and processes to determine how (or if) Wyoming's economic activities are changing and if so, how these changes affect the demand for the relevant occupations in the state. This is an initial study to establish a baseline for further research efforts as these changes continue to impact Wyoming's economy.

The impetus for this study was identified in the Northern Plains and Rocky Mountain Consortium's technical proposal (Northern Plains and Rocky Mountain Consortium, 2010):

- “The Green Jobs Act of 2007 mandates that state labor market research, information, and labor exchange research programs identify job openings in the renewable energy and energy efficiency sector”;

- “Special research is needed to determine how green energies such as biofuels, wind power and carbon sequestration are to be measured from both an industrial (e.g. for the 2012 NAICS revision) and occupational perspective.”

### *Definitions*

The abbreviation “EE” (energy efficiency or energy-efficient jobs) is used to represent the jobs discussed in this article. This term includes more than jobs that enhance energy efficiency. It includes jobs in the production, implementation, or regulation of:

1. Renewable energy and alternative fuels. Manufacturing, construction, design, research, delivery, operation, storage or maintenance of wind, solar, biomass, hydro, alternative transportation fuels, geothermal, methane, and waste incineration as a fuel source.
2. Energy efficiency and conservation. Manufacturing, construction, or installation of energy-efficient products, energy efficiency services, weatherization, building retrofitting/efficiency, energy-efficient production processes, energy distribution improvements, and transportation technology.
3. Pollution, waste, and greenhouse gas management; prevention, and reduction. Activities related to controlling emissions and pollution. Includes controlling and reducing greenhouse gas emissions, waste water, and other pollutants.
4. Environmental cleanup and restoration and wastewater cleanup and mitigation. Environmental restoration including the cleanup and disposal of pollution, waste, and hazardous materials; Superfund/brownfield redevelopment; and landfill restoration.
5. Education, regulation, compliance, public awareness, training, and energy trading. Activities that educate on energy efficiency, renewable energy, energy rating systems certifications, and more efficient energy consumption. Enforcement of compliance requirements and regulations, and training on effective use of energy-related products and processes.
6. Sustainable agriculture and natural resource conservation. Products and services to conserve, maintain, and improve natural resources and environment, including low carbon and organic agriculture, land management, water management and conservation, wetlands restoration and environmental conservation.

The preceding six categories of EE employment are considered as EE output employment; these employees produce or in some way enhance an EE product.

There is another method by which employment could be considered EE employment: *EE process employment*. This occurs when the firm does not produce an EE product, but the employees provide skills that result in a more EE outcome to the production process. For example, a large construction contractor listed no EE products. This firm employed an environmental engineer and a safety and occupational health manager that both provided EE benefits during the firm's production activities. These two jobs would be considered as EE process jobs.

The survey results show total employment of 3,734. Depending on the method of EE job estimation used, the total employment for EE jobs was 122 or 141. The resulting percentage of EE jobs was 3.3% and 3.8%, respectively.

### *Methodology*

#### Sample Selection

The sample was chosen by taking a sample that proportionally reflects the Wyoming industry mix. A total of 1,034 business units were surveyed. The first mailing occurred on June 21, 2010 with questionnaires (and associated cover letters and brochures) being mailed to all business units chosen for sampling. Examples of the cover letter, the brochure, and the questionnaire are shown in Appendixes A, B, and C. The subsequent two mailings were sent only to those business units for which no response had been received or the questionnaire had been undeliverable. The second mailing occurred on July 15 and the third on August 12. Data collection ended on September 17.

Of the 1,034 questionnaires mailed, 453 were completed (at least partially), two were refused, and 51 were undeliverable. The response rate was 43.8%.(453/1034). Of these 453, 46 were excluded from further analysis due to the business being out of business or sold, or because the firm did not provide an answer to the question, "How many employees does your organization have at this location?" There were 407 observations left after excluding the aforementioned questionnaires. This number allows for a statewide (not industry-specific) analysis with a 95% level of confidence and a 4.8% margin of error.

#### Calculation of total EE employment

Eighteen employers listed detailed job descriptions on the inside of the survey after they have stated that there were no EE jobs or left question 2 blank. There are two likely possibilities for this discrepancy:

1. The employer thought he or she was supposed to list all jobs, not just EE jobs, or;
2. The employer did not answer question 2, but actually did have EE jobs listed under the detailed section.



Therefore, the detailed section was examined to see if the employer marked any of the three categories listed under the “Percent of time involving environmental benefits or energy efficiency improvement for workers who had this job.” If so, it is assumed that this was an EE job, at least partially, and was therefore counted in the EE job total.

### Calculation of Wages

Wage information was obtained by asking respondents to indicate how many employees fell into the 12 wage categories provided. These categories were borrowed from the Occupational Employment Statistics (OES) survey instrument (Hauf, 2010). For more information on OES, see <http://wydoe.state.wy.us/lmi/oes2010/oes10.pdf>. The midpoint of each category was used to calculate the average wage in categories 2 through 11. There is no midpoint for categories 1 and 12, therefore the boundary wage was used (e.g. \$9.25 and \$90.00, respectively).

### *Results*

Table 1 shows a gross response rate of 43.8%. After adjusting for non-deliverable questionnaires, the net response rate was 46.3%. After removing incomplete questionnaires or responses from firms that were out of business or had been sold, there were 407 observations remaining for analysis.

Table 2 indicates that 11.5% of the employers surveyed had EE production activities.

There were 3,734 total employees included in the analysis (see Table 3). Of these, depending on the method of EE job estimation used, 122 (3.3%) or 141 (3.8%) people had at least a portion of their work time devoted to EE activities. While both calculations have strengths and weaknesses, the remainder of this article will use the 141 figure, as this has been deemed the most representative of the respondents’ intentions. This 3.8% roughly corresponds with the findings of California (3.4%; State of California, 2010), Oregon (3.0%; Oregon Employment Department, 2009), and Washington (3.3%; Hardcastle, 2009).

### EE Process vs. Output Jobs

Of the 141 total EE jobs, 33 could be considered EE process jobs, which is 0.01% of total employment and 23.4% of all EE employment. There is a possibility that some of these jobs would have been allocated to EE output employment, but the respondent left Question 2 blank or felt that the firm’s product did not fit into any of the six categories shown.

### Industries Involved in EE Activities/Employment

Table 4 displays the percentages of EE activity and employment by major industry classification. Approximately 28% of the construction firms indicated that they participated in EE activities, followed closely by manufacturing firms at 25.0%. In terms of employment, the manufacturing sector (14.9%) and the professional & business services sector (6.6%) indicated the highest levels of EE employment.

#### Occupations Involved in EE Activities

Table 5 details the information that was gathered regarding job titles, job requirements, and the minimum educational level required. Due to the relatively small sample size of detailed occupational information, no strong conclusions can be reached from this information. The occupation occurring most frequently was electrician. There were 12 electricians listed as having some portion of their time spent on EE activities. This increases to 16 if the four individuals with the job title “energy efficient lighting” are included. Respondents also indicated that there were 7 plumbing and 6 HVAC (Heating, Ventilating, and Air Conditioning) EE jobs. Table 6 indicates the average wage for an electrician from this study, a related study called the New Hires Survey, and the Occupational Employment Statistics (OES) survey.

This sample indicates that in Wyoming, EE jobs largely exist within established occupations rather than in new occupations. The wind energy sector may be the exception. There were three jobs with a job title of “field engineer/wind tech” which would likely be coded in the Standard Occupational Classification (SOC) as “wind energy technicians” or “wind turbine service technicians,” both of which have an SOC code of 49-9081. This is a new code in the 2010 SOC edition. There was no code for this in the previous edition of the SOC, which was published in 2000.

#### Increased Demand in the Near Future?

One objective of this survey was to determine (if possible) whether there would be an increased near-term need for EE jobs. Unfortunately, the question regarding how many vacancies there were for a particular occupation was left largely blank. From the detail grid on pages 2 and 3 of the survey instrument, 11 respondents listed at least one vacancy for a given occupation. Only 5 of these vacancies were for an EE job. A companion survey titled the New Hires Survey (Chapter 6) is an ongoing survey that focuses on newly hired employees and may shed more light on the issues of increased demand for new or emerging occupations.

#### Analysis of Non-Response

Is there anything systematically different between respondents and non-respondents? Tables 7 and 8 indicate the number of respondents, the number of non-respondents, and the ratio of number of respondents to the total number of questionnaires mailed (excluding non-deliverable questionnaires). Table 7 is organized by major industry classification, while Table 8 is organized by the size class of the firm based on total employment. Table 7 shows that the response rates for the manufacturing and public administration sectors had higher response rates than the other sectors. In Table 8, the two smaller size classes had the best response rates.

No strong inference has been drawn from these results. However, there are many factors that could have affected response rates. Responding to this survey was not mandatory. Therefore, the response rate may have been affected by a potential respondents' willingness to complete the questionnaire. This in turn may have been affected by their feelings regarding the worth of the survey's objectives, and whether they had enough time to complete the questionnaire. Another important factor may have been whether the questionnaire was seen by a person in the firm that would have enough knowledge of the firm's operations (e.g. a human resource specialist or a manager) to respond to the survey effectively. This may be one reason that the firms in the lower two size classes responded at a higher rate than larger firms. For example, a potential respondent at a firm with eight employees is more likely to be informed about all the firm's activities than a potential respondent at a firm with 500 employees.

### *Further Research*

There are other issues regarding EE employment that could be the focus of future research. For example, how much job creation is temporary (i.e. during construction) versus long-term (i.e. ongoing operation and maintenance)? The creation of a wind turbine farm is a good example of this issue. How much is true job creation vs. job replacement? The longitudinal nature of the UI database will prove useful in assessing this issue.

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**Table 1: Response Rate**

<b>Survey Status</b>	<b>Count</b>	<b>Percent</b>
<i>Returned</i>	453	43.8%
Complete	407	39.4%
Incomplete or Out of Business/Sold	46	4.4%
Non-Deliverable	51	4.9%
Non-Response	528	51.1%
Refusal	2	0.2%
<b>Total Mailed</b>	<b>1,034</b>	<b>100.0%</b>

The remaining tables are based on data from the 407 questionnaires that provided employment data.

**Table 2: Energy Efficiency Activity (Are the Companies Involved in Any EE Production Activities?)**

<b>EE Activity</b>	<b>Count</b>	<b>Percent</b>
No	360	88.5%
Yes	47	11.5%
<b>Total</b>	<b>407</b>	<b>100.0%</b>

**Table 3: Energy Efficiency Employment (Do the Companies Have Any Employees Engaged in EE Activities?)**

<b>EE Activity</b>	<b>Count</b>	<b>Percent</b>
Total Employment	3,734	
Total EE Employment <sup>1</sup>	122	3.3%
Total EE Employment <sup>2</sup>	141	3.8%

<sup>1</sup> Summation of responses to question 3 on questionnaire.

<sup>2</sup> The summation of all EE jobs from the detail section of the questionnaire.

Table 4: **Percentage of Energy Efficiency Activities and Energy Efficiency Employees in Each Industry**

<b>Industry</b>	<b>Surveys Completed</b>	<b>Units with EE Activity</b>	<b>% with EE Activities</b>	<b>EE Employment</b>	<b>Total Employment</b>	<b>% of EE Employment</b>
Natural Resources & Mining	23	3	13.0%	6	206	2.9%
Construction	43	12	27.9%	40	886	4.5%
Manufacturing	24	6	25.0%	21	141	14.9%
Trade, Transportation, & Utilities	85	10	11.8%	33	584	5.7%
Information	9	1	11.1%	0	367	0.0%
Financial Activities	42	0	0.0%	1	193	0.5%
Professional & Business Services	53	4	7.5%	9	137	6.6%
Educational & Health Services	47	7	14.9%	22	476	4.6%
Leisure & Hospitality	35	2	5.7%	0	376	0.0%
Other Services	36	1	2.8%	8	134	6.0%
Public Administration	10	1	10.0%	1	234	0.4%
<b>Overall</b>	<b>407</b>	<b>47</b>	<b>11.5%</b>	<b>141</b>	<b>3,734</b>	<b>3.8%</b>

Table 5: Percentage of Energy Efficiency Activities and Energy Efficiency Employees in Each Industry

Job Title	Brief Description	Job Requirements	Minimum Education	Employees	Vacancies
	Blow in Insulation Walls & Attic	Retro Fit Insulation	Apprenticeship/OJT	1	0
Apprentice Electrician	Installs Radiant Heat	WY Apprentice LLC	Trade Certified	2	1
Bike Sales and Service			Apprenticeship/On-the-Job Training	3	0
Car Wash Attendant		None	No Requirements	3	0
Carpet Cleaner			No Response	1	
Carpet Cleaning/Flood Restoration		IIRC	Trade Certified	1	1
Commercial Driving Instructor		Class A CDL and Experience	Trade Certified	5	0
Construction Worker		None	Apprenticeship/On-the-Job Training	1	0
Counter Salesman			Apprenticeship/On-the-Job Training	2	0
Dental Assistant		Dental Assistant Cert.	Trade Certified	2	
Drivers		Training on Site	HS Diploma/GED	2	0
Electrician			Apprenticeship/On-the-Job Training	3	0
Electrician		Electrical St. License	Trade Certified	6	0
Energy-Efficient Lighting			Apprenticeship/On-the-Job Training	4	0
Engineer			Graduate/Professional Degree	3	0
Environmental Engineer			Bachelor's Degree	1	0
Escort Car Driver		Pilot Car Cert.	HS Diploma/GED	1	0
Extension Educators		Master's Degree Coquate Field	Graduate/Professional Degree	5	0
Factory Sales Rep		Factory Sales Training Class	Bachelor's Degree	1	0
Fence Material Manufacturer	Wildlife Friendly Fencing		Apprenticeship/On-the-Job Training	1	0
Field Engineer/Wind Tech	Repair and Maint on Wind Turbines	Climb Safety Rope, Rescue CPR/First Aid, Driver's License Tree Measurement Plant Identification	Post High School, No Degree	3	1
Forester			Bachelor's Degree	1	0
General Manager	Produces Grass for Cattle	None	Bachelor's Degree	1	0
Heating and Air Conditioning			Apprenticeship/On-the-Job Training	2	0
Heating and Air Conditioning Helper			High School Diploma/GED	4	0
House Caretaker		None	No Response	1	0
Inside Sales		None	Post High School, No Degree	2	0
Journeyman Electrician		WY Journeyman License	Trade Certified	1	1
Labor	Shredding and Recycling		No Requirements	8	0
Laborer	Recycling, Cuts Up Old Railroad Cars, Cleans Up Scrap Piles at Mining Sites, Etc.		No Requirements	1	0
Laborer (Plumbing)			Apprenticeship/On-the-Job Training	2	1
Lead Field Engineer/Wind Tech		Climb Safety Rope, Rescue CPR/First Aid, Driver's License	Post High School, No Degree	1	
Logger	Creates Space Between Trees, Removes Unhealthy Trees for a Healthy Forest		Apprenticeship/On-the-Job Training	1	0
Manager			No Response	1	
Manager			Post High School, No Degree	1	0
Office Manager			Trade Certified	1	
Oilfield Maintenance		None	No Requirements	2	
Oilfield Pumper and Operates Wells		None	High School Diploma/GED	3	0
Oil & Gas Process Equip. Tech.		None	High School Diploma/GED	4	0

**Table 5: Percentage of Energy Efficiency Activities and Energy Efficiency Employees in Each Industry**

(Table 5 Continued)

Job Title	Brief Description	Job Requirements	Minimum Education	Employees	Vacancies
Operator			Apprenticeship/On-the-Job Training	5	0
Plumber		Master Plumber	Trade Certified	1	0
Plumber		RINNEI Certification	Trade Certified	6	0
Project Inspection		State Certification	Graduate/Professional Degree	1	0
Registered Dental Hygienist		Hygienist	Bachelor's Degree	1	
Roaster/Manager		Roasts & Prepares Organic Coffee for Sale	High School Diploma/GED	1	0
Safety and Occ Health			Post High School, No Degree	1	0
Sales		Sell the Organic Product to Potential Customers	High School Diploma/GED	1	0
Sales			High School Diploma/GED	3	0
Salesperson	Selling Organic Livestock Feed		No Requirements	5	0
Secretary			No Requirements	1	0
Senior Loan Processor		None	High School Diploma/GED	1	0
Site Manager		Climb Safety Rope, CPR/First Aid, Driver's License	Associate's Degree	1	
Spray Foam Tech	Oilfield Tank Set (Residential)	Cert. Foam Tech	Trade Certified	1	0
Supervisor			No Requirements	1	0
Tire Technicians	Gets Tires Ready for Recycling, Documentation of Disposal, Etc.		Apprenticeship/On-the-Job Training	6	0
Truck Driver		CDL Heavy Haul Cert.	High School Diploma/GED	1	0
Visitor Center		Professional Engineer, Professional Geologist	Bachelor's Degree	4	
Web Site Sale		None	Apprenticeship/On-the-Job Training	1	0
Welder		Certified Welder	No Response	3	0
Window and Door Installer			Apprenticeship/On-the-Job Training	3	0
Wool Processing			High School Diploma/GED	4	0

**Table 6: Average Hourly Wage for Electricians**

Source	N Observed	Average Hourly Wage
Current Study	12	\$21.65
Current Study <sup>1</sup>	16	\$25.15
New Hires Survey	33	\$24.40
OES Estimate	Unknown	\$23.77

<sup>1</sup>Including the four observations with a job title/brief description of "energy-efficient lighting."



**Table 7: Response Rate by Major Industry**

<b>Industry</b>	<b>Respondents</b>	<b>Respondents</b>	<b>Total<sup>1</sup></b>	<b>Ratio of Respondents to Total</b>
Natural Resources & Mining	30	40	70	42.9
Construction	51	75	126	40.5
Manufacturing	27	16	43	62.8
Trade, Transportation, & Utilities	97	129	226	42.9
Information	10	12	22	45.5
Financial Activities	45	44	89	50.6
Professional & Business Services	55	72	127	43.3
Educational & Health Services	51	52	103	49.5
Leisure & Hospitality	39	49	88	44.3
Other Services	39	36	75	52.0
Public Administration	11	3	14	78.6
<b>Overall</b>	<b>455</b>	<b>528</b>	<b>983</b>	<b>46.3</b>

<sup>1</sup>Non-deliverable surveys were removed.**Table 8: Response Rate by Size Class**

<b>Size Class</b>	<b># of Respondents</b>	<b># of Non-Respondents</b>	<b>Total<sup>1</sup></b>	<b>Ratio of Respondents to Total</b>
1-4	286	316	602	47.5
5-9	103	105	208	49.5
10-19	38	67	105	36.2
20-49	21	31	52	40.4
50+	7	9	16	43.8
<b>Total</b>	<b>455</b>	<b>528</b>	<b>983</b>	<b>46.3</b>

<sup>1</sup>Non-deliverable surveys were removed.

## **Chapter 6. A Summary of the New Hires Survey**

(By Lisa Knapp; prepared December 2010)

### *Introduction*

The purpose of this survey was to determine the job title, knowledge, skills, and abilities of newly hired employees and secondarily, what percent (if any) of the time “was this job involved in activities and duties related to increasing energy efficiency, utilizing or developing renewable energy resources, or preserving and/or restoring the environment.” This is an ongoing survey and will likely yield useful information in terms of the demographic characteristics of these newly hired workers as well as statistics related to job tenure and wage progression. Evidence of great value can be attained from this survey in that we will be able to determine what jobs are in great demand as opposed to the jobs that are not. This information can be then used to assess the dynamics of the job market (i.e. the occupations that are in high demand) which can aid students at educational institutions, those currently unemployed, those looking to relocate, etc. so that these people have some idea of the job market in which they are (or will be) competing.

This study employs a strategy of combining survey data with administrative datasets such as the Wyoming Unemployment Insurance (UI) Wage Records database and the Quarterly Census of Employment and Wages (QCEW). Among the advantages to using the UI wage records database linked to other administrative datasets is that it is a low-cost source of data and, since it is collected by law for tax purposes, there is less chance for recall bias or misrepresentation, making the data more accurate.

Currently there is little research available about what jobs are most likely to perform energy-efficient activities but the results of this study should help to provide more insight. This research will also provide information about the industries in which these energy-efficient jobs are found. Staffing patterns can then be used to determine whether any differences exist in the way employers hire energy-efficient jobs and jobs that are not. Analysis will also compare tenure and wage progression for employees working in energy-efficient jobs compared to those not working in energy-efficient jobs.

Because so little research is available on energy-efficient jobs, there is currently no way of knowing if these jobs require or put an emphasis on a different skill set than do jobs that are not considered energy-efficient. The data from this project will allow for the comparison of the types of skills needed for jobs that perform energy-efficient activities and those that do not. It will also allow for the comparison of other job-related attributes such as education, benefits, and wages will also be possible.

There is also no current comprehensive and accurate source of data describing the jobs for which Wyoming employers hire. The data collected during this study will not only show what types of job openings are available in the state but also the skills and qualifications workers need for those jobs. Benefits and pay rates are also being collected and will be analyzed by job and industry. Finally, the results of this study will be combined with wage and employer data from the UI wage records database to determine job tenure, or how long the employee stayed with the firm, and wage progression. Tenure and wage progression are both important tools in assessing job quality. Research & Planning (R&P) has done some research on this subject in the past, particularly in terms of evaluating training programs, and it continues to be a topic of interest. With the results of this study, job tenure can be measured for jobs that perform energy-efficient activities and for those that do not, and can be compared to determine any significant differences between the two types of jobs.

### *Methodology*

For this study, the first panel sample was selected from new hires in 2009Q4 (the most current quarter of data available when the project started). A *new hire* was defined as someone who was hired by a firm that they had not worked in at least the last 20 years (the time frame for which R&P has UI wage records). There were 28,193 total new hires during 2009Q4. Industries in Wyoming vary widely in their turnover, hiring practices, skill sets, etc. Therefore, the sample was drawn independently for each industry in a manner that would ensure a 95% confidence level with +/- 0.05 error. By doing this, the goal is to use a large enough sample so that it is representative of the whole population of new hires. Questionnaires for 4,376 employees were mailed for the first panel. This methodology was used for the first three panels and will be used for a fourth panel. The sample timeframe increases one quarter for each panel (i.e. the sample timeframe was 2010Q1 for the second panel).

This project was designed to measure elements of the job rather than attributes and abilities of the employee hired for the job. Questions on the mail questionnaire pertained to the rate of pay, hours worked, benefits offered, and qualifications needed for the job as well as the amount of time that job performed energy-efficient tasks. The questionnaire also included a series of job skills and asked employers to rate the level of importance of each skill to the job on a scale of one to three. These skills included service orientation, critical thinking, reading comprehension, technology design, and operation and control. Employers were given a space to write in the one skill they felt was most important to performing the job's duties. That skill may have been one that was included in those that the employer had previously rated, or it might have been something completely

different. Finally, there were two questions about the employee: the employer's level of satisfaction with the employee's work skills and if the employee was still employed in the job. These two were the only questions on the survey instrument that referred directly to the worker. Data collection for the first panel of this project began in June 2010 and ended in September 2010. Data collection for the second panel of this project began in September 2010 and ended in January 2011. Data collection for the third panel began in January 2011. As of January 2011, preliminary analysis had been conducted using only the first panel of data. Data cleaning and verification of the second panel is ongoing and data collection for the third panel has recently begun. A fourth panel is planned. The result will be data for four quarters of economic activity.

### *Preliminary Results (First Panel of Data Only)*

After removing the questionnaires that could not be delivered from the total, the overall response rate for the survey was 72.9% (3,035 completed surveys). The response rate by industry ranged from a high of 92.9% for management of companies and enterprises to a low of 64.8% for retail trade. The first question of the survey asked whether the employee had worked for the business in 2009Q4. More than nine-tenths of the questionnaires were marked "yes" (93.6%; 2,841), while 6.4% (194) were marked "no." Ideally, 100% would have marked "yes." However, two main factors lead to less than a 100% yes rate. First, the questionnaires were sent to the correct employer, but the employee worked at a different location than the one to which the survey was mailed (e.g. the business is a pizza restaurant with five locations). Secondly, the possibility of human error exists in that the reference period may have been up to 11 months prior to the respondent completing the survey and, therefore, may have inaccurately answered the question. Therefore, 2,841 observations were available for analysis.

One of the research questions this project seeks to answer is whether there is a difference in job tenure for those employed in energy-efficient jobs compared to those employed in jobs that employers do not consider energy-efficient. To do this, the proportion of employees still employed by the same firm one quarter after hire (the most current data available) were compared for each group. Because currently only one panel of data has been collected, only broad generalizations are possible at this time. As R&P collects more data, advanced statistical analysis will be performed. In total, 446 (16.0%) worked in energy-efficient jobs while 1,838 (66.1%) worked in jobs that were not considered energy-efficient. The energy-efficient status was unknown for almost one in five workers (N = 498, 17.9%). A greater proportion of those working in energy-efficient jobs (356, or 79.8%) were still employed one quarter after hire compared to those not

working in energy-efficient jobs (1,375, or 74.8%) or those where the energy-efficient status was not known (375, or 75.3%).

Table 1 contains the results of the energy-efficiency jobs for all employment and for two industries that provide much of the foundation of Wyoming's economy: mining, and health care & social assistance (e.g. hospitals, nursing homes, child and youth services, and daycare facilities).

Completed questionnaires were received for 184 new hires in the mining industry and 235 new hires in the health care and social assistance industry. In mining, 46 employees (25.0%) had energy-efficient jobs and of those, 76.1% (N = 35) were still employed one quarter after hire. In comparison, far fewer employees in health care and social assistance had energy-efficient jobs (N = 15, 6.4%), but a larger proportion of those that did have energy-efficient jobs were still employed after one quarter (N = 14, 93.3%).

Table 1. Selected Statistics for All Jobs, Jobs in Mining, and Jobs in Health Care

	N, New Hires	Energy Efficient Jobs				Not Energy Efficient Jobs				Energy Efficient Status Unknown			
		N	% of Total	N, Still Emp	% of Total	N	% of Total	N, Still Emp	% of Total	N	% of Total	N, Still Emp	% of Total
All Jobs	2,782	446	16.0%	356	79.8%	1,838	66.1%	1,375	74.8%	498	17.9%	375	75.3%
Jobs, Mining	184	46	25.0%	35	76.1%	79	42.9%	54	68.4%	59	32.1%	43	72.9%
Jobs, Health Care	235	15	6.4%	14	93.3%	193	82.1%	163	84.5%	27	11.5%	21	77.8%

### Conclusions

Although the data collection process for this project is not complete, and there is not enough information to make solid conclusions, the evidence thus far supports the concept that new hires holding energy-efficient jobs are more likely to stay employed at that job for longer than those in jobs that are not energy-efficient. Currently R&P has collected data for one panel in one quarter. Ultimately, at least four quarters of data will be collected, which should result in enough data to conduct more in-depth statistical analyses. Future analyses will study tenure differences in greater detail as well as look into the possible reasons that employees with energy-efficient jobs have longer tenure, should that continue to be true. Analyses will also be done to compare the types of jobs that are considered energy-efficient and those that are not, and to compare the types of skills workers need to work in energy-efficient jobs compared to the skills needed for jobs that are not energy-efficient.

To see the full preliminary report on the New Hires Survey see

<http://doe.state.wy.us/LMI/energy.htm>. Further reports containing results from the second and third panels of the survey are forthcoming.



New Hires Survey Instrument



THE STATE

OF WYOMING

**MATTHEW H. MEAD**  
**GOVERNOR**

*Department of Employment*

**P.O. BOX 2760**  
**CASPER, WY 82602**

**RESEARCH & PLANNING SECTION**

**(307) 473-3807**

February 10, 2011  
[IDNum]

[Firm Name]  
[Firm Address Line 1]  
[Firm Address Line 2]  
[Firm City State Zip]

Dear Wyoming Employer:

Enclosed is/are # questionnaires regarding the skill requirements of jobs in your firm. To do this, we are focusing on jobs filled by your firm during the third quarter of 2010. The information gathered during this project will be used by educators, employment training organizations, and vocational counselors to identify what skills are most needed by employers in the state and develop curriculums emphasizing those skills. This will help you and employers like you access the skilled labor force essential to your businesses.

Positions from your company were randomly selected to represent many businesses so it is important that you complete the forms and return them as soon as possible. For your convenience, you may respond by any of the following methods:

- Completing the questionnaire and returning it in the stamped self-addressed return envelope.
- Faxing it to us at 307-473-3829 or 1-877-827-9511.
- Calling us toll free at 1-866-579-3873 and providing your responses to us over the phone.

Please respond to this questionnaire by February 28, 2011.


The results of this study will be published and distributed to those who are concerned with employee skills in order to encourage discussion. These results will also be posted on our website at <http://doe.state.wy.us/LMI>. All of the information provided by you will be kept confidential by law. For more information on our confidentiality policies or this study, please contact Lisa Knapp toll free at 1-866-579-3873 or [LKnapp@state.wy.us](mailto:LKnapp@state.wy.us).

Sincerely,

A handwritten signature in black ink, appearing to read "Tom Gallagher".

Tom Gallagher  
Manager, Research and Planning

Enclosures

<b>Department of Employment Job Skills Survey – Fax to 1-877-827-9511 or 307-473-3829</b>		Rev. 9/2010 Survey Date: December 2010
	Wyoming Department of Employment Research & Planning P.O. Box 2760 Casper, WY 82602 Tel. (866) 579-3873 <a href="http://doe.state.wy.us/LMI/">http://doe.state.wy.us/LMI/</a>	<b>Please return form by February 28, 2011</b>  <i>We expect this form to take approximately 10-15 minutes to complete</i> [ID]
All data collected by Research & Planning must, by the Workforce Investment Act (see: 29 USC sec. 491-2 (a)(2)) and the Wyoming Employment Security Law (section 27-3-603), be held in the strictest confidence, with results published only as summary statistics.		
Employee holding this job: [J. Jones]		
<b>This is a request for information about this job: work, pay, and benefits</b>		
1. Our records indicate the above-named individual was an employee of your business during the reference period of April, May, or June, 2010. Is this correct? <i>(Please select one response)</i>		
<input type="checkbox"/> Yes <i>(if yes, please continue)</i> <input type="checkbox"/> No <i>(if no, STOP. Please return this form in the enclosed self-addressed stamped envelope or fax it to one of the numbers above. Thank you.)</i>		
2a. What was the rate of pay for this job during the reference period of April, May, or June, 2010? \$ _____ per _____ <i>(check one)</i>		
Please include base rate of pay, tips, commissions, and other monetary compensation.		<input type="checkbox"/> Hour <input type="checkbox"/> Week <input type="checkbox"/> 2 Weeks <input type="checkbox"/> Month <input type="checkbox"/> Other <i>(specify: e.g. supplemental insurance)</i> _____
2b. On average, how many hours were worked in this job each week at that time? _____ Hours		
3. Were any of the following benefits offered for the job? <i>(Please check all that apply)</i>		
<input type="checkbox"/> Health insurance <input type="checkbox"/> Retirement plan <input type="checkbox"/> Paid time off <input type="checkbox"/> Other <i>(specify):</i> _____ <input type="checkbox"/> No benefits offered		
<b>Type of Work</b>		
4a. During the reference period, what was the job title for this job? <i>(For example, secretary, accountant, personnel manager. Please print in the space provided.)</i>		
4b. During the reference period, what were most important activities or duties of this job? <i>(For example, typing and filing, reconciling financial records, directing hiring policies. Please print in the space provided.)</i>		
4c. What percent of the time was this job involved in activities and duties related to increasing energy efficiency, utilizing or developing renewable energy resources, or preserving and/or restoring the environment <i>(Please select one of the following)</i>		
<input type="checkbox"/> None of the time <input type="checkbox"/> Less than 50% of the time <input type="checkbox"/> More than 50% of the time <input type="checkbox"/> Don't know		

 (Over Please)  
 Confidential

1-NH.1



<b>Employee Qualifications and Skills</b> <span style="float: right;">[ID]</span>							
<p>We are seeking information about the qualifications required for this job and the importance of the following skills for the job in which the worker was employed during the <b>reference period</b> of April, May, or June, 2010. Skills are defined as the capacity to carry out the tasks required to accomplish the activities and duties of this job.</p> <p>When possible, we request that someone with knowledge about this job complete all parts of questions 6 through 12. <b>Please use a scale of 1 to 3 where 1 means Unimportant and 3 means Important. Please circle or check the most appropriate response for this job. Thank you.</b></p>							
<b>Qualifications</b>							
<p><b>5. Check the qualifications required for the type of work described in questions 4a and 4b. (Please check all that apply)</b></p> <table style="width: 100%; border: none;"> <tr> <td style="width: 33%; vertical-align: top;"> <input type="checkbox"/> On-the-job training  <input type="checkbox"/> Postsecondary technical training  <input type="checkbox"/> Work experience in related occupations </td> <td style="width: 33%; vertical-align: top;"> <input type="checkbox"/> Associate's degree  <input type="checkbox"/> Bachelor's degree or greater  <input type="checkbox"/> Licensure or certification </td> <td style="width: 33%; vertical-align: top;"> <input type="checkbox"/> None required  <input type="checkbox"/> Other (<i>specify; for example, a course in medical terminology</i>)  <div style="border-bottom: 1px solid black; width: 100%; margin-top: 5px;"></div> </td> </tr> </table>				<input type="checkbox"/> On-the-job training <input type="checkbox"/> Postsecondary technical training <input type="checkbox"/> Work experience in related occupations	<input type="checkbox"/> Associate's degree <input type="checkbox"/> Bachelor's degree or greater <input type="checkbox"/> Licensure or certification	<input type="checkbox"/> None required <input type="checkbox"/> Other ( <i>specify; for example, a course in medical terminology</i> ) <div style="border-bottom: 1px solid black; width: 100%; margin-top: 5px;"></div>	
<input type="checkbox"/> On-the-job training <input type="checkbox"/> Postsecondary technical training <input type="checkbox"/> Work experience in related occupations	<input type="checkbox"/> Associate's degree <input type="checkbox"/> Bachelor's degree or greater <input type="checkbox"/> Licensure or certification	<input type="checkbox"/> None required <input type="checkbox"/> Other ( <i>specify; for example, a course in medical terminology</i> ) <div style="border-bottom: 1px solid black; width: 100%; margin-top: 5px;"></div>					
<b>Skills</b>							
<p><b>6. How would you rate the level of importance for <i>service orientation</i> for this job? (Involves actively looking for ways to help people.)</b></p> <table style="width: 100%; border: none;"> <tr> <td style="width: 25%;">Unimportant 1</td> <td style="width: 25%;">Neither Important nor Unimportant 2</td> <td style="width: 25%;">Important 3</td> <td style="width: 25%;"><input type="checkbox"/> Don't know</td> </tr> </table>				Unimportant 1	Neither Important nor Unimportant 2	Important 3	<input type="checkbox"/> Don't know
Unimportant 1	Neither Important nor Unimportant 2	Important 3	<input type="checkbox"/> Don't know				
<p><b>7. How would you rate the level of importance for <i>critical thinking</i> for this job? (Involves using logic and reasoning to identify the strengths and weaknesses of alternative solutions or approaches to problems.)</b></p> <table style="width: 100%; border: none;"> <tr> <td style="width: 25%;">Unimportant 1</td> <td style="width: 25%;">Neither Important nor Unimportant 2</td> <td style="width: 25%;">Important 3</td> <td style="width: 25%;"><input type="checkbox"/> Don't know</td> </tr> </table>				Unimportant 1	Neither Important nor Unimportant 2	Important 3	<input type="checkbox"/> Don't know
Unimportant 1	Neither Important nor Unimportant 2	Important 3	<input type="checkbox"/> Don't know				
<p><b>8. How would you rate the level of importance of <i>reading comprehension</i> for this job? (Involves understanding written sentences and paragraphs in work related documents.)</b></p> <table style="width: 100%; border: none;"> <tr> <td style="width: 25%;">Unimportant 1</td> <td style="width: 25%;">Neither Important nor Unimportant 2</td> <td style="width: 25%;">Important 3</td> <td style="width: 25%;"><input type="checkbox"/> Don't know</td> </tr> </table>				Unimportant 1	Neither Important nor Unimportant 2	Important 3	<input type="checkbox"/> Don't know
Unimportant 1	Neither Important nor Unimportant 2	Important 3	<input type="checkbox"/> Don't know				
<p><b>9. How would you rate the level of importance of <i>technology design</i> for this job? (Involves generating or adapting equipment and technology to serve user needs.)</b></p> <table style="width: 100%; border: none;"> <tr> <td style="width: 25%;">Unimportant 1</td> <td style="width: 25%;">Neither Important nor Unimportant 2</td> <td style="width: 25%;">Important 3</td> <td style="width: 25%;"><input type="checkbox"/> Don't know</td> </tr> </table>				Unimportant 1	Neither Important nor Unimportant 2	Important 3	<input type="checkbox"/> Don't know
Unimportant 1	Neither Important nor Unimportant 2	Important 3	<input type="checkbox"/> Don't know				
<p><b>10. How would you rate the level of importance of <i>operation and control</i> for this job? (Involves controlling operations of equipment or systems.)</b></p> <table style="width: 100%; border: none;"> <tr> <td style="width: 25%;">Unimportant 1</td> <td style="width: 25%;">Neither Important nor Unimportant 2</td> <td style="width: 25%;">Important 3</td> <td style="width: 25%;"><input type="checkbox"/> Don't know</td> </tr> </table>				Unimportant 1	Neither Important nor Unimportant 2	Important 3	<input type="checkbox"/> Don't know
Unimportant 1	Neither Important nor Unimportant 2	Important 3	<input type="checkbox"/> Don't know				
<p><b>11. In your opinion, what one skill is <i>most</i> important to accomplishing the activities and duties of this job? It could be one of the above or it could be another skill. (Please print in the space provided)</b></p> <div style="border-bottom: 1px solid black; height: 20px; width: 100%;"></div>							
<p><b>12. How would you rate your overall satisfaction with this employee's <i>work skills</i>? (for example, cooking, customer service skills, welding, teaching skills, heavy lifting skills.)</b></p> <table style="width: 100%; border: none;"> <tr> <td style="width: 25%;">Unsatisfied 1</td> <td style="width: 25%;">Neither Satisfied nor Unsatisfied 2</td> <td style="width: 25%;">Satisfied 3</td> <td style="width: 25%;"><input type="checkbox"/> Don't know</td> </tr> </table>				Unsatisfied 1	Neither Satisfied nor Unsatisfied 2	Satisfied 3	<input type="checkbox"/> Don't know
Unsatisfied 1	Neither Satisfied nor Unsatisfied 2	Satisfied 3	<input type="checkbox"/> Don't know				
<p><b>13. Is this person still employed at your firm?</b>      <input type="checkbox"/> Yes      <input type="checkbox"/> No</p>							
<p><b>14. Contact person name and title (Please print)</b></p> <p>First _____ Last _____ Title _____</p> <p>Phone number (<i>Please include area code</i>) _____</p> <p>Email address _____</p>							
<p><b>15. Would you like to receive a copy of the statistical report compiled from all of the questionnaire results?</b></p> <p><input type="checkbox"/> Yes      <input type="checkbox"/> No</p>							

**Thank You!**

2-NH.1

## Chapter 7. Text Mining Analysis of the New Hires Survey

(completed in March 2011 by Sara Saulcy and Tony Glover.)

### *Introduction*

Using the data from the *new hires* survey from the previous chapter (2009Q4 and 2010Q1), a project was conducted to identify the job skills required for newly hired employees. Additionally, the difference in skill sets between those workers with an EE component to their jobs was compared to those workers that did not (see Chapter 1 for the definition of EE employment). The results of this research will be used to inform employees, educators, policy makers, and training providers about the skills necessary to gain employment in Wyoming's labor market.

### *Methodology*

The new hires questionnaire was comprised of two types of questions: closed-ended questions and open-ended questions. Closed-ended questions limit the number of responses possible that a respondent can provide. These types of questions force respondents to choose from a limited number of responses. An example of a closed-ended question is “What time is it where you live?” In open-ended questions, response options are not limited. “What is your opinion of Wyoming's economy?” is an example of an open-ended question. To assess employer skills needs, R&P first asked employers closed-ended questions about five types of skills:

- **service orientation** (actively looking for ways to help people);
- **critical thinking** (using logic and reasoning to identify the strengths and weaknesses of alternative solutions, conclusions or approaches to problems);
- **reading comprehension** (understanding written sentences and paragraphs in work-related documents);
- **technology design** (generating or adapting equipment and technology to serve user needs);
- and **operation and control** (controlling operations of equipment or systems).

The open-ended question was “In your opinion, what one skill is most important to accomplishing the activities and duties of this job? It could be one of the above or it could be another skill.”

In order to evaluate respondents' answers to the open-ended question, a technique called *text mining* was employed. R&P used PAWS Text Analytics for Surveys 4 (TAS) software (SPSS, 2010).

Text mining is a useful tool for evaluating and quantifying responses to open-ended questions. The process helps to identify themes that cannot otherwise be determined from closed-ended questions. The purpose of identifying themes is to capture information based on what respondents consider important, not what researchers consider important. For large surveys (over 5,000 responses in this case), text mining by hand is impractical. Therefore, R&P used text mining software to expedite the process of capturing common themes reported by employers about skills needed to be successful in jobs for which employees were newly hired.

### *Results*

Of the 5,331 newly hired positions examined, service orientation was the skill most frequently reported as being important (28.9%). Understandably, more than one skill was considered as important for many of these newly hired jobs. The 10 most frequent co-occurrences are shown in Table 1.

Table 1. Number of Co-Occurrences of Skills Reported as Important for the Wyoming New Hires Survey

<b>Category 1 (Total Responses)</b>	<b>Category 2 (Total Responses)</b>	<b>Number</b>
Critical Thinking(1021)	Operation & Control(821)	146
Service Orientation(1496)	Critical Thinking(1021)	119
Reading Comprehension(202)	Critical Thinking(1021)	81
Operation & Control(821)	Service Orientation(1496)	70
Critical Thinking(1021)	Technology Design(116)	69
Reading Comprehension(202)	Service Orientation(1496)	67
Reading Comprehension(202)	Operation & Control(821)	66
Technology Design(116)	Operation & Control(821)	66
Reading Comprehension(202)	Technology Design(116)	65
Technology Design(116)	Service Orientation(1496)	65

Figure 1 represents a skills concept map. The size of the blue dots represents the number of responses for a given skill. The width of the red lines defines the amount of co-occurrence between a particular set of skills. For example, in the upper left of the figure, it can be seen that service orientation and critical thinking both had many responses and that there was a strong co-occurrence between the two skills.

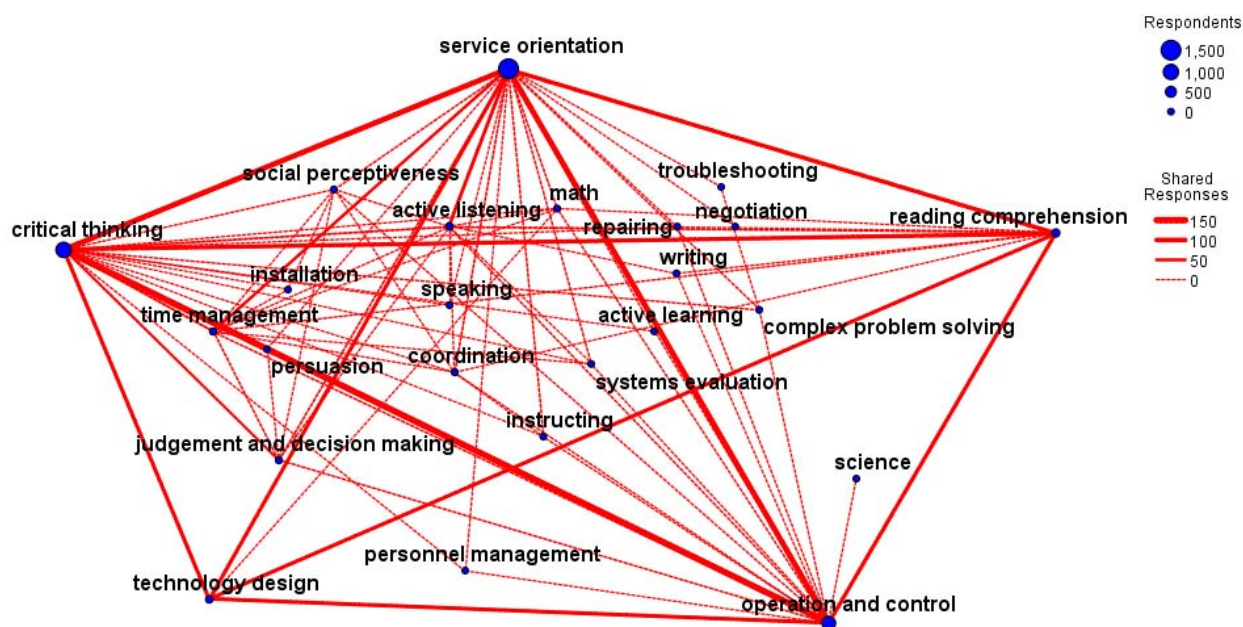
Of all new hires, 926 (17.4%) held EE jobs (those that involve activities and duties related to increasing energy efficiency, utilizing or developing renewable energy resources, or preserving and/or restoring the environment some or all of the time). Of the five skills, critical thinking had the highest frequency of importance for environmental jobs (247 of 926; 26.7%) followed by service orientation

(185 or 20.0%). Although critical thinking was more important for environmental jobs (26.7%) relative to non-environmental jobs (16.8%), it was important for all jobs. For the full text mining report see [http://doe.state.wy.us/lmi/energy/text\\_mining\\_draft.pdf](http://doe.state.wy.us/lmi/energy/text_mining_draft.pdf).

## References

SPSS, Inc. (2010). *IBM SPSS Text Analytics for Surveys 4.0 User's Guide*.  
<http://www.spss.com/software/statistics/text-analytics-for-surveys/>

**Figure 1. Wyoming New Hires Study, Relationship of Critical Thinking, Technology Design, Reading Comprehension, and Operation and Control to Other Skills, Fourth Quarter 2009 and First Quarter 2010**



## Chapter 8. Wyoming IMPLAN Analysis of ARRA Spending

(By Douglas W. Leonard. Originally published in October 2010 issue of *Wyoming Labor Force Trends*, online at <http://doe.state.wy.us/LMI/1010/a3.htm>)

One objective of the consortium's portion of the American Recovery and Reinvestment Act of 2009 grant funding was to examine the state and/or regional impacts of a new economic development project. IMPLAN economic impact modeling software can be used to estimate economic benefits at various levels (e.g. county, region, state level, etc.). In Wyoming's analysis the region of interest consisted of Campbell, Laramie, Lincoln, Natrona, Sublette, and Sweetwater counties. The project analyzed was an ARRA funded program to retrofit non-road construction equipment to reduce pollution emissions (EPA-ARRA). The analysis takes into account the direct, indirect, and induced effects of the grant funding on employment and income.

The purpose of this research was to demonstrate the use of IMPLAN modeling software in estimating the economic impact of a specific ARRA project performed in Wyoming. This work occurred as part of a multi-state (South Dakota, Iowa, Montana, Nebraska, Wyoming, and Utah) collaboration to estimate the impacts of ARRA spending (among other objectives) in those respective states. No selection criteria were used for the project analyzed other than the activity occurred in Wyoming and was performed as a result of an ARRA grant. Although the project analyzed was part of the ARRA Clean Diesel Program, the funding for the impact research was not. Nor was the research funded through the grant awarded to DEQ and its subcontractors to perform the work. The Research & Planning (R&P) section of the Wyoming Department of Employment has used IMPLAN for a variety of projects including the estimation of impacts due to Unemployment Insurance claims payments and power plant construction. Some data elements were suppressed to maintain employer and worker confidentiality.

### *Method Section I – Input Assumptions*

Wyoming's basic assumptions for the project are contained in Table 1. From the ARRA database, the project was scheduled to begin in first quarter 2010 and be completed in that quarter. Therefore, the project duration was 90 days. To properly allocate grant amounts to the various economic sectors, R&P had to know what proportion of the revenue (grant amounts in this case; see Table 2) consisted of wages and salaries. The WYGEN-III industrial siting application (ISA) indicated this proportion was approximately 33% for construction projects (CH2M Hill, 2010). Dividing the wage and salary amounts in each industry by the average wage paid in each industry during first quarter 2010, R&P

developed estimates of the number of jobs created or supported by the project in each industry. These numbers will be used later for housing and food spending by out-of-county workers. The housing breakouts also came from the WYGEN-III ISA (CH2M Hill, 2010). This ISA was used rather than those associated with wind power because it seems to be more closely matched to that type of project than a wind power project. No dollar deductions were made to the government portion of the project as all of that activity was assigned to the multi-county analysis area.

To adjust for worker commuting, R&P used the commuting pattern estimates from fourth quarter 2009 for the specific employers included in the grants, not the industries in which they operate. The data showing distribution of wages paid by residence were suppressed for confidentiality reasons. Using the amount of wages calculated in the basic assumptions, wages were allocated to the various counties where those firms' workers reside (see Tables 3 and 4).

The estimates of housing impacts (see Table 5) were calculated using the estimated number of workers and the proportions using each type of housing in combination with the distribution of wages paid by residents (suppressed data) in addition to Sublette County average rents (Wyoming Community Development Authority, 2010). These amounts were also subtracted from the gross grant amounts. The meal calculations shown in Table 6 were performed in much the same manner as the housing estimates in Table 5 but instead used the meal per diem cost from Table 1 rather than Sublette County estimated rents (General Services Administration, 2010). These expenditures do not funnel through the industries but through the households supported by the expenditures. Table 7 contains the estimates of monies which actually flow through those firms for material purchases, upkeep, and local worker wages.

### *Method Section II – IMPLAN Execution*

R&P used the model assumptions and calculations (Method Section I above) to develop the inputs for Table 8. Although multiple private sector firms and industry sectors were involved in the project, all private sector activity was combined into one category for the purposes of this report. The final dollar amounts are the initial grant amounts less commuter wage, meal, and housing adjustments.

### *Results*

The results of the model are shown in Table 9. At first glance the employment calculations for the project appeared quite low. Estimates of employment change used in the worksheet based on the proportion of project funds accounted for by wages and salaries and the average QCEW wage was approximately 35. However, IMPLAN assumes the project takes an entire year to complete while the

estimated project timeline was one quarter. While the labor income, value added, and total output dollar amounts are correct, the employment estimate is one-fourth of the actual level. Therefore, all employment estimates must be multiplied by four to account for the difference. Techniques to adjust IMPLAN dollar inputs and/or employment outputs to account for project time spans are not unusual.

For example, the Wygen III ISA states, "10. Because the IMPLAN model is a short-term annual model, the construction analyses are evaluated for a one-year period. Then all costs are averaged over the 29-month construction duration and multiplied by 12 months to arrive at an annual estimate of potential changes to the county's economy." (CH2M Hill, 2010, page 3-36.)

The adjusted employment figures are shown in the second column of Table 9. The 33.2 estimated direct jobs created or sustained by the project is very close to the amount calculated when the out-of-state wages are removed (33.9). The model estimates indicate that for each direct job created in the project, 0.43 additional jobs were created as a result of business to business purchases and increases in household expenditures. Where output is concerned, each \$1 spent on the project resulted in \$1.36 in increased economic activity in the region of interest (Campbell, Laramie, Lincoln, Natrona, Sublette, and Sweetwater counties).

The breakdown of employment and economic output added (with adjusted employment values) is shown in Table 10. The top 10 industries shown accounted for 82.3% of the total employment added.

### *Conclusion*

The results indicate a jobs multiplier of 1.43 and an output multiplier of 1.31 for this project, assuming its one-quarter completion time horizon as proposed. The output multiplier calculation was based on the gross grant amount. This multiplier would be 1.36 if based on the net grant amount impacting the study area. The level of calculated employment impact is an upper-limit estimate because the Recovery.gov website indicated the project was still in progress (more than 50%) into second quarter 2010. The output multipliers would be unaffected as long as project completion occurs in 2010.

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## Appendix A: Baseline Survey Cover Letter and Survey Instrument



Dear Wyoming Employer:

The Research & Planning section is conducting a study to determine current and future employment needs of businesses in Wyoming. The enclosed questionnaire is made up of parts.

Part 1 concerns your company as a whole. We ask if **your business generates revenue** from any energy efficiency, pollution control, or conservation practices (See more detailed descriptions on page 1 of the questionnaire).

Some examples include:

- Land reclamation or other activities related to conservation
- Installation and maintenance of wind turbines or solar panels, or other activity related to alternative energy
- Installation of energy efficient appliances, windows, or other products designed to save energy

Part 2 of the questionnaire concerns your employees. Even if your firm does not generate revenue from the activities mentioned in Part 1, employees may have duties that provide environmental benefits (e.g. An environmental compliance worker at an oil refinery or an employee with hazardous waste responsibilities).

**Please return this questionnaire even if your business is not involved in any of these activities. Your response is greatly appreciated. We especially appreciate responses to the “comment” question on page 4.**

For your convenience, you may respond by any one of the following methods:

- Completing the questionnaire and returning it in the stamped self-addressed return envelope.
- Faxing it to us at 1-877-827-9511.
- Calling us toll free at 1-866-579-3873 and providing your responses to us over the phone.

Please respond to the questionnaire no later than September 7, 2010.

The results of this study will be published in summary form only. They will be used by educators and employment training organizations to plan for future Wyoming workforce educational needs. The results will be posted on our website at <http://doe.state.wy.us/LMI>. All data collected must, by the Wyoming Employment Security Law 27-3-603, be held in the strictest confidence.

If you have any questions regarding the study or the survey form, please contact Patrick Manning toll free at 1-866-579-3873 or [PManni@state.wy.us](mailto:PManni@state.wy.us).

Thank you for your time and assistance in completing this survey. If you have already returned the questionnaire, thank you for your response.

Sincerely,

Tom Gallagher  
Manager, Research & Planning

Enclosures

## Appendix B: Brochure

**Confidentiality**

Your individual responses will be kept in confidence and only released in summary statistical reports.

**How to respond**



Call (307) 473-3837,  
or toll-free  
(866) 579-3873



Fax your response  
to: (877) 827-9511



Mail your response to:  
LMI Improvement Grant  
Department of  
Employment  
PO Box 2760  
Casper, WY 82601-9957

Wyoming Department of Employment  
Research & Planning  
246 S. Center St.  
Casper, WY 82601  
<http://doe.state.wy.us/LMI>



# Occupational Survey

**Dear Employer**

Thank you for taking the time to complete the enclosed survey. Our goal is to collect information about jobs in Wyoming's economy in which employees use specific skills that result in environmental benefits.

Your participation in this survey is crucial. Even if you don't believe your business produces products that are environmentally friendly, your daily activities may very well positively impact the environment.

Your assistance will help us educate potential future workers, training centers, and economic development agencies by sharing your knowledge.

Please assist us in identifying skills needed for both new and existing occupations that require proficiency with developing technologies and materials. Properly trained workers are needed to fill job openings created through public and private investments, such as carbon sequestration, wind energy, and energy efficient construction techniques.

Please return the completed survey by June 30, 2010. Once again, thank you for your time and assistance.

**What types of activities?**

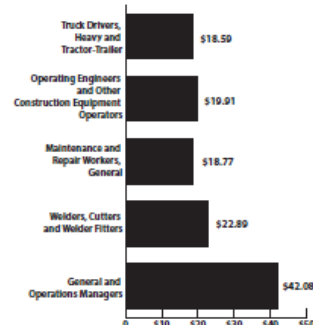
The Bureau of Labor Statistics has defined these types of activities as those "that help protect or restore the environment or natural resources conservation," and has identified seven broad categories related to these activities:

- Agricultural and natural resources conservation
- Renewable energy
- Energy efficiency
- Greenhouse gas reduction
- Pollution reduction and cleanup
- Recycling and waste reduction
- Education, compliance, public awareness, and training

**Jobs in demand**

A recent report released by the U.S. Department of Labor has identified several occupations that will be in demand as more businesses implement environmentally-friendly activities.

Research & Planning data suggests demand is likely to increase for the following jobs in Wyoming as a result of the aforementioned activities.

**Mean Wage per Hour**

Data from September 2009. For a complete list of occupations and wages, see <http://dls.state.wy.us/fm/ces.htm>.

**What do we hope to learn?**

- We know what these employees make now. How will these new activities affect what you pay your employees in the future?
- How will that impact your ability to recruit and retain employees in these jobs?

## **Appendix C: Survey Instrument**



The **Northern Plains & Rocky Mountain Consortium** researching the green economy  
Iowa, Montana, Nebraska, South Dakota, Utah, & Wyoming



We are conducting a survey about jobs in our economy where green activities result in environmental benefits. Your response to the survey is important even if you do not consider your business activities to be green. Please complete all items to the best of your knowledge by completing the survey form and returning it in the envelope provided, or by faxing it to (877) 827-9511. **Please respond by September 7, 2010.**

**If your business is not currently in operation, please indicate which situation best applies and return the survey form in the envelope provided. Thank you for your time.**

- ☐ **Temporarily out of business**
- ☐ **Permanently out of business**
- ☐ **Sold/Merged**

**If you have any questions about the survey, please contact:**  
**Patrick Manning at pmanni@state.wy.us or (866) 579-3873.**

## Company Information

**1. How many employees does your organization currently have at this location?**

*(do not include contractors or temporary employees)* \_\_\_\_\_

**2. Your *company* may be involved in more than one of the green economic categories listed below, but please check the box that most closely corresponds to the primary green category within your business.**

- ☐ **Renewable Energy and Alternative Fuels**  
*Manufacturing, construction, design, research, delivery, operation, storage or maintenance of wind, solar, biomass, hydro, alternative transportation fuels, geothermal, methane and waste incineration as a fuel source.*
- ☐ **Energy Efficiency and Conservation**  
*Manufacturing, construction, or installation of energy efficient products, energy efficiency services, weatherization, building retrofitting/efficiency, energy efficient production processes, energy distribution improvements, and transportation technology.*
- ☐ **Pollution, Waste, and Greenhouse Gas (GHG) Management, Prevention, and Reduction**  
*Activities related to controlling emissions and pollution. Includes controlling and reducing greenhouse gas emissions, waste water, and other pollutants.*
- ☐ **Environmental Cleanup and Restoration and Waste Clean-up and Mitigation**  
*Environmental restoration including the cleanup and disposal of pollution, waste, and hazardous materials; Superfund/Brownfield redevelopment; and landfill restoration.*
- ☐ **Education, Regulation, Compliance, Public Awareness, and Training and Energy Trading**  
*Activities that educate on energy efficiency, renewable energy, energy rating systems certifications, and more efficient energy consumption. Enforcement of compliance requirements and regulations, and training on effective use of energy related products and processes.*
- ☐ **Sustainable Agriculture and Natural Resource Conservation**  
*Products and services to conserve, maintain and improve natural resources and environment, including low carbon and organic agriculture, land management, water management and conservation, wetlands restoration and environmental conservation.*
- ☐ **None of the Above** *This establishment does not participate in any of the above green categories.*

This portion of the survey is intended to capture information on employees directly performing green-related activities as a part of their job duties. Even if you answered “None of the Above” on question 2, you may have employees performing green-related activities. Do not include:

- consultants, contractors or temporary agency employees not on your payroll;
- employees not directly involved in green activities, such as administrative support employees; or
- employees who perform green activities that do not directly contribute to your business's product or service, like those that carpool or recycle.

**3. Based on these instructions, how many employees at this location perform green-related activities? \_\_\_\_\_**

Please fill out the matrix below by job title for your green employees. If you have no green employees, continue to the next page.

Job Title & Brief Description  <i>Only list current jobs which produce a product or service that can be considered green. (please do not use acronyms)</i>  <i>List job title and briefly describe duties related to green related activities.</i>	Total Employees  <i>Number of employees that have this job duty.</i>	Minimum Education/Training Requirement  <i>Use the following codes: 1 = No Requirements 2 = HS Diploma/GED 3 = Post HS, No Degree 4 = Apprenticeship/ On-The-Job Training 5 = Trade Certified 6 = Vocational Degree 7 = Associate Degree 8 = Bachelors Degree 9 = Graduate/Professional Degree</i>	Special Requirements  <i>Please list any required licenses, certificates or other training above and beyond the normal requirements of this occupation which are necessary due to the green activities of this position. (please do not use acronyms)</i>	Number of workers having green job responsibilities. <i>(based on percent of time dedicated to green work)</i>		
				Between 1% - 49%	Between 50% - 99%	100%
<i>Example: Wind Turbine Technician - Installs &amp; repairs wind turbines</i>	7	5	<i>Renewable energy technician certification</i>	2	4	1
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						
11.						
12.						
13.						
14.						
15.						

<sup>1</sup> A vacancy exists if it meets the following criteria: a specific position exists; work could start within 30 days; and you are actively seeking workers to fill this

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[illegible]

*position.*



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Once completed, return this survey form in the envelope provided  
or cut and fax to (877) 827-9511

<b>Contact Information:</b>		Date Completed		/		/	
Name:							If your organization would like a copy of the findings, how would you like them delivered? <input type="checkbox"/> Email <input type="checkbox"/> Postal Mail
Phone Number:							
Email:							

Thank you for taking the time to provide us with this valuable information.



## Appendix D: Wyoming Community Colleges and University of Wyoming Environmental Programs of Study Offered

Compiled by S. Sauley, Senior Economist, Wyoming Department of Employment, Research & Planning (prepared January 2011)

College or University	Contact Information	Enrollment <sup>a</sup>	Description
Casper College	125 College Drive Casper, WY 82601 800-442-2963 307-268-2100 <a href="http://www.caspercollege.edu/">http://www.caspercollege.edu/</a>	4,478	Casper College offers certificate and Associate's degree programs in environmental science. Also offered is a program in water quality technology. According to their Continuing Education Courses bulletin, Casper College is offering short-term training in the following areas: accredited geothermal installer; LEED "green associates" training; and LEED "AP building design+construction." It is unclear if these three programs will be permanent program offerings or only for spring 2011. In addition, Casper College is offering a lecture series in green building and hosting a green conference in March 2011.
Central Wyoming College	2660 Peck Avenue Riverton, WY 82501 307-855-2000 1-800-735-8418 <a href="http://www.cwc.edu/">http://www.cwc.edu/</a>	2,404	CWC offers two programs of study: environmental science & leadership; and environment, health & safety - environmental technician.
Eastern Wyoming College	3200 West C Street Torrington, WY 82240 866-327-8996 800-877-9965 <a href="http://www.ewc.wy.edu/">http://www.ewc.wy.edu/</a>	1,391	EWC offers a program in weatherization. One certificate is offered for weatherization technician (17 credit hours) and the other is offered for advanced weatherization technician (34 credit hours).
Laramie County Community College	1400 East College Drive Cheyenne, WY 82007 800-522-2993 <a href="http://www.lccc.wy.edu/">http://www.lccc.wy.edu/</a>	4,905	LCCC offers a heating, ventilation, and air conditioning/ refrigeration (HVAC/R) program with a focus on energy efficiency.

			Both an Associate's degree and a certificate are offered in the program. Also offered is an Associate's degree for wind turbine technician.
Northwest College	231 West 6 <sup>th</sup> Street Powell, WY 82435 800-560-4692 <a href="http://www.northwestcollege.edu/">http://www.northwestcollege.edu/</a>	2,099	None offered.
Northern Wyoming Community College District	3059 Coffeen Avenue Sheridan, WY 82801 800-913-9139 307-674-6446 <a href="http://www.sheridan.edu/site/">http://www.sheridan.edu/site/</a>	3,899	NWCCD offers a program in natural resources & ranch land management. Among the careers pursued by individuals who achieve an Associate's of Science are "in range management, ranch land management, wildlife management, restoration ecology, and environmental consulting."
Western Wyoming Community College	2500 College Drive Rock Springs, WY 82901 307-382-1600 <a href="http://www.wvcc.wy.edu/">http://www.wvcc.wy.edu/</a>	4,079	None offered.
University of Wyoming	UW Admissions Dept. 3435 1000 E. University Avenue Laramie, WY 82071 800-342-5996 307-766-5160 <a href="http://www.uwyo.edu/">http://www.uwyo.edu/</a>	12,427	UW offers a variety of programs in environmental studies. They include environmental engineering; an interdisciplinary program through the School of Environment and Natural Resources; and research through the Institute of Environment and Natural Resources. In addition the School of Energy Resources offers lectures in renewable energy.

<sup>a</sup>Enrollment figures are from the National Center for Education Statistics,  
<http://nces.ed.gov/collegenavigator/?s=WY>