

## National Geothermal Data System Design and Testing

Project Officer: Arlene Anderson  
Total Project Funding: \$4,992,089.00  
April 22, 2013

Principal Investigator  
**Harold Blackman**  
**Boise State University**  
Track 3

- ◆ NGDS Design and Testing is a part of the larger NGDS Initiative
- ◆ Other NGDS projects deal with system data development and population
- ◆ Our Project Objective is to provide *access to* data from all geothermal resources to all parties to further enhance *their decision making* ability based upon available data *that will in turn* support the discovery and generation of geothermal sources of energy
- Increase the efficiency of exploration, development and usage of geothermal energy by providing an effective, searchable database to support financial risk analysis
- Assist state and federal agencies in making land and resource management assessments
- Foster the discovery of new geothermal resources by supporting ongoing and future geothermal research
- Increase public awareness of geothermal energy

- Our innovation lies in the creation of a free, downloadable, federated system that will be able to organize, and access data stored in:
  - different systems
  - different places
  - by different people
- Our data system consists of a network of three linked communities:
  - Data providers who will expose information to the system through standardized, internet accessible interfaces and interchange formats
  - Software developers who will build applications that utilize the data in the system, and make it easier for end-users to interact with the system
  - End-users who will utilize the software and information provided by the system in order to understand and develop geothermal resources

The NGDS consortium is defining data formats and software products free for download and use!

- The NGDS data formats
  - Template formats for geo-data
  - Metadata standards

- NGDS Software Products

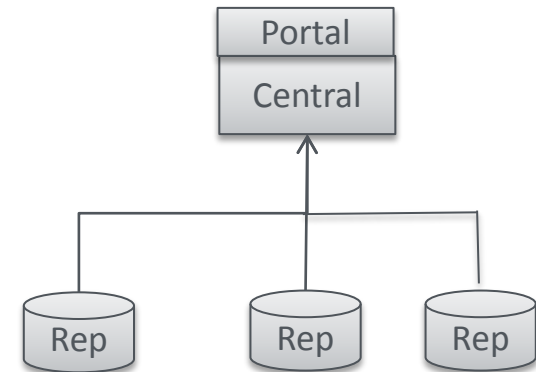
1. NGDS Node-in-a-box Repository

- Install this software package on your server and start storing and publishing data using standardized OGC protocols



2. NGDS Central Node

- This software package provides the central entry point for searching the entire grid of repositories
- Provides an efficient portal for searching resources



**Increase NGDS impact by providing effective architecture, and relevant, easy to use software for providers and end users.**

- System Architecture
  - System will include data from a wide range of topics, from well logs and drilling data to temperature, geochemical, and geo physical measurements, as well as journal articles
  - Catalogue services will support data providers as well as users in discovery and access through standardized metadata for describing resources, content models for geothermal data, and common web-protocols for exchanging information
- Data provider software
  - Redistributable, open-source software will provide simple ways to register data sources, load data, and expose those data in a node in NGDS
- End user software
  - Access will be provided to users through the NGDS website, that leads to a map-centric search application to support finding, visualizing, mapping, and acquisition of data

- Phase I/II review (May/June 2012) indicated a need to re-plan so a new project management plan and resource loaded schedule were delivered
- Three major parallel paths are being followed:
  - data assessment, import, integration, and testing
  - software development
  - sustainability

- Data assessment, import, integration, and testing are composed of two major elements:
  - Data assessment: determining the amounts and types of data available to the NGDS resulting in consortium member work plans
  - Data import, integration and testing: enabling discovery and download of annotated files with geothermal data, discovery and access of web-services with geothermal data, and automated import of metadata and data, including production data integration

- Software development is following agile development process
  - Created software requirements specification
  - Selected software development environment
  - Employing multiple sprints (15 to 19 dependent on funding and schedule)
  - Resulting in distribution and rollout of a redistributable software package
- Sustainability
  - Create a plan for the future of NGDS



- There is one long-term issue:  
NGDS funding is limited
  - Only so many features can be realized
  - Bug fixing must come to a halt once the funding is used up
  - Internet technology evolves rapidly beyond the project horizon
- Solution lies in Open Source:
  - NGDS development will be made available under an open source license
    - Shall be attractive to an open source community for further enhancements
  - Make use or hook into an already existing open source project
    - Foster cooperation with existing open source projects
    - Search for solutions beyond national borders

- Data Assessment Task is complete and results are documented in two reports
  - 1. Data Acquisition for National Geothermal Data System
    - Defines and describes the catalogue
    - Provides research protocols for metadata, data delivery, and description of the metadata and content models and schema
  - 2. NGDS Design and Testing Sub recipient Data Inventory
    - Provides a complete inventory and plan for each sub recipient including Arizona Geological Survey, Energy & geosciences Institute at the University of Utah, Geo-Heat Center at the Oregon Institute of Technology, Nevada Bureau of Mines and Geology-University of Nevada-Reno, and Stanford University
  - Data providers are updating catalogues of their repositories with metadata that meets the requirements of the content models making the catalogues searchable
  - Each data provider has processed thousands of data records to support NDGS
  - Repositories collect structured data (well headers or heat flow) and unstructured data such as publications
  - Data is made digitally available and exposed as Web Feature Services, Web map services and or Web coverage services

# Accomplishments, Results and Progress- User Concept

The screenshot displays the NGDS website interface. At the top, there is a navigation bar with links for Home, About, Sign up, and Login. Below this is the NGDS logo and the tagline "REDUCE RISK, INCREASE CREATIVITY". The main content area is divided into several sections: a search bar with a "Map" dropdown and a "Go" button; a "DATA WATCH" section listing recent publications such as "Selected Hydrologic Data, San Pitch River Drainage Basin, Utah" and "Maryland Oil and Gas Wells Log Metadata"; a "MAP" section with the text "Find data for a specific geographic area"; a "LIBRARY" section with the text "Look up data for a specific geographic area"; a "RESOURCES" section with the text "Use or add to our list of websites & tools for geothermal exploration"; and a "CONTRIBUTE" section with the text "Share data, learn about the National Geothermal Data System". A large featured image shows a geothermal landscape with the headline "Two geothermal exploration licenses issued in Germany" and a "Learn more" button. Below this are two smaller images: one for the "MAP IT" section and one for the "FIND IN LIBRARY" section. The footer contains links for "About NGDS", "Help", "I want to...", and "Hello, we share data with NGDS" (listing AZGS, GDR, SMU, and EGI), along with a "Give us feedback" button and a "Contribute" button.

Concept based on  
User Research

Capability includes  
map and library  
based searches,  
plus faceted search  
capability

# Accomplishments, Results and Progress- User Concept

The screenshot displays the NGDS (National Geothermal Data System) web application interface. At the top, there are navigation links for Home, About, Sign up, and Login. The main header features the NGDS logo with the tagline "REDUCE RISK, INCREASE CERTAINTY". Below the header, there are four main sections: MAP (Find data for a specific geographic area), LIBRARY (Look up data for a specific geographic area), RESOURCES (Use or add to our list of websites & tools for geothermal exploration), and CONTRIBUTE (Share data, learn about the National Geothermal Data System).

The central part of the interface shows a search results page for "Geysers near Pine Grove, CA". The search bar contains the text "Geysers near Pine Grove, CA" and a "Go" button. Below the search bar, it states "The Geysers" we found 120 results" and provides a "Narrow your results" dropdown menu. The results are listed in a vertical column, each with a red location pin icon and a title:

- A Well log 712**: Description of well logs obtained from three wells in Cove Fort-Sulphurdale area. Publication Published 09/10/2012.
- B Well log**: AASG geothermal data compiled from logs acquired in boreholes. Dataset Published 08/03/2012.
- C Liquefaction**: AASG geothermal data compiled from logs acquired in boreholes. Document Published 07/28/2012.
- D A reservoir assessment of the Geyser Geothermal Field**: Content model for a subsurface temperature measurement made in a borehole. Data set Published 05/13/2012.

At the bottom of the results list, there are navigation buttons for "1 2 3 4 5". To the right of the search results is a map of the region, showing various cities and landmarks. The map includes a search bar, a "Basemap" dropdown, and a "Layers" dropdown. The map displays several red location pins, with four specific areas highlighted by red dashed boxes and labeled A, B, C, and D, corresponding to the search results. The map also shows a scale bar and a zoom control.

At the bottom of the page, there are several sections for user navigation and sharing:

- About NGDS**: Partners, Data, History.
- Help**: New to NGDS?, Get started now, FAQ's.
- I want to...**: Contribute data to NGDS, Contact NGDS, View my saved searches, Share my favorites.
- Hello, we share data with NGDS**: Logos for AZGS, GDR, SMU, and EGI.
- Do you want to share with us?**: Contribute button.

The footer contains the text "© U.S. DEPARTMENT OF ENERGY" and navigation links for HOME, CONTACT, and TERMS OF USE & PRIVACY.



# Accomplishments, Results and Progress- User Concept

The screenshot displays the National Geothermal Data System (NGDS) website. At the top, there is a navigation bar with links for Home, About, Sign up, and Login. The main header features the NGDS logo and the tagline "REDUCE RISK, INCREASE CREATIVITY". Below the header, there are four main sections: MAP (Find data for a specific geographic area), LIBRARY (Look up data for a specific geographic area), RESOURCES (Use or add to our list of websites & tools for geothermal exploration), and CONTRIBUTE (Share data, learn about the National Geothermal Data System).

The central part of the page shows a search interface. A search box contains the text "Geysers near Pine Grove, CA" and a "Go" button. Below the search box, it states "The Geysers" we found 120 results" and provides a "Narrow your results" dropdown menu. The search results are listed in a vertical column, each with a star icon and a title:

- Well log 712**: Description of well logs obtained from three wells in Cove Fort-Sulphurdale area. Publication Published 09/10/2012
- Well log**: AASG geothermal data compiled from logs acquired in boreholes. Dataset Published 08/03/2012
- Liquefaction**: AASG geothermal data compiled from logs acquired in boreholes. Document Published 07/28/2012
- A reservoir assessment of the Geyser Geothermal Field**: Content model for a subsurface temperature measurement made in a borehole. Data set Published 05/13/2012

Below the search results is a pagination control showing "1 2 3 4 5". To the right of the search results is a large map of the geothermal region in California. The map includes a toolbar with icons for print, email, and share, and dropdown menus for "Basemap" and "Layers". The map shows various cities and locations, including Fort Bragg, Ukiah, Lakeport, Clearlake, Healdsburg, Windsor, Santa Rosa, Rohnert Park, Petaluma, Novato, Vallejo, Napa, Fairfield, Vacaville, Woodland, Sacramento, Elk Grove, Roseville, Citrus Heights, Yuba City, Oroville, Chico, Paradise, and Plumas National Forest. The map also shows the Mendocino National Forest and Plumas National Forest.

At the bottom of the page, there is a footer section with several columns of links and information:

- About NGDS**: Partners, Data, History
- Help**: New to NGDS? Get started now. FAQ's
- I want to...**: Contribute data to NGDS, Contact NGDS, View my saved searches, Share my favorites
- Hello, we share data with NGDS**: AZGS, GDR, SMU, EGI
- How do you like our website?**: Give us feedback.
- Do you want to share with us?**: Contribute

The footer also includes copyright information: © U.S. DEPARTMENT OF ENERGY, and links for HOME, CONTACT, and TERMS OF USE & PRIVACY.

# Accomplishments, Results and Progress- Web Site



Search site or data

Site

Data

- Home
- Use Data
- Publish Data
- Developers
- Events
- About

Welcome to NGDS, information for discovery, evaluation, and development of geothermal resources.

NGDS is your source for access to information resources on geothermal energy from a national network of data providers. Data are contributed by academic researchers, private sector participants, and state and federal agencies, primarily the Department of Energy. Access, view, and download data with this free and [easy online search tool](#).



### Find Data

- [Search Catalog](#)
- [Types of Data](#)
- [Data Contributors](#)



### Tools & Apps

- [Access Apps](#)
- [For Developers](#)
- [Register Apps](#)



### New Data

Oklahoma submitted new Scanned Well Log Data for the AASG State Geothermal Data Project.

- HELP
  - [Glossary](#)
  - [USGIN Tutorials](#)
  - [Using Apps](#)
- FAQ
- FIRST VISIT
- CONTACT US

### SHARE DATA

Becoming a data provider to the NGDS is simple. To learn more about contributing your project's data to the DOE Geothermal Data Repository, data interchange formats, and data services follow the links below:

- [Contribute to DOE Geothermal Data Repository](#)
- [Register Data](#)
- [Data Interchange Formats](#)

### PARTICIPANTS



Association of American State Geologists



Boise State University



National Renewable Energy Laboratory



Southern Methodist University



U. S. Geological Survey

[Full list of contributors](#)



This material is based upon work supported by the U.S. Department of Energy's Geothermal Technologies Program under award DE-EE0001120.

[www.geothermaldata.org](http://www.geothermaldata.org)

- Software Requirements Specification completed December 2012
- Specification went through extensive review by project technical monitors
- Five basic needs for NGDS are:
  - Enable data collectors to create and administrate a repository for geothermal data
  - Enable end user/data consumers including:
    - Search for geothermal data across repositories
    - Evaluate discovered data
    - Acquire selected data
    - Analyze selected data

- Accomplishments in Sprints 1 through 3 include:
  - CKAN selected as software development environment
  - CKAN was installed and scripts developed for build and development environments
  - CKAN upload mechanism developed and server solutions for Python CKAN were studied
  - Use cases refined for development
  - Prototype map, upload page, and first version UI were completed
  - Extension for data harvesting developed
  - Plugins for metadata and geoserver functionality were researched
  - Message sequencing for uploading of structured data were developed



- Pilot data import, integration, and testing
  - Content model repository updated with new schemas and content models
  - ISO metadata support and CSW integration built into node in a box
  - Metadata converted and added from Arizona Geological Survey, Energy & Geosciences Institute, Geo-Heat Center, Nevada Bureau of Mines and Geology, and Stanford University
  - Total data amount to over 20,000 records
    - This includes metadata records, well logs, geologic map series, and technical documentation (journal articles)
  - Server-side functions testing begun to ensure functionality
- Sustainability Plan
  - Data collected from potential end users including existing business models from similar systems (CUAHSI)
  - Existing NGDS nodes provided cost and personnel data
  - Draft plan out for review

Original Planned Milestone/Technical Accomplishment	Actual Milestone/Technical Accomplishment	Date Completed
Data Assessment	Results contained in 2 reports: "Data Acquisition for National Geothermal Data System", and "NGDS Design and Testing Sub Recipient Data Inventory"	December 2012
User Research and Experience Concept	Results documented in wireframes and user stories	November 2012
Software Requirement and Design Specification	Documented in "Software Requirements Specification NGDS Version 2.7"	December 2012
Project Website	May be found at <a href="http://geothermaldata.org">geothermaldata.org</a>	October 2012

Milestone	Status	Expected Completion
Software Development, Iteration and Usability	Completed 4 sprints, on schedule for remaining	9-13 or 3-14
Pilot Data Import, Integration, and Testing	Data review and entry will continue	9-13 or 3-14
Distribute, document & rollout	Not started	9-13 or 3-14
Service Testing & maintenance	Ongoing in software development	9-13 or 3-14
Sustainability plan	Draft out for comment	9-13 or 3-14
Phase III Review	DOE will make a go/no-go decision prior to phase IV	May 31, 2013

- NGDS has made good progress since July of 2012
- As planned, the system will support geothermal exploration and research
- Ultimate number of features included in the system will be dependent upon our success, time and money
- Sustainability of the system is critical and implementation of the final plan is essential for the future of NGDS

## Timeline:

Planned Start Date	Planned End Date	Actual Start Date	Current End Date
July 1, 2012	September 30, 2013	July 30, 2012	September 30, 2013 or March 31, 2014

## Budget:

Federal Share	Cost Share	Planned Expenses to Date	Actual Expenses to Date	Value of Work Completed to Date	Funding needed to Complete Work
4,992,089.00	0	3,082,673.66	3,082,673.66	3,082,673.66	1,909,415.34

- Project is not planned using earned value techniques- we are actively managing the project through a combination of techniques
- Resource loaded plan, sprint plan, data work plans, weekly, now biweekly team meetings, with specific subgroup meetings on software and user interface development
- Weekly reporting by each contributor on weekly basis including cost and schedule estimates
- Quarterly meetings with the larger NGDS team for coordination
- Participation in major technical meetings for community feedback
  - Geothermal Energy Expo 2012
  - Stanford 38<sup>th</sup> Workshop on Geothermal Reservoir Engineering 2013
- Requested no cost extension to allow more complete data integration, and to test NGDS nodes