

## **Wyoming State Geological Survey**

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**Report Period:** FY2008

### **Quality of Life Result**

Wyoming natural resources are managed to maximize the economic, environmental, and social prosperity of current and future generations.

### **Contribution to Wyoming Quality of Life**

Currently continuing to accelerate its transition from a traditional, reactive state agency to a modern, dynamic, and applied organization, the Wyoming State Geological Survey (WSGS) strives to provide state decision-makers with the best science possible to ensure that development occurs to benefit Wyoming residents, promote economic prosperity, and protect state resources. In addition to ensuring Wyoming has the geologic, geophysical, and geohydrologic information necessary to solve existing problems and anticipate future challenges, the WSGS collaborates closely with other state agencies, various organizations, and stakeholders to solve multidisciplinary problems. The WSGS also supplies the geologic knowledge necessary for the beneficial and responsible development of Wyoming's unconventional energy resources, including shale gas, bypassed underpressured natural gas, deep gas (more than 15,000 feet below ground), in-situ coal gasification, uranium, and liquid syngases from oil shale and coal.

While working to increase public awareness of its contributions, the WSGS endeavors to provide Wyoming residents with the most accurate, up-to-date information on geologic hazards, natural resource and energy issues, water issues, and other geology-related topics so they can make informed decisions about issues that affect them. The WSGS aims to reduce risks associated with geologic hazards such as landslides, volcanism, earthquakes, avalanches, and floods.

Ultimately, WSGS employees seek to establish the agency as a premier organization dedicated to applied geologic, geophysical, and geohydrologic research, such as investigating geological CO<sub>2</sub> sequestration; developing new exploration strategies and techniques designed specifically for Wyoming's natural resources; creating strategies to prevent or minimize waste of natural

resources; constructing integrated geohydrologic models; building three-dimensional rock-fluid models of Wyoming's geologic basins; evaluating the potential for commercial metals/mineral development in Wyoming; and developing visualization techniques for a variety of geologic, geophysical, and geohydrologic processes.

## **Basic Facts**

The WSGS has 27 employees and operated with a 2007-2008 budget of \$5,536,906 in general funds.

In the spring of 2004, State Geologist Ronald Surdam presented a new vision of a proactive, dynamic state geological survey. Because of the support subsequently provided by Governor Freudenthal and the Wyoming Legislature, much of the WSGS vision has become reality. The reorganization of the agency emphasizes teamwork between scientists with diverse interests instead of traditional sections with rigid, narrowly-defined boundaries that restrict communication. Though individuals typically cannot solve the many complex natural resource problems facing Wyoming, focused, talented, integrated teams that bridge traditional barriers and emphasize common-sense problem solving in realistic timeframes can. The WSGS has recently acquired expertise and data in areas such as geohydrology, geophysics, and geological process modeling/visualization. Combined with existing agency talent, these new additions and organizational changes allow the WSGS to provide technology, strategies, techniques, and information to help the state address a multitude of natural resource issues.

Examples of this new approach include developing a way to predict water quality in any coal bed in the Powder River Basin, conducting a statewide geological CO<sub>2</sub> sequestration site inventory, partnering with China and the U.S. Department of Energy on CO<sub>2</sub> sequestration, studying coalbed methane water issues in the Powder River Basin, developing new exploration strategies and techniques for unconventional energy resources, and launching the Granite Mountains Metals Investigation Project.

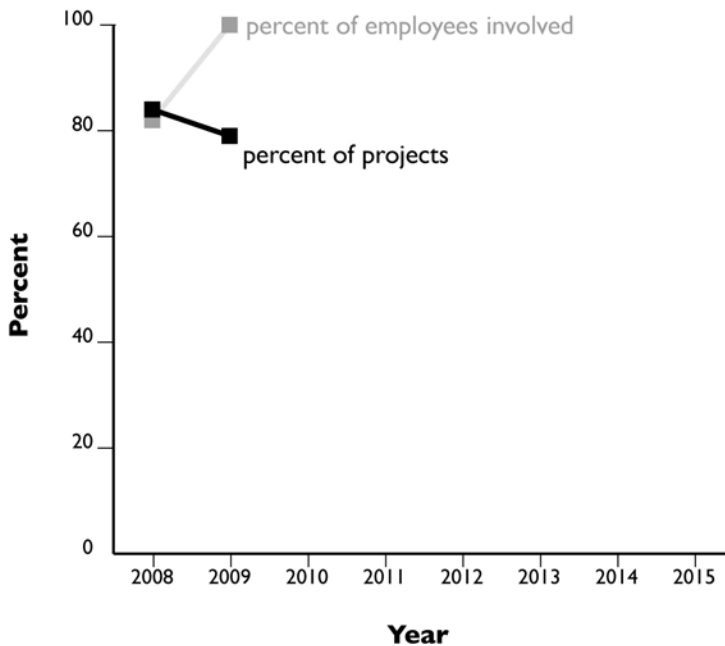
In addition, the WSGS collaborates closely with other state and federal agencies to solve key problems. For example, projects with the U.S. departments of energy and state (CO<sub>2</sub> sequestration partnership with China), DEQ (determining the remaining assimilative capacity of the Powder River Basin), SEO (modeling the potentiometric surface in the Powder River Basin), and the University of Wyoming Department of Renewable Resources (evaluating the efficacy and efficiency of low-cost mineral cation exchangers to treat CBNG produced water) are currently underway. The WSGS also continues to work closely with the U.S. Bureau of Land Management, U.S. Geological Survey, Wyoming Water Development Commission, Wyoming Oil and Gas Conservation Commission, Wyoming Pipeline Authority, and Wyoming Office of State Lands and Investments.

## Performance

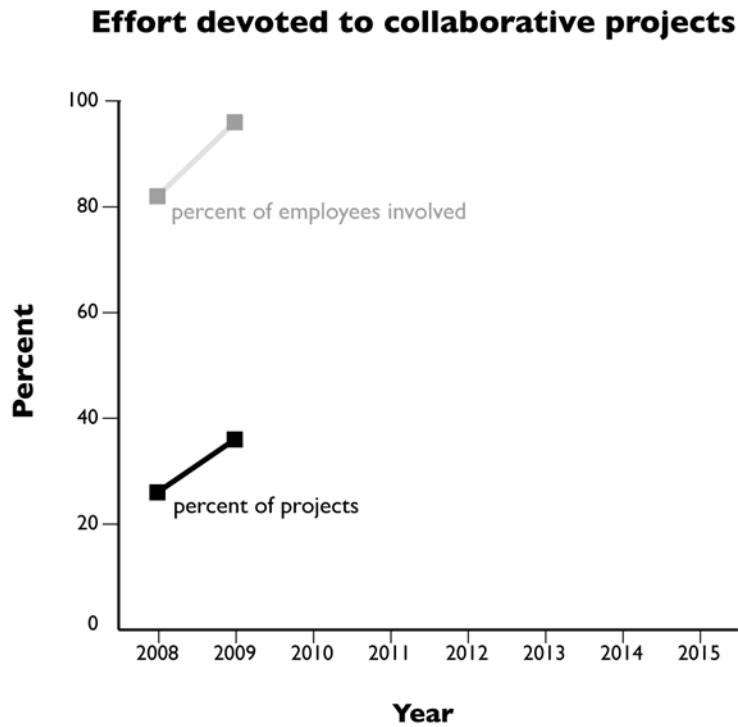
*The WSGS evaluated the performance metrics used in its 2007-2008 strategic plan, and found that those metrics did not accurately depict the agency's contribution to Wyoming and its residents. The agency will therefore use the new metrics listed below to better capture its contribution to quality of life in Wyoming.*

*Effort devoted to projects that apply geologic knowledge and research to natural resource and energy issues in Wyoming. This metric has two components: percentage of WSGS projects that involve applied geologic research and address natural resource/energy issues; and percentage of WSGS employees involved in applied research/natural resource/energy projects. Including both measurements depicts both overall agency effort and collaboration between employees with different areas of expertise.*

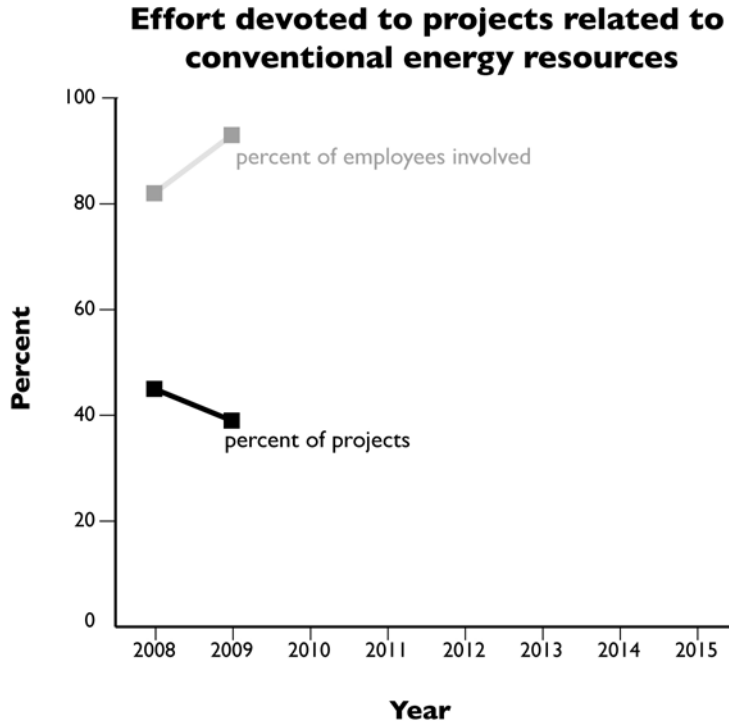
### **Effort devoted to projects that apply geologic knowledge to natural resource and energy issues**



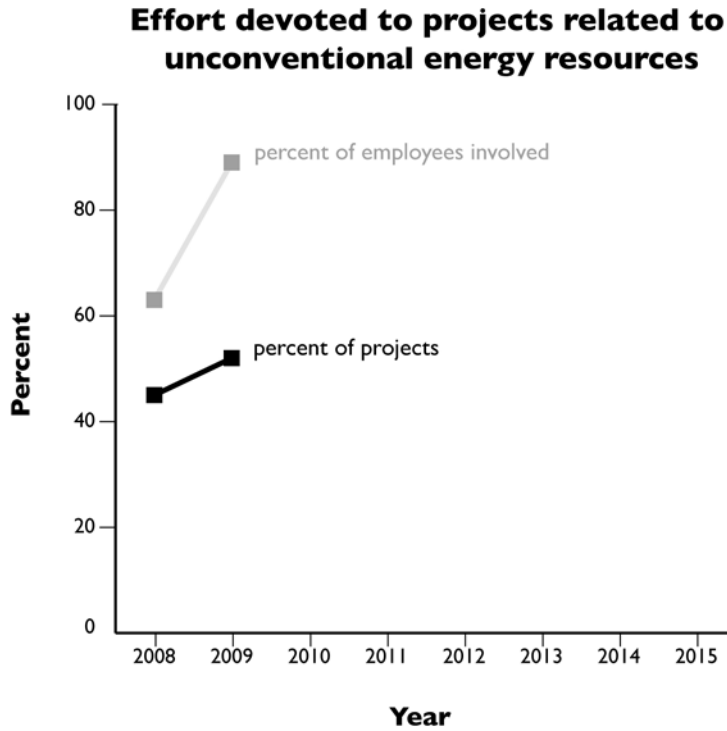
*Effort devoted to collaborative projects.* This metric has two components: percentage of projects that involve collaboration with other agencies and organizations; and percentage of employees involved in collaborative projects. Including both measurements depicts both overall agency effort and collaboration between employees with different areas of expertise.



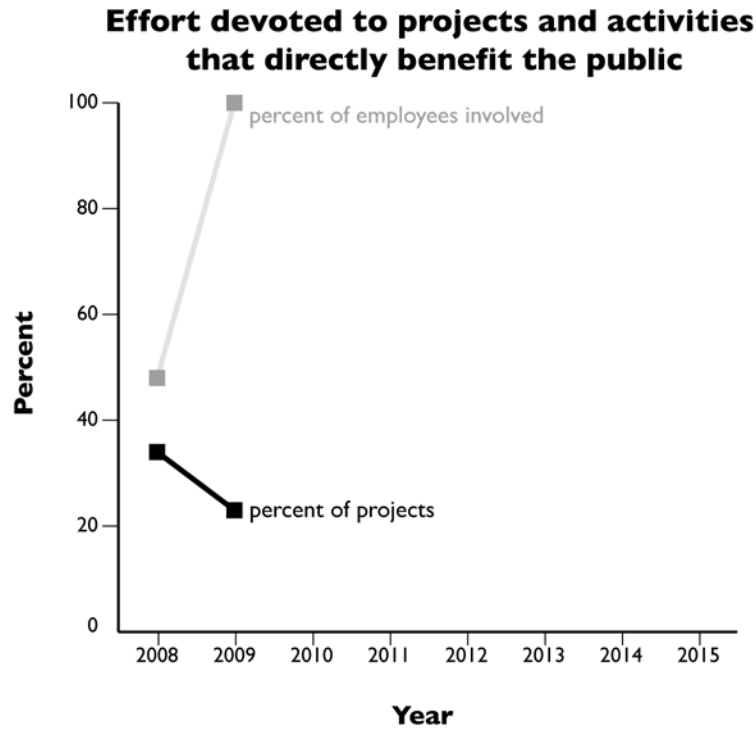
*Effort devoted to projects related to conventional energy resources.* This metric has two components: percentage of projects related to conventional energy resources; and percentage of employees involved in projects related to conventional energy resources. Including both measurements depicts both overall agency effort and collaboration between employees with different areas of expertise.



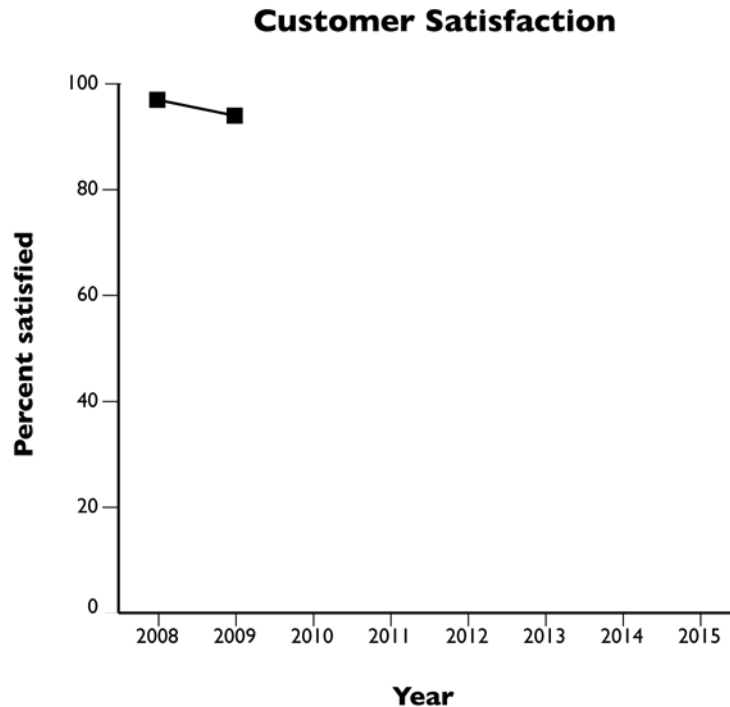
*Effort devoted to projects related to unconventional energy resources.* This metric has two components: percentage of projects related to unconventional energy resources; and percentage of employees involved in projects related to unconventional energy resources. Including both measurements depicts both overall agency effort and collaboration between employees with different areas of expertise.



*Effort devoted to projects and activities that directly benefit the public.* This metric has two components: percentage of projects that directly benefit the public; and percentage of employees involved in public outreach/educational activities, hazards-related projects, and water-related projects.



*Percentage of satisfied customers.* This metric depicts customer satisfaction. Because customers self-identify as industry, education, government, or general public, the agency can further explicate customer satisfaction based on affiliation. This will help monitor how well the agency serves different sectors.



### **Story Behind the Performance**

*Effort devoted to projects that apply geologic knowledge and research to natural resource and energy issues in Wyoming.* By applying geologic knowledge to researching issues associated with natural resources and energy development in Wyoming, the WSGS ensures that state decision-makers base policy on the best science available. Responsible, informed development of state resources will optimize both economic prosperity and resource protection for Wyoming residents.

*Effort devoted to collaborative projects.* Collaborating closely with other agencies and organizations allows a dynamic, multi-disciplinary approach to problem-solving. This approach ensures that the challenges facing Wyoming will be addressed by teams of experts familiar with different aspects of an issue, and facilitates creative solutions.

*Effort devoted to projects related to conventional energy resources.* By applying geologic

knowledge to conventional energy development issues, the WSGS facilitates responsible development of state resources.

*Effort devoted to projects related to unconventional energy resources.* By applying geologic knowledge to unconventional energy resources (clean coal technologies, shale gas, coal bed natural gas, deep gas, etc.) the WSGS can help the state develop new resources in a responsible manner and diversify its energy portfolio.

*Effort devoted to projects and activities that directly benefit the public.* By taking steps to educate the public about geologic, natural resource, and energy issues, the WSGS provides Wyoming residents with the information they need to make informed decisions about issues that affect them. Additionally, by working to improve understanding of geologic hazards and water issues in Wyoming, the WSGS helps protect residents from harm and maximizes beneficial use of Wyoming's water.

*Percentage of satisfied customers.* Working to ensure WSGS customers are satisfied with the assistance and information they receive from the agency is a top priority. Measuring customer satisfaction monitors how well the WSGS meets the needs of the public, industry, educational institutions, and other government agencies.

### **What has been accomplished?**

Examples of WSGS accomplishments from the reporting year are listed below.

The WSGS worked with other state agencies and the Wyoming Water Development Commission to develop a tool to predict water quality associated with coal beds in the Powder River Basin. This work should help managers dealing with the evolving CBNG play in the PRB.

The WSGS is collaborating with the U.S. Department of Energy and China to advance CO<sub>2</sub> sequestration in the U.S. and China. This partnership will allow Wyoming to remain at the forefront of sequestration technology, and maintain its robust economy in a carbon-constrained world.

The agency prepared a paper explaining Wyoming's role in the current global energy economy, and why the boom and bust paradigm no longer applies to energy development in the state.

The WSGS has developed an integrated approach to energy development in the PRB involving clean coal technology (integrated gasification combined cycle or underground coal gasification), enhanced oil recovery, and CO<sub>2</sub> sequestration. Though this plan is specific to the Powder River Basin, it could be modified and applied to other areas of Wyoming.

The agency is working with the USGS, Wyoming Water Development Commission, and Water Resources Data System on a detailed study of the aquifers of the Green River Basin. The study

will include information on aquifer extent, water chemistry and other properties, quantity of water available, recharge areas, and recharge rates.

As part of an ongoing search for additional, unconventional energy resources which could diversify the state's energy portfolio and help satisfy the nation's increasing demand for energy, the WSGS evaluated the potential for shale gas resources in the Cow Creek area along the Atlantic Rim in the Washakie Basin.

As part of the STATEMAP program, the WSGS completed ten 1:24,000-scale bedrock maps, seven 1:100,000-scale bedrock maps, and 4 1:100,000-scale surficial maps. The agency also updated many of its energy resource maps to reflect current conditions.

The WSGS defined the boundaries of the Wyoming Range and adjacent mountain ranges based on criteria related to geology, geologic structure, and topography, as traditionally defined in geologic/topographic maps, publications, and scientific reports relative to this area. This effort should support Senator John Barrasso's legislation proposing protection for areas of the range.

WSGS staff served on the following committees: American Association of State Geologists Environmental Affairs and Policy Committee, Governor's Carbon Sequestration Commission, Wyoming Oil and Gas Conservation Commission, Wyoming Board of Professional Geologists Board, Wyoming Consensus Revenue Estimating Group, and University of Wyoming Enhanced Oil Recovery Institute Commission.

The WSGS is inventorying all of the significant potential geological CO<sub>2</sub> sequestration sites in the state, with special emphasis on deep saline aquifers, compartmentalized gas reservoirs, and deep coal-bearing intervals. Results from this project suggest that the Rock Springs Uplift of southwestern Wyoming is an outstanding sequestration site.

The WSGS determined the origin of the thermogenic and biogenic natural gas in the Fort Union Formation – the gas produced in the Powder River Basin (PRB) CBNG.

The agency evaluated natural gas and water production histories for all CBNG wells in the PRB, and delineated regional trends in groundwater flow and preliminary changes in the regional groundwater elevation map. This work provides a tool for resource management in the PRB.

The WSGS compared Phase I and Phase II of the Energy Policy and Conservation Act inventory.

The WSGS helped develop a reasonable management plan for oil shale development in Wyoming. The agency is making every effort to ensure that information about Wyoming oil shale is reliable and accurate, and that oil shale development proceeds responsibly on Wyoming's terms.

The WSGS is developing long-range natural gas availability scenarios for the state, including new, unconventional, underdeveloped, or undeveloped resources (esp. deep gas, bypassed gas, underpressured gas, shale gas, and coal gasification).

The WSGS constructed and continues to update an interactive Energy Impact Map, which allows users to examine the seven areas of Wyoming most heavily impacted by energy development.

