

A Change in Course: Jobs and the Regulatory Environment



Energy Efficiency



A Change in Course:

Jobs in the Regulatory Environment

Wyoming Department of Employment

Joan Evans, Director

Research & Planning

Tom Gallagher, Manager

Prepared by:

Sylvia D. Jones

Edited by:

Phil Ellsworth

Michael Moore

Submitted for Publication March 2011

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Introduction

As mandated by the Green Jobs Act of 2007, state labor market research, information, and labor exchange programs must identify job openings in burgeoning industries with an emphasis on energy efficiency and environmental benefits. The goals of this jobs initiative are to provide information on the number of energy-efficient jobs and trends over time as well as provide information on industrial, occupational, and geographic distribution of these jobs. As such, there is a growing demand for information about which industries contain these types of jobs, how many workers are employed in these jobs, how many openings are expected in the near future, and the skill and education requirements for these jobs. The information is required to ensure employer, worker, and community competitiveness. Objective data must be made available to the employment and training system so that it can efficiently and effectively respond to the needs of workers and employers.

The regulatory environment is ubiquitous in energy efficiency. In fact, all energy efficiency innovations need to be evaluated for their potential environmental impact and a determination made as to whether or not they will need to be regulated. Few realize that even those technologies with the most benevolent appearance may have side effects needing regulatory attention. For instance, oil used in wind generator gear boxes and water returned from ground source heat pump systems are likely to require regulatory oversight. However, beyond the termination of this project no entity has the designated

responsibility for identifying the impact of innovation on the human resource needs of either the regulator or the regulated.

The lack of regulatory oversight also can halt ongoing production that uses new technology. In April 2010, the Wyoming Oil and Gas Commission stopped field testing that used microbes to generate natural gas from coal because the state had no regulatory process that oversaw microbial conversion projects (Fugleberg and Pelzer, 2011).

Before any research can be conducted, a set of definitions must be established. Through collaboration of state and federal entities, it was established that there are two types of energy-efficient jobs (Sommers, 2010). The first includes jobs in businesses that produce goods or provide services that benefit the environment or conserve natural resources. These businesses include those that produce energy from renewable sources, improve energy efficiency, reduce or remove pollution, reduce emissions of greenhouse gases, recycle wastes, conserve natural resources, regulate or enforce environmental compliance, provide education and training on environmental issues, or promote public awareness about the environment, among others.

The other type of energy-efficient jobs include jobs in which workers' duties involve making their establishment's production processes more environmentally friendly or use fewer natural resources. In this case, the nature of the business is not energy efficient, but the job within the business is involved in improving energy efficiency, reducing or removing pollution, reducing

emissions of greenhouse gases, etc. (Sommers, 2010).

The two definitions of energy-efficient jobs are not mutually exclusive. In the regulatory environment, especially in Wyoming, the duality is especially apparent. Many fossil fuel industries (coal mines, for instance) have separate functions (coal-to-liquid gasification) and associated workers that are decidedly involved in activities intended to increase energy efficiency.

Despite the common language, limited state budgets have led to fragmented research efforts and little usable information. In an effort to increase the amount of available information, the Northern Plains and Rocky Mountain Consortium was established in 2009 through a USDOL Labor Market Information Improvement Grant. The consortium is composed of representatives of Iowa, Montana, Nebraska, South Dakota, Utah, and Wyoming. By combining resources, the partnership aims to build upon research already conducted in the individual states and expand it into neighboring states, and to construct models that can be emulated in other regions and labor market information consortia.

While the consortium is focusing on several areas of research, this particular section addresses energy-efficient jobs that are the product of the regulatory environment. The purpose of this section is to identify and quantify skill and competency requirements, establish a listing of renewable energy businesses and related employment, anticipate industry growth, and recognize technological applications affecting labor

requirements unique to the regulatory environment.

State Setting

Wyoming is comprised of a total geographical area of 97,814 square miles, most of which is land area (97,100 square miles). The climate is generally considered semi-arid and is known to be dry and windy, especially when compared to other states in the Rocky Mountain region. An estimated 544,270 people (5.6 persons per square mile) were living in Wyoming during 2009 (Liu & Bittner, 2010), representing the largest population growth between 2008 and 2009 of any state in the nation. The median household income in Wyoming was \$52,664 in 2009, compared to \$50,221 for the United States. This placed Wyoming as the 20th highest in the nation (Liu, 2010).

According to the Bureau of Labor Statistics (2010), there were about 273,000 people working in Wyoming during October 2010. About 20,000 were unemployed, and the state had an unemployment rate of 6.7%. The economic life of Wyoming is largely sustained by mining, including petroleum and natural gas production. Taxes on mineral production makes up close to two-thirds of total government revenue, including severance taxes, federal mineral royalties, mineral property taxes, and coal lease bonuses (McVeigh, 2006).

Methodology

A comprehensive literature review was

conducted during July and August 2010 to establish a foundational knowledge of the Wyoming regulatory environment. Example documents reviewed included the 2011-2012 budget requests for sections within the Wyoming Department of Environmental Quality (DEQ), the Wyoming laws specific to the functioning of the Wyoming DEQ, and media related to environmental issues. The researcher was also supplied with an overview of Wyoming DEQ rules relative to jobs and industries that may be affected by regulation; this overview was created by R&P Manager Tom Gallagher. In addition, Wyoming DEQ data were used to establish a basic outline of industries likely regulated by the various sections of Wyoming DEQ and the occupations associated with the industries. Contact was made with an administrator of the Wyoming DEQ and consent was obtained for project participation.

A similar research project was under way in South Dakota where the Labor Market Information (LMI) Center in the South Dakota Department of Labor was initiating contact with the Department of Natural Resources. Initial interviews in each state with their respective regulatory entities revealed that the staff members in these two agencies were not comfortable using standard classification systems for occupations and skills used in LMI to describe the current and future demand for labor. Given these conditions, the LMI offices in each state selected an interview strategy for data collection that relied on open-ended questions and post-interview coding of human resource issues to the Standard Occupational Code, O*NET skills, and the identification of academic degrees and certificates. While this strategy limits the ability to quantify the demand for labor in all of the desired detail, it

must be recognized that researching the regulatory environment for its impact on job requirements and the future demand for labor is in its exploratory phase. Given the circumstances, the methodological approach used to develop this report is probably the most defensible.

In September 2010, a Wyoming DEQ administrator selected representatives from the various Wyoming DEQ departments to be interviewed. Each selectee was sent an e-mail explaining the project and instructing that person that an R&P staff member would contact them to schedule an interview. Within two weeks of sending the explanatory e-mail, another e-mail was sent referencing the original message and requesting a telephone interview.

All interviews were conducted by the same staff member and were conducted between September 6, and November 1, 2010. Twelve persons were interviewed, and interviews lasted approximately 30 minutes. Each interview started with a brief explanation of the project and an assurance that while the information gathered from the interview would be used in a final report, the respondent would not be personally identified. Each participant agreed to continue with the interviews after being given a chance to ask questions. When the interviews were completed, the responses were combined into an overview, which was given to the R&P manager for review.

Another interview was completed with the Human Resources department during the last week of November 2010. While not identical, the questions were similar to those asked of the department representative.

After all interviews were completed,

data were combined to establish qualitative answers to the questions posed by the consortium. Information was gleaned from the interview conversations as a whole, rather than from specific, verbatim answers to specific questions. In many cases, for example, the respondent gave a great deal of information regarding skill requirements while answering other questions; however, when asked specifically about skill requirements, the respondent could think of very few. By looking at the interview as a whole, a more comprehensive picture of the jobs associated with the regulatory environment was made.

Quantitative data were gathered from the Wyoming Long-Term Projections 2008-2018 in order to establish expected employment trends for the designated energy-efficient jobs. Current projections serve as a baseline from which to assess the impact of federal, state, and private sector investments in regulation, technology, and new systems. One purpose of the current research with the Wyoming DEQ is to identify points of departure from the expected employment trends. We hope 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 energy-efficient technologies.

Background Information on DEQ

The Wyoming Department of Environmental Quality seeks to

“contribute to Wyoming quality of life through a combination of monitoring, inspection, enforcement, and restoration/remediation activities which protect the environment while supporting responsible stewardship of the state’s resources” (DEQ Budget Request, 2010). The agency employs 268 individuals who collectively work to minimize environmental pollution while enabling responsible economic development within the state. There are six divisions within DEQ, not including 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, or 20% of all businesses 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 General Funds.

Air Quality

The Air Quality Division of DEQ requested \$19,494,172 for the overall budget, including funding for 74 full-time positions. Then-Gov. Dave Freudenthal recommended approval of \$19,309,545 and only 73 positions as one had been vacant for 22 months prior to the request for funding.

The purpose of the Air Quality program is to protect the public health and welfare from the harmful effects of air pollution. They work 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.

The major program activities include:

The construction permit review and issuance activity reviews plans for all new emission sources, or modifications of existing emission sources, to ensure that the source is built with Best Available Control Technology to limit emissions to the lowest technically and economically achievable level to minimize impact to Wyoming's air resource. W.S.35-11-110

The operating permit (Title V) review and issuance activity 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. W.S.35-11-203

The compliance review and facility inspection activity 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. W.S.35-11-110

The planning activity is charged

with 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. W.S.35-11-110

The workload of the Air Quality Division has increased during recent years and is expected to continue to increase despite the recent economic downturn in Wyoming. 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 and are required to address any new compliance monitoring requirements.

The Air Quality Division's compliance workload is expected to increase similarly. At the end of FY-09 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 and agricultural wastes (Lacock, 2010). The plant is slated to begin construction sometime during 2011 and 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. They 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, they are also required to address unique air quality issues as they arise. For example, the Upper Green River Basin has higher than average wintertime ambient ozone levels. The Air Quality Division is working to develop strategies to address 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 to decrease the resulting air pollution.

Water Quality

The Water Quality Division of DEQ requested \$24,179,280 for the overall 2011-2012 budget, including funding for 75 full-time positions. The governor recommended approval of the funding and staffing levels.

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 carrying out enforcement activities by protecting surface and groundwater from pollution. W.S.35-301,302,901

Permitting the construction of public water distribution systems and treatment plants, and wastewater collection systems and treatment plants. W.S.35-11-301, 302

Assuring the technical competence of operators of public water supply systems and municipal wastewater systems by requiring operator certification. W.S.35-11-302

Providing 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 section also manages the State Revolving Fund programs for the construction and upgrading of sewer and water systems. W.S.35-11-302, 16-1-201-207, 26-1-301-308

Subdivision application reviews result in recommendations to County Commissioners as to the safety and adequacy of proposed sewer and water

systems for subdivisions. W.S.18-5-306

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.

The Information Processing and Support section performs functions such as data management, document development, proof reading, filing for disbursement, etc.

Earlier this year, 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 initiate or enhance 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 proprietary. However, because of the potential for the fracking fluids leaching into groundwater, the ingredients are required to be given to the division.

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 DEQ 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 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 its stability over an indefinite period. 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 Wyoming Oil and Gas Conservation Commission, the division regulates all carbon sequestration projects in the state.

Land Quality

The Land Quality Division requested \$9,646,460 to include funding for 47 full-time employees. The governor recommended approval of the request.

The purpose of this division is to ensure that mining and exploration for solid minerals are conducted in a manner that protects the public and the environment from harmful impacts. The program also ensures the land 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 coal mining and exploration including reclamation, monitoring, and bonding to ensure reclamation of the mine in the event of operator failure.

Issue permits for non-coal mining and exploration including reclamation, monitoring and bonding to ensure reclamation 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.

Wyoming's coal program is the smallest of the major coal producing states, despite the amount of coal produced, the number of acres involved in coal production, or the

number of permitting actions initiated by coal operators. The budget and number of personnel are similar to those of surrounding states even with a new mine recently permitted and several other new mines planned or in the permitting stages. The division is likely to remain busy; the Bureau of Land Management has initiated the process to lease more than 4 billion additional tons of coal that will result in significant permitting activity.

In addition to the coal program, this division also oversees uranium mine operations. The recent resurgence of interest in uranium resulted in four additional mining permit applications in addition to a major amendment to an existing application. Another six mine applications are expected within two years. In addition to work related to permitting, uranium adds workload to the division because of the special interest groups, concerned citizens, and competitors who have questions about operator compliance with Wyoming law.

According to a Casper Star-Tribune article (2010), the state is losing significant tax revenue because of the slow permitting process. Industry has consistently criticized state regulators over the permitting backlog, which has reportedly grown as mineral production has increased. The number of individuals employed by the permitting agency has stayed fairly constant despite the increase in demand. The article cites John Corra, the director of Wyoming's DEQ, as saying the Land Quality Division needs another seven people to meet the current workload. The mining industry has proposed its own solution: the state should allow the industry to hire its own contractors to perform permit reviews; the Wyoming Mining Association proposed

an amendment to the Environmental Quality Council statutes to allow for this (Joint Minerals, Business & Economic Development Committee, 2010). While that solution is opposed by environmental and watchdog groups, it may be the only solution if additional DEQ positions are not funded.

Solid and Hazardous Waste

The Solid and Hazardous Waste Division requested a total of \$15,241,154 including funding for 46 positions. The governor recommended \$14,241,154 to include funding for the same 46 positions.

This 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, this 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 works to remediate these sites at the state's expense should the facilities experience a release of a regulated substance. Specifically, the division engages in the following activities:

Permitting new and existing solid waste management facilities are the primary mechanism for managing municipal, commercial, and industrial solid wastes. W.S.35-11-501-515

Administering a state grant award program to local government entities that own or are responsible for any municipal solid waste landfill for the

purpose of completing groundwater monitoring activities to identify which landfills in Wyoming are currently contaminating, or have already contaminated, groundwater. W.S.35-11-521-522

Administering an integrated solid waste management planning review and cost reimbursement program to local government entities that own or are responsible for solid waste landfills and must prepare and maintain integrated solid waste management plans that describe local management of solid wastes generated within their jurisdictions. W.S.35-11-1901-1904

Permitting and overseeing corrective action cleanup operations at hazardous waste treatment, storage, and disposal and other contaminated facilities to ensure protection of the public health, welfare, and environment. W.S.35-11-516-520

The voluntary remediation program continues to work with owners of contaminated sites to clean up those sites that will allow prompt reuse and redevelopment of contaminated properties and to develop and/or revise program guidance documents, as necessary, to assist contaminated site owners. W.S.35-11-1601-1613

The targeted brownfields program provides an incentive with limited financial and technical assistance to government entities for site assessments and corrective actions where the existence of contamination is impeding an economic development project. W.S.35-11-1601.

Contaminated sites considered

to be orphan sites are identified, inventoried, prioritized, and remediated, as funds are available and allow, to protect public health and the environment. W.S.35-11-1701

The solid and hazardous waste inspection and compliance program inspects solid waste management facilities, hazardous waste management facilities, and generators and transporters of hazardous waste and used oil to ensure compliance with applicable state regulations. The program also ensures compliance with waste management standards through educational outreach, technical assistance, and enforcement activities, as needed. W.S.35-11-109.

The storage tank program administers the corrective action which funds remedial activities of releases from regulated storage tank systems. A storage tank compliance program supports the remediation program with the purpose of preventing future soil and/or groundwater contamination caused by storage tank systems. W.S. 35-11-1414-1428.

This division is currently involved in landfill testing for groundwater pollution. Since 2006, the Wyoming legislature has designated \$8 million to test for groundwater contamination at landfills throughout the state. Of the 76 tested so far, about 96% have shown evidence of contamination. State regulators estimate the cleanup effort to take over 20 years and more than \$200 million (Bleizeffer, 2010).

Abandoned Mine Reclamation

The division requested \$60,123,709 to

include funding for 12 full-time employees and 1 AWEC position. The governor recommended \$33,400,000 for the same number of positions.

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 other mineral mining through construction contracts for the reclamation of abandoned mine sites. To achieve this purpose, the program engages in the following:

Management of engineering contracts for design and construction inspection services, and construction contracts for the reclamation of abandoned mine sites including mitigation of hazards to public safety and human health associated with such sites.

Disbursal of funds for program functions, accountability for program funds, selection of engineers and general contractors, evaluation of project applications, engineering and construction proposals, evaluation of completed projects.

To date, the program has reclaimed or contracted for reclamation of more than 900 abandoned mine sites, to include a total of over 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 as well as to 35 different research projects aimed at improving the efficacy and efficiency of mine land reclamation efforts.

The program also manages a Mine Subsidence program which offers protection

from the effects of mine subsidence to property owners in mine-occupied areas. Those who benefit from the program are compensated for damages to structures located over historic mine voids if the damage can be attributed to subsidence caused by mining activities. More than 750 home and business owners in mining impacted communities have acquired subsidence insurance through the program.

Results

Identify and Quantify Skill and Competency Requirements

During the interviews,

participants were asked to identify occupations and skills necessary for success in the regulatory environment, either on the regulatory side or on the industry side. The most common answers are found in Table 1. Engineering was, by far, the most commonly mentioned occupation and educational preparation. Some divisions felt strongly that the professional engineer certification was important for success while others felt it was of little importance. One division manager stated, “Professional engineer certification has not proven itself to me to be overly useful.” Another stated that applicants had little chance of employment without the certification.

many in the regulatory environment as an indicator of education, not experience. “We have some issues filling positions in that we want people who have some experience in the industrial activities they are regulating.” According to both human resources and the various managers, finding educated applicants is not difficult. Finding educated applicants with experience is far more challenging.

Groundwater sciences were mentioned frequently during interviews with managers as common educational backgrounds for both employees and industry representatives. Specifically, occupations such as groundwater hydrologist, groundwater modeler, and hydrochemist were mentioned. While engineering and geology specialists were typically educated at the bachelor’s level, those in the groundwater sciences were typically educated at the master’s or doctoral level. Individuals with this type of background were typically employed by industry or consultants to specifically address groundwater issues. They interacted directly with those in the DEQ but were usually not employees of the department itself.

Similarly, geologists were mentioned by most of the managers interviewed but the professional geologist certification was viewed differently by different divisions. In one division, the professional designation is required in order to review permit applications. However, the designation is not necessarily a marker of applicant quality. Like the professional engineer certification, the professional geologist certification is seen by

Table 1: Occupations in the Regulatory Environment

Occupation
Engineer
Geologist
Groundwater Hydrologist
Groundwater Modeler
Hydrochemists
Biologist
Chemist
Botanist
Soil Scientist
Wildlife Manager
Toxicologist
Archaeologist
Statistician
Service Technician
Wastewater Plant Operator
Landfill Manager

Another commonly mentioned occupation and educational background is the natural sciences. This includes specialties such as biology, botany, chemistry, soil science, wildlife management, etc. Within this category, education level varies from a bachelor's degree to a doctoral degree, depending upon the specialization and job function. Several DEQ managers stated they sometimes hire applicants with a general, natural science education, such as biology, and then provide the applicant with job-specific training. The interviewees indicated that for most jobs in regulation, a basic science understanding is vital so that job-specific knowledge can be added on. On the industry side, those with a natural science background tend to be specialized and hold advanced degrees. Like those educated in groundwater sciences, those in natural sciences, such as toxicology, are often hired by contractors to address specific parts of projects or permit applications.

A social science background was mentioned by a few of the managers interviewed; specifically, statistics and archaeology. Archaeology was important for the cultural clearance process necessary for the permitting process and statistics was mentioned as important for compliance evaluation. While none of the managers stated they seek out applicants with a social science education, many mentioned they look for skills learned through education in these fields. Cultural clearance, or the survey of any culturally-sensitive resources, may become a larger issue as more lands become available for leasing and permitting.

Several technical occupations were also listed by those interviewed. For

instance, service technicians, wastewater plant operators, and landfill operators were mentioned specifically. In these cases, the level of education was not as important as the skill level acquired through experience. Some of the managers mentioned that they would prefer to hire applicants with the minimum required education (bachelor's degree in engineering or science) who also had industry experience. Otherwise, all of those interviewed mentioned working with technicians on the industry side. Technicians carry out the plans created by the engineers and are often involved in compliance inspections because they understand the day-to-day working of the facilities.

The skills mentioned by interviewees are listed in Table 2 (see page 17). The most commonly mentioned include oral and written communication, which were mentioned by everyone interviewed. These translate to "speaking" and "writing" in the Occupational Information Network (O*NET) Basic Skills category (O*NET, 2010). Speaking and writing, while discrete skills, are closely related to the Social Skills category. Those interviewed were generally unaware of O*NET skill classification. As such, it fell to the researcher to translate their qualitative answers into quantitative data, specifically by applying O*NET skill assignments. In the case of "oral communication" or "written communication," as stated by the interviewees, the meaning went beyond the ability to speak and included more of the social skills such as "persuasion." As such, Table 2 is not necessarily a direct count of skills listed by those interviewed but rather reflects an interpretation of their answers. However, there were some instances where the actual basic skill was referenced. For instance, grant writing, a

form of writing, was specifically mentioned by one manager. Similarly, contract writing was listed as important by another manager.

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.” While not specifically mentioned by anyone interviewed, it is likely that the other basic skills of active learning, active listening, and learning strategies are also required for success in both the public and private regulatory environment.

Table 2: Skills Necessary for Success in the Regulatory Environment

		Technical Skills	Basic Skills		
Geology	8	Engineering	Active Learning		
Groundwater Science	8	Slope Stability Analysis	Active Listening		
Biology and Botany	7				
Industrial Activities, Including Exploration, Drilling, Well Construction, Exploration	6	Construction Design	Critical Thinking	Critical Thinking	Problem Solving
Engineering, misc.	5	Establishing Priorities	Learning Strategies		
Chemists, Including Geochemistry and Toxicology	4	Professional Bid for Services	Mathematics	Statistics	Accounting
Soil Science	3	Computer Skills	Monitoring	Monitoring and Inspection	Physical Observation
Professional Engineers	3	GIS	Reading Comprehension	Reading Comprehension	
Wildlife Management	3	Mapping Applications	Science	Science Foundation	
Engineering, Civil	2	AutoCAD	Speaking	Oral Communication	
Engineering, Environmental	2	GPS Use	Writing	Written Communication	
Landfill Design and Operation	2	Computer Skills			
Social Sciences Such as Statistics and Archaeology	3	Database Skills			
Service Technicians	2	Groundwater Investigation and Characterization	Resource Management Skills		
Wastewater Plant Operator		Waste Treatment	Management of Financial Resources	Project Management	
		Waste Disposal Practices	Management of Material Resources	Project Management	
		Remediation	Management of Personnel Resources	Project Management	
		Technical Knowledge Work Independently	Time Management	Time Management	
			Social Skills		
			Coordination	Collaboration	
			Instruction		
			Negotiation	Contract Negotiation	
			Persuasion		
			Service Orientation		
			Social Perceptiveness		

All of the resource management skills were mentioned or implied during interviews of the DEQ managers. “Time management” was mentioned by nearly all of those interviewed. “Management of financial resources,” “management of material resources,” and “management of personnel resources” were not mentioned specifically by name but were implied. For example, “We have ‘x’ amount of dollars and ‘y’ number of projects that need remediation. We have to prioritize the projects and decide which ones get funded first.” Another example is, “We monitor a wide variety of industries but we inspect higher risk categories much more frequently than the lower risk categories because we just can’t get to them all. We have to decide, from all of the places that need to be inspected, which ones are the most likely to cause problems. Then we inspect those.” The term “project management” was used by several different managers. The term implies use of all the resource management skills.

Similarly, all of the social skills (“coordination,” “instructing,” “negotiation,” “persuasion,” “service orientation,” and “social perceptiveness”) were mentioned by interviewees as important either directly or indirectly. Included in this category are what most people referred to as “people skills.” Other variations include “ability to work with other agencies,” “ability to work with difficult people,” “ability to tell people something they don’t want to hear,” and “ability to deal with people.” All of the managers explained that they have contact with the public to some degree. Therefore, it is expected that individuals in their sections are able to effectively work with other people regardless of situation.

Finally, domain-specific technical skills mentioned by those interviewed

are also included in Table 2. These skills do not correspond to an O*NET category. They include such abilities as slope stability analysis, construction design, GIS, autoCAD, GPS use, waste disposal practices, mediation processes, engineering, and database administration, among others. In addition, all managers stated that applicants who are hired into the different divisions are expected to gain on-the-job training in order to acquire the specific knowledge base required for the job.

Establish a Listing of Renewable Energy Businesses and Related Employment

DEQ was unable to provide an extract from the state vendor system for the contractors they hire. A list of regulated industries in NAICS, based on DEQ rules and interviews, is provided in Table 3 (see page 19).

As previously established, there are two types of energy-efficient jobs (Sommers, 2010). The first, which includes jobs in businesses that produce goods or provide services that benefit the environment or conserve natural resources, is the easiest to establish specific industries and associated businesses. However, the second, those which include jobs wherein the workers’ duties involve making their establishment’s production processes more environmentally friendly or use fewer natural resources, is much harder to identify because workers in any industry can be charged with improving the efficiency of a process. Even in the regulatory-specific environment, any industry could be affected. For instance, Educational Services (NAICS 611000), an industry seemingly unrelated to

Table 3: Regulated Industries by NAICS Code, as Referenced on DEQ Rules and Interviews

Air Quality Division

NAICS Code	Industry	
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

NAICS Code	Industry	
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

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	Beet Sugar Manufacturing	
562991	Septic Tank and Related Services	

(Table continued on page 20)

regulation, is subject to DEQ oversight because of the amount of electronic hazardous waste – obsolete or broken equipment, for example – produced. In Wyoming, most of the energy-efficient jobs are of the latter type. Because of regulatory requirements, it is likely that many firms in the state hire individuals for environmental monitoring, either as the sole job duty or as one of many job duties. However, firms working exclusively in energy efficiency are very rare in the state.

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 2 years by R&P and can be found online at <http://doe.state.wy.us/LMI>.

wy.us/LMI/projections.htm. R&P also has produced specialized occupational projections related to environmental health and safety (Gallagher, et. al, 2008).

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. Regulatory impacts on occupational requirements will be discussed at length in the next section. Turnover is the focus for this section.

Each of those interviewed were asked questions about turnover. Specifically they were asked how often they had openings in their section, how difficult it was to fill positions, and where those who left typically found employment. The results were very similar among the different sections. The answers to each question were all interrelated and related to the local economy. Specifically, each manager stated that when the economy is in a downturn, there are very few job openings because

(Table continued from page 19)

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

of fewer opportunities available elsewhere. Furthermore, when openings do occur, they are easily filled. According to one manager, "Right now, in this economy, there are lots of underemployed engineers and geologists. It is pretty easy to fill any open positions."

Conversely, a growing economy results in difficulty hiring and retaining qualified individuals in DEQ. "There was a spell during the coalbed methane boom where there was a great amount of drilling and development of the gas fields in the state. Recruiting some positions was very difficult during that time because educated

individuals were being taken over by the industry."

Another manager indicated that some positions are always difficult to fill, regardless of the outside economy. "It is, however, always difficult to fill technical positions. It all has to do with pay scales." Comments about pay were repeated by several of those interviewed. The higher pay offered by private industry was noted as a reason the state has difficulty competing. "I don't think private industry has any difficulty in recruiting educated workers because they pay so much more than we do. Especially since we train most of them first." The pay differential was also cited as a factor

in retaining qualified individuals. “DEQ is a really good training ground. Private industry looks to employees with DEQ experience and offers them more than we can pay them. This is especially true of the younger workers. There is very little turnover in our senior level workforce.”

According to wage record analysis by R&P, there was a 27.2% overall permanent exit rate from DEQ between the start of 2006 and the end of 2009. The percentage varied substantially depending on occupation, education and training, and age at time of exit. A significant portion (28.3%) of those working for DEQ are eligible for retirement within 10 years (or are age 55 or older). As with other state government agencies, impending retirements makes succession planning an important issue. Succession planning is defined as a “process that not only seeks to identify areas within an organization that will not have enough workers as older employees retire, but also seeks to identify areas of workplace satisfaction that could be improved upon to increase worker retention” (Knapp, 2009). However, each of the managers indicated he or she has a substantial workload, and many are expecting increased work related to changing legislation. Few, if any, would be able to invest the time required for succession planning.

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.

New technologies have the potential to increase or decrease regulatory workload. One interviewee said, “There is always something new on the horizon. The firms we oversee oftentimes come up with new technologies that someone is out there testing. Normally we use standard technologies but we are always looking for innovative technologies, especially if they are green. Green technologies are the new thing. But it is hard to prove them because they are new.” In this case, the manager was referring to technology related to remediation. Finding ways to increase the effectiveness and efficiency of remediation could decrease the workload of regulatory staff.

There are some industries in which automation is more practical than in others. For instance, with the continued increase in air quality standards, IT-related systems for monitoring emissions are becoming more common. There is a push to automate as much as possible in order to accommodate the increase in expectations. Computerized systems in industry could decrease the workload for DEQ staff because more of the oversight functions can become automated.

Alternatively, technological innovation has the potential to increase the workload for those charged with monitoring and compliance. For example, wind generators have gear boxes that generate used oil every month. Because the used oil is considered a hazardous waste, its disposal must be monitored. A significant increase

in the number of wind generators would result in an increased need for monitoring staff, especially in the Solid and Hazardous Waste Division. However, if the generators were to decrease the use of coal-generated power plants, the workload of the Air Quality Division may similarly decrease.

Another example of energy-efficient technology having the potential to increase regulatory workload is the ground source heat pump system. Because the system uses water to extract heat from the earth and then reinjects the water after use, it requires oversight by the Water Quality Division. Staff time is required for every system in use to include time for permitting, inspecting, and monitoring.

Coal-to-liquid gasification is a developing technology with implications for the regulatory environment. Medicine Bow Fuel & Power LLC is developing a coal-to-liquids facility near Medicine Bow that is projected to produce 13,000 barrels of ultra-low sulfur diesel and naphtha per day (Wyoming State Engineer's Office, 2007). While certainly considered an energy-efficient project, there are permitting and oversight implications for the Air Quality Division, the Water Quality Division, Land Quality Division, and likely the Hazardous Waste Division.

Carbon sequestration is another energy-efficient innovation that could substantially alter the workload of compliance staff. One of the four major categories of risk associated with geologic sequestration of carbon dioxide includes contamination of underground sources of water, which may include potable water (Carbon Sequestration Working Group, 2009). Because of this risk, the Water Quality Division is integral to the future of carbon sequestration in Wyoming. This division's presence is required throughout the phases of the sequestration

process, from characterizing potential sites through the long-time stewardship of the closed site because of the associated risk to groundwater supplies. This equates to significant staff resources.

Another example includes the renewed interest in uranium mining. The mines themselves are regulated as well as the uranium itself as it is stored and transported. Biostimulation is an emerging technology related to remediation effort that if developed will very likely place additional demands on DEQ permitting staff. In short, biostimulation is the injection of specific microbes that ingest, and thereby remediate, contamination caused by methane, oil, or even uranium.

Most managers also mentioned that changing legislation will significantly affect regulatory workloads. 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.

In September 2009, the U.S. Environment Protection Agency announced a proposal that would require facilities emitting over 25,000 tons of greenhouse gases per year to obtain permits demonstrating use of best practices for minimizing emissions. Carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride would all be included in the monitoring. The required permitting process would affect Wyoming-based power plants as well as

landfills, placing additional burden on the Air Quality Division.

Also affecting the Air Quality Division would be the implementation of the one-hour National Ambient Air Quality Standards for nitrogen dioxide (NO₂) and sulfur dioxide (SO₂) (Andracsek, 2010). The proposed one-hour SO₂ standard significantly affects coal-fired power plants, like those found in Wyoming. It will be nearly impossible for an unscrubbed, coal-fired plant to demonstrate compliance with proposed changes, meaning increased work for the Air Quality Division in monitoring, compliance, and permitting.

Another example of a recent legislative change that affected staffing is the permitting program for the application of pesticides. As of 2010, anyone who applies aquatic pesticides in, on, or around surface bodies of water is required to apply for a permit. Prior to 2010 individuals were only required to comply with label instructions and work with the Wyoming Department of Agriculture for appropriate licensing for pesticide application. With the new rules in place, individuals are required to write integrated pest management plans and apply for a permit prior to using the pesticides. Because this is a new program, the workload on regulatory staff is likely to be high because the public will have little experience in writing the required plans for the permit application.

Proposed changes to wastewater treatment have the potential to significantly affect staffing levels on both the regulation side as well as the operator side. Currently there are no numeric requirements for nutrients, such as nitrates and phosphorus, in treated waste water. However, there are proposed legislative changes that would require them. Should that occur, the

wastewater treatment facilities in the state would have to be rebuilt to accommodate the higher standards. As all construction plans must be approved, and all facilities must be overseen by DEQ, this would result in increased workload.

Another issue associated with proposed changes involves waste management. Historically, Wyoming complied with basic regulations and created minimal landfill designs. The aim was to contain as much waste as possible with the least expense incurred. However, recent research found that despite Wyoming's dry climate, landfills do pollute groundwater. As a result, there are recommendations to move toward integrated waste management and regional landfills. The current standard of a landfill in every community is not cost effective. However, the cost of moving to a new system is considerable. Current landfills have to be closed and the pollution must be remediated. In situations where the cost of change is too great, alternative solutions, such as biofuel power plants, may be required. Some communities, including Casper, have access to inexpensive land designated for their landfill. Because of the vast space available and the relative low cost of sequestering waste, there is little interest in variation from the current plan, especially when cost is involved. Even relatively minor changes, such as "pay-as-you-throw" modes of operation are resisted because the current cost is so low. Regardless of the case, significant input from DEQ staff will be required.

Finally, changes in regulations regarding endangered species habitat could significantly affect staffing levels. Currently, the state rules regarding sage grouse habitat impacts the amount of permitting review work necessary by DEQ staff. If rules are expanded or if they

become actual regulations, more staff time will likely be required.

Conclusion

The world, the U.S., and Wyoming are all currently attempting to transition to lower carbon intensity economies. Each has similar goals but different avenues for reaching those goals. Wyoming has traditionally been reliant on fossil fuels and their extraction for a significant portion of its economy. Making the change to cleaner technologies has provided opportunities and challenges to the state leadership. Efforts have been made to ensure that jobs potentially lost in non-energy-efficient industries are replaced by new jobs in green industries. However, specific education is required for some of those jobs. It is hoped that the information provided in this paper can be used by training agencies to help prepare the upcoming workforce for the emerging jobs.

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Table 4a: DEQ Staffing by Occupation Average Quarterly Data, 2006Q1 to 2009Q4

Occupation Code aN/D Title	Average SSNs in Quarter		Permanent Exits		Exit Rate
	N	%	N	%	
11-1011 - Chief Executives	N/D		N/D		N/D
11-3011 - Administrative Services Managers	N/D		N/D		N/D
11-3021 - Computer & Information Systems Managers	N/D		N/D		N/D
13-1041 - Compliance Officers, Except Agriculture, Construction, Health & Safety, & Transportation	N/D		N/D		N/D
15-1031 - Computer Software Engineers, Applications	N/D		N/D		N/D
15-1132 - Software Developers, Applications	N/D		N/D		N/D
15-2041 - Statisticians	N/D		N/D		N/D
19-3011 - Economists	N/D		N/D		N/D
25-4011 - Archivists	N/D		N/D		N/D
27-3031 - Public Relations Specialists	N/D		N/D		N/D
43-4161 - Human Resources Assistants, Except Payroll & Timekeeping	N/D		N/D		N/D
47-2031 - Carpenters	N/D		N/D		N/D
47-2111 - Electricians	N/D		N/D		N/D
47-3012 - Helpers--Carpenters	N/D		N/D		N/D
47-4011 - Construction & Building Inspectors	N/D		N/D		N/D
49-9071 - Maintenance & Repair Workers, Gen	N/D		N/D		N/D
51-9061 - Inspectors, Testers, Sorters, Samplers, & Weighers	N/D		N/D		N/D
13-1199 - Business Operations Specialists, All Other	N/D		N/D		N/D
15-1051 - Computer Systems Analysts	N/D		N/D		N/D
15-1071 - Network & Computer Systems Administrators	N/D		N/D		N/D
43-1011 - First-Line Supervisors/Managers of Office & Administrative Support Workers	N/D		N/D		N/D
43-3031 - Bookkeeping, Accounting, & Auditing Clerks	N/D		N/D		N/D
13-1111 - Management Analysts	N/D		N/D		N/D
15-1151 - Computer User Support Specialists	N/D		N/D		N/D
29-2011 - Medical & Clinical Laboratory Technologists	N/D		N/D		N/D
29-2031 - Cardiovascular Technologists & Technicians	N/D		N/D		N/D
AWEC - AWEC	N/D		N/D		N/D
Occupations with Fewer Than 5 SSNs Per Quarter	46	14.7%	12	14.1%	26.1%
43-6011 - Executive Secretaries & Administrative Assistants	5	1.6%	N/D		N/D
43-9061 - Office Clerks, General	5	1.6%	N/D		N/D
11-9199 - Managers, All Other	7	2.2%	N/D		N/D
13-2011 - Accountants & Auditors	7	2.2%	N/D		N/D
11-9041 - Engineering Managers	31	9.9%	N/D		N/D
Occupations with At Least 5 SSNs Per Quarter but Less Than 5 Permanent Exits	55	17.6%	11	12.9%	20.0%
43-6014 - Secretaries, Except Legal, Medical, & Executive	5	1.6%	5	5.9%	100.0%
19-4091 - Environmental Science & Protection Technicians, Including Health	11	3.5%	0	0.0%	0.0%
19-2042 - Geoscientists, Except Hydrologists & Geographers	16	5.1%	0	0.0%	0.0%
11-9121 - Natural Sciences Managers	33	10.6%	11	12.9%	33.3%
17-2051 - Civil Engineers	46	14.7%	10	11.8%	21.7%
19-2041 - Environmental Scientists & Specialists, Including Health	100	32.1%	36	42.4%	36.0%
Total All Occupations	312	100.0%	85	100.0%	27.2%

N/D = Not disclosable due to confidentiality of data.

Table 4b: DEQ by Age Group 2009q4 - Current Age Distribution

Age Group	Average SSNs in Quarter	
	N	%
20-24	ND	ND
25-34	40	15.1%
35-44	57	21.5%
45-54	81	30.6%
55-64	69	26.0%
65-Up	6	2.3%
Unknown	ND	ND
Total	265	100.0%

Table 4c: DEQ by Education Average Quarterly data 2006q1 to 2009q4

Education & Training	Average SSNs in Quarter		Permanent Exits		Exit Rate
	N	%	N	%	
Short to Long Term OJT	19	7.5%	17	20.0%	89.5%
04-Work Experience Related Occupation	16	6.3%	7	8.2%	43.8%
05-Associate Degree	15	5.9%	0	0.0%	0.0%
06-Bachelors Degree	43	17.0%	13	15.3%	30.2%
07-Bachelors Degree Plus Experience	56	22.1%	12	14.1%	21.4%
08-Masters Degree	104	41.1%	36	42.4%	34.6%
Total	253	100.0%	85	100.0%	33.6%



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