



# Exploration Best Practices & The OpenEI Knowledge Exchange



## Geothermal Technologies Program Webinar

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## PROJECT GOALS

<http://en.openei.org>

### Develop Knowledge Exchange & collect data to help identify:

- Best practices/pitfalls for hydrothermal exploration
- Techniques used in some regions, that could be implemented in other regions
- Techniques used to identify blind systems
- Techniques that could be useful with additional investment to reduce time, cost, risk
- Regional reconnaissance techniques to identify more of the undiscovered resource

NREL Photo



## PROJECT ACTIVITIES

<http://en.openei.org>



NREL Photo

### 1. Set Up Exploration Knowledge Structure

- Develop OpenEI mock-ups, templates, relationships
- Work conducted by: Kate Young, Jon Weers, Teresa Wong, KC Hallett, Graham Hill

### 2. Delineate Exploration Regions

- Work conducted by: Kermit Witherbee, Kate Young, with input from Hidda Thorsteinsson, Mack Kennedy, Colin Williams

### 3. Conduct Literature Survey

- Work conducted by: Kate Young, Tim Reber
- Reviewed approximately 2000 documents
- Cataloged over 1,300 exploration activities from over 230 documents

### 4. Interview Industry Experts

- Interviewees included developers, consultants, national laboratory and university personnel from geothermal and oil and gas industry
- Interviewed 11 experts (~75% of those contacted provided feedback)
- Conducted via phone and in person from prepared list of questions, and with follow up questions in subsequent phone calls
- Additional information, beyond the questions asked, was often provided by the interviewee

### 5. Populate OpenEI Knowledge Exchange

- Import data into OpenEI
- Populate pages with additional information
- Develop more complex templates, forms

## OPENEI FACILITATES THE DESIRED EXCHANGE

<http://en.openei.org>

### History

- Gives public access a collaborative, knowledge-sharing platform
- Provides free and open access to energy-related data, models, tools, and information
- Developed in 2009 by the National Renewable Energy Laboratory
- Sponsored by the U.S. Department of Energy in support of the White House's Open Government Initiative

### Wiki Platform

- Utilizes same underlying technology as Wikipedia
- Enables users to view, edit, add and download, data – all for free
- Allows the assignment of queryable properties via semantic links
- Creates relationships automatically between pages
- Permits querying and exporting of data, similar to a database, in universal formats such as RDF and CSV
- Includes a variety of data display formats including maps, charts, graphs, and timelines

### Data Quality

- Forms often requires references be cited
- Pages can be “watched” for changes, updates
- User community can help expand the data and increase accuracy



### OpenEI Statistics \*

• Content Pages	55,674
• Downloadable Datasets:	798
• Languages Used:	English, Spanish
• Registered Users:	3,231
• Unique Visitors/Week:	over 8,000
• Visits Last Year:	359,195
• Countries Visiting Site:	212

*\*per Google Analytics as of January 25, 2012*

# OPENEI OVERVIEW

**OpenEI | OPENENERGYINFO**

Wiki | Datasets | Linked Data

Browse | Page Actions | View | Get Involved | Help

Page | Discussion | Edit | History

**Clean Energy Economy**

**CLEAN**

coordinated low emission assistance network

Incentives and Policies

International Clean Energy Analysis

Latinoamérica

LEDS

low emission development strategy

Renewable Energy News

U.S. Open Access

Browse by region

Feature | OpenEI

Annual Energy Outlook Report

**Page Actions:** menu allows user to discuss, edit, view history, move and watch a page.

**HELP PAGE:** tips on reading, searching, editing, querying and other Semantic Media Wiki information.

**SEARCH:** the OpenEI contents

**LOGIN:** Sign up and log in to contribute information. A user page is created for each user to input information about themselves for the user community.

**HISTORY PAGE:** see complete page development and revision history, with date, contributor name, and contributor notes. Compare versions. Roll back to previous versions

**EDIT PAGE:** correct or update information on a page, or contribute additional information

**DISCUSSION PAGE:** view and contribute to discussion on page content

**Recent Contributors**

new this week:

- Inter4522 (1)
- Jsmithhhhh (1)
- Burnsmarty (1)

most active:

- 54 authors modified 278 articles
- Ysuryan (132)
- Aaferka (71)
- Mesalle (38)

**Recent Updates**

...see recent updates (+)

**Follow OpenEI on:**

f t YouTube e

**Twitter: @OpenEnergyInfo**

**About**

Open Energy Information (OpenEI) is a knowledge sharing online community dedicated to connecting people with the latest information and data on energy resources from around the world. By providing access to energy-related information via geographic discovery, unique visualizations, and

**Feedback**

We welcome your feedback on Open Energy Information and encourage you to provide additional

# EXAMPLE HISTORY PAGE

<http://en.openei.org>

**OpenEI | OPENENERGYINFO** Welcome Kyoung | Log out

Wiki | Datasets | Linked Data

Browse | Page Actions | View | Get Involved | User | Help

Gateway | Discussion | Edit | History

Revision history of "Gateway:G"

From Open Energy Information

View logs for this page

Browse history

From year (and earlier):  From month (and earlier):  Deleted only

Diff selection: mark the radio boxes of the revisions to compare and hit enter or the button at the bottom.

Legend: **(cur)** = difference with latest revision, **(prev)** = difference with preceding revision, **m** = minor edit.

- (cur | prev) 15:10, 20 September 2011 Graham7781 (Talk | contribs) (7,191 bytes) (undo)
- (cur | prev) 15:04, 20 September 2011 Graham7781 (Talk | contribs) (8,017 bytes) (undo)
- (cur | prev) 12:05, 2 November 2010 Woodjr (Talk | contribs) (7,191 bytes) (undo)
- (cur | prev) 20:11, 29 October 2010 Twong (Talk | contribs) (7,185 bytes) (undo)
- (cur | prev) 19:49, 29 October 2010 Twong (Talk | contribs) (7,183 bytes) (undo)
- (cur | prev) 21:46, 28 October 2010 Woodjr (Talk | contribs) **m** (6,505 bytes) (Text replace - '{{#Widget:SetTitle|title=' to '{{DISPLAYTITLE:}}') (undo)
- (cur | prev) 14:20, 27 October 2010 Woodjr (Talk | contribs) (6,515 bytes) (undo)
- (cur | prev) 14:00, 27 October 2010 Woodjr (Talk | contribs) **m** (6,488 bytes) (Fixed closing tag syntax for the <references>...</references> block) (undo)
- (cur | prev) 12:32, 27 October 2010 Woodjr (Talk | contribs) (6,488 bytes) (undo)
- (cur | prev) 12:31, 27 October 2010 Woodjr (Talk | contribs) (6,465 bytes) (undo)
- (cur | prev) 13:52, 2 September 2010 Rmckeel (Talk | contribs) (6,298 bytes) (undo)
- (cur | prev) 14:08, 30 August 2010 Woodjr (Talk | contribs) (6,259 bytes) (→Geothermal Incentives & Policies) (undo)
- (cur | prev) 16:41, 27 August 2010 Twong (Talk | contribs) (6,254 bytes) (undo)
- (cur | prev) 11:11, 27 August 2010 Jackie Lyndon (Talk | contribs) (6,130 bytes) (undo)
- (cur | prev) 11:09, 27 August 2010 Jackie Lyndon (Talk | contribs) (6,167 bytes) (undo)
- (cur | prev) 08:11, 16 August 2010 Jackie Lyndon (Talk | contribs) (6,130 bytes) (undo)
- (cur | prev) 12:55, 10 August 2010 Jackie Lyndon (Talk | contribs) (6,132 bytes) (undo)
- (cur | prev) 12:55, 10 August 2010 Jackie Lyndon (Talk | contribs) (6,168 bytes) (undo)
- (cur | prev) 12:53, 10 August 2010 Jackie Lyndon (Talk | contribs) (6,167 bytes) (undo)
- (cur | prev) 12:51, 10 August 2010 Jackie Lyndon (Talk | contribs) (6,264 bytes) (undo)
- (cur | prev) 12:40, 10 August 2010 Jackie Lyndon (Talk | contribs) (6,016 bytes) (undo)
- (cur | prev) 12:35, 10 August 2010 Jackie Lyndon (Talk | contribs) (6,100 bytes) (undo)
- (cur | prev) 12:31, 10 August 2010 Jackie Lyndon (Talk | contribs) (6,154 bytes) (undo)
- (cur | prev) 09:19, 10 August 2010 GregZiebold (Talk | contribs) (4,643 bytes) (undo)

**COMPARISON TOOL:** Select two versions to compare differences

**CONTRIBUTOR:** See contributor, talk with contributor, see list of contributions from contributor

**UNDO:** Undo previous edits.

**NOTES:** Comments from the contributor on edits made this revision.



# OPENEI OVERVIEW

<http://en.openei.org>

The screenshot shows the OpenEI website interface. At the top left is a world map. The main content area contains various charts, graphs, and a GE logo. On the right side, there are sections for 'Recent Contributors' and 'Recent Updates'. At the bottom, there is a navigation bar with several links. Five callout boxes provide detailed explanations for specific features:

- WHAT LINKS HERE:** provides a list of all internal OpenEI pages that link to this page
- UPLOAD FILE:** allows user to upload a file (e.g. map, spreadsheet) to OpenEI for reference on other pages (available only from the OpenEI homepage)
- SPECIAL PAGES:** provides a list of special pages, including: Categories, Users, User Settings (changing passwords), User Groups, Manage Watch List
- BROWSE PROPERTIES:** displays a list of semantic properties (and values) associated with this page, available for use in queries.
- LINKED DATA:** Provides information on Linked Data including overview, tutorials, frequently asked questions and a glossary of terms.

What links here | Related changes | Upload file | Special pages | Printable version | Permanent link | Duplicate this page | Browse properties

About Us | Disclaimers | Blog | MediaWiki | **Linked Data** | Services

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# GEOHERMAL STRUCTURE ON OPENEI

<http://en.openei.org>

## Location

**Power Plants/Projects** →

*Blundell 1 Power Plant*



Photo Credit: <http://www.pacificorp.com/es/re/blundell.html>

**Geothermal Area** →

*Roosevelt Hot Springs*



**Geothermal Region**

*Northern Basin & Range*



## Exploration Techniques

**Category** →

*Remote Sensing*

(can use any number of subcategories in OpenEI)

→

**Subcategory** →

*Active Sensors*

→

**Subcategory** →

*Radar*

→

**Technique**

*InSAR*

## Activities

**Source** +

*Reference (Kennedy & Van Soest, 2006)*

+

**Geothermal Area** +

*Dixie Valley Area*

+

**Exploration Technique**

*Water Sampling*

## References

**Info included:** Title, Author(s), Publisher, Date, Abstract – can also upload files



# GEOHERMAL GATEWAY

<http://en.openei.org>

The screenshot shows the OpenEI Geothermal Gateway page. The page is titled "GEOHERMAL ENERGY" and features a large image of a geothermal power plant. The page is organized into several sections:

- Geothermal Information:** Includes links for Geothermal Energy Overview, Types of Geothermal Resources, Energy Conversion Technologies, Cooling Technologies, Exploration Techniques, and Reference Materials.
- Resource Assessments:** Includes links for USGS Maps (2008), Geothermal Resource Potential Map, Geothermal Areas, and Geothermal Regions.
- Installed & Planned Capacity:** Includes links for Geothermal Generation, Installed Capacity, and Planned Capacity.
- Geothermal RD&D:** Includes links for Enhanced Geothermal Systems, Hydrothermal Resource Confirmation, Low-Temperature Resources, DOE-Funded Projects, Systems Analysis, and DOE Geothermal Data Repository.
- Permitting & Policy:** Includes links for Policymakers' Guidebook, Developers' Permitting Checklist, State Geothermal Incentives, and DSIRE - Database of State Incentives for Renewables & Efficiency.
- Geothermal Models & Tools:** Includes links for GETEM, SAM, PROSPECTOR, and MPACT.
- Geothermal Financing:** Includes links for Developers' Financing Handbook, RE Project Finance, CREST, HOMER, and REFTI.

Callout boxes provide additional context:

- EXPLORATION:** direct links to Exploration Techniques and Reference Materials (points to the "Exploration Techniques" link in the Geothermal Information section).
- GATEWAY:** direct link back to this geothermal gateway (points to the "Geothermal Home" link at the top right).
- LOCATIONS:** direct links to Geothermal Areas and Geothermal Regions (points to the "Geothermal Areas" and "Geothermal Regions" links in the Resource Assessments section).
- POWER PLANTS:** direct links to Installed Geothermal Plants and Planned Projects (points to the "Installed Capacity" and "Planned Capacity" links in the Installed & Planned Capacity section).

## GEOHERMAL PLANTS & PROJECTS

<http://en.openei.org>



NREL Photo

### Category: Energy Generation Facilities

- Listed on OpenEI for all renewable energy technologies
- Specific geothermal properties created for geothermal facilities (e.g. Geothermal Area in which the plant is located, average well depth, and average temperature of geofluid into the plant)
- Properties allow for data input and queries.
- Not all information and data in OpenEI have been populated; additional data could be added by industry or through additional industry surveys.

### Category: Geothermal Projects

- Listed in OpenEI, by geothermal area and region.
- Projects and associated data properties adapted from Geothermal Energy Association's (GEA) 2011 U.S. Geothermal Power Production and Development Update (Jennejohn, 2011).
- Properties include location (county, geothermal area if known, geothermal region), developer, project type, development phase, and capacity estimate.

Annual U.S. Geothermal Power Production  
and Development Report  
April 2011



**GEA**  
GEOHERMAL ENERGY ASSOCIATION



# EXAMPLE: QUERY RESULTS TABLE PAGE

<http://en.openei.org>

## Category:Energy Generation Facilities

From Open Energy Information

All Geothermal (68)

**QUERY TABLE:** example query with partial results displayed in a table format, sortable by any column.

☒	☒ Owner	☒ Facility Type	☒ Capacity (MW)	☒ Commercial Online Date	☒ Geothermal Area	☒ Geothermal Region
	Calpine	Dry Steam	20	1989	Geysers Geothermal Area	Holocene Magmatic Geothermal Region
	Amedee Geothermal Venture	Binary	1.6	1988	Amedee Geothermal Area	Walker-Lane Transition Zone Geothermal Region
	Coso Operating Co.	Double Flash	90	1989	Coso Geothermal Area	Walker-Lane Transition Zone Geothermal Region
	Calpine	Dry Steam	20	1988	Geysers Geothermal Area	Holocene Magmatic Geothermal Region
	Beowawe Power LLC	Double Flash	16.6	1985	Beowawe Hot Springs Geothermal Area	Central Nevada Seismic Zone Geothermal Region
	Calpine	Dry Steam	97	1980	Geysers Geothermal Area	Holocene Magmatic Geothermal Region
	PacificCorp Energy	Single Flash	29	1984	Roosevelt Hot Springs Geothermal Area	Northern Basin and Range Geothermal Region
	PacificCorp	Binary	11	2007	Roosevelt Hot Springs Geothermal Area	Northern Basin and Range Geothermal Region
	Ormat Technologies	Double Flash & Binary	12	1992	Brady Hot Springs Geothermal Area	Northwest Basin and Range Geothermal Region
	CalEnergy Generation	Single Flash	10	2000	Salton Sea Geothermal Area	Gulf of California Rift Zone Geothermal Region
	Calpine	Dry Steam	80	1984	Geysers Geothermal Area	Holocene Magmatic Geothermal Region
	Chena Hot Springs	Binary	0.45	2006	Chena Geothermal Area	Alaska Geothermal Region
	Calpine	Dry Steam	20	1979	Geysers Geothermal Area	Holocene Magmatic Geothermal Region
	CalEnergy Generation	Double Flash	20	1989	Salton Sea Geothermal Area	Gulf of California Rift Zone Geothermal Region
	Ormat Technologies	Binary	11	2006	Desert Peak Geothermal Area	Northwest Basin and Range Geothermal Region
	Terra-Gen Operating Co.	Double Flash	67.2	2006	Dixie Valley Geothermal Area	Central Nevada Seismic Zone Geothermal Region
	Calpine	Dry Steam	110	1989	Geysers Geothermal Area	Holocene Magmatic Geothermal Region
	CalEnergy Generation	Double Flash	38	2000	Salton Sea Geothermal Area	Gulf of California Rift Zone Geothermal Region
	Nevada Geothermal Power	Double Flash	20	2000	Salton Sea Geothermal Area	Northwest Basin and Range Geothermal Region
	Ormat Technologies	Double Flash	18	2000	Salton Sea Geothermal Area	Gulf of California Rift Zone Geothermal Region
	Ormat Technologies	Double Flash	18	2000	Salton Sea Geothermal Area	Gulf of California Rift Zone Geothermal Region
	Ormat Technologies	Binary	15	2000	Walker-Lane Transition Zone Geothermal Area	Walker-Lane Transition Zone Geothermal Region

**TEXT COLOR:** blue text indicates clean link to OpenEI page; red text indicates broken link to a page that does not yet exist on OpenEI

# EXAMPLE: LINK TO GEA DEVELOPMENT PHASES

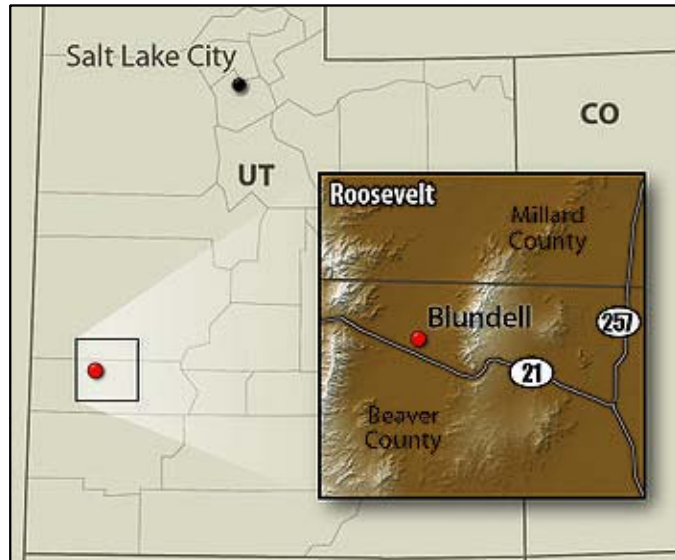
<http://en.openei.org>

The image shows two screenshots of the OpenEI Wiki interface. The left screenshot shows the 'GEOHERMAL ENERGY' category page with the sub-category 'GEA Development Phases'. A list of pages in this category is shown, with 'Phase I - Resource Procurement and Identification' highlighted in a box. A large black arrow points from this box to the right screenshot, which shows the full content of the 'Phase I' page. The right screenshot shows the page title 'GEA Development Phase I: Resource Procurement and Identification' and its detailed content, including criteria for resource development, transmission, and external development.



## GEOHERMAL AREAS & REGIONS

<http://en.openei.org>



Map Credit: Billy Roberts

### Category: Geothermal Areas

- Geothermal areas are specific locations of geothermal potential (e.g., Coso Geothermal Area).
- Base set of geothermal areas used came from the 253 geothermal areas identified by the USGS Resource Assessment (Williams *et al.*, 2008).
- Additional areas added based on the literature search and projects listed in the GTP's database of funded projects.

### Category: Geothermal Regions

- 21 Regions were outlined for the western United States (including Alaska and Hawaii)
- Regions were developed based on the USGS physiographic regions
- Boundaries adjusted to fit geothermal parameters such as differences in geologic regime, structure, heat source, surface effects (weather, vegetation patterns, groundwater flow), and other relevant factors.



Map Credit: Billy Roberts

# EXAMPLE: GEOTHERMAL AREA PAGE

<http://en.openei.org>

OpenEI | OPENENERGYINFO

Login | Sign Up

Wiki Datasets Linked Data

Browse Page Actions View Get Involved Help

Page Discussion Edit with form History


Go Search

Share this page on [f](#) [t](#) [...](#)

GEOTHERMAL ENERGY Geothermal Home

## Resource Area: Roosevelt Hot Springs Geothermal Area

Details
Power Plants (2)
Projects (0)
Techniques (7)



**Area Overview**

Roosevelt Hot Springs is among the hottest and best documented of the geothermal resources in the Basin and Range Province. The field is located on the eastern edge of the Province in south central Utah, on the western margin of the Mineral Mountains, approximately 15 miles northeast of the town of Milford and about 165 miles south of Salt Lake City. Blundell Plant 1, a 26 megawatt (MW) installed-capacity single-flash unit was completed in 1984. The project earned the U.S. Department of Energy's innovation award in 1984 for being the first commercially-produced geothermal power plant outside of California. In 2007, Blundell 2, an 11 MW binary bottoming-cycle unit was brought on-line. The geothermal fluid for both plants comes from four production wells and three injection wells that are between 2,100 and 6,000 feet deep with bottom-hole temperatures 469 and 514°F, respectively. In 1981, the hot springs were also the test site of a 1.6 MW biphasic turbine research unit. This was a "total flow" turbine that would accept both brine and steam to improve energy conversion by utilizing both the thermal and kinetic energy of the geothermal fluid.

However, a conventional flash unit was selected to be installed at the site instead, and thus, the biphasic unit was decommissioned.

Geothermal Area Profile	
<b>Location</b>	Milford, Utah
Exploration Region	Northern Basin and Range
GEA Development Phase	Operational
<b>Coordinates</b>	38.4867158822°, -112.852795604° <a href="#">Display map</a>
USGS Resource Estimate	
Mean Reservoir Temp (°C)	250
Estimated Reservoir Volume (km <sup>3</sup> )	8.5
Mean Capacity (MW)	119.53
Power Production Profile	
Gross Production Capacity (MW)	
Net Production Capacity (MW)	206,098
Number of Operating Plants	2
Owners	<ul style="list-style-type: none"> <li>• PacificCorp Energy</li> <li>• PacificCorp</li> </ul>
Power Purchasers	
Well Field Information	
Number of Production Wells	8
Number of Injection Wells	3
Average Temperature of Geofluid (°C)	340
Average Depth to Reservoir (km)	4,132
Development Area (km <sup>2</sup> )	30,720
<b>References</b>	Electrical Power Generation in the Roosevelt Hot Springs Area - The Blundell Geothermal Power Plant <sup>[1]</sup> An Overview of Environmental Issues: Roosevelt Hot Springs KGRA, Utah; Geothermal Noise Effects <sup>[2]</sup>

**Geology and Hydrothermal System**

**History and Infrastructure**

**Technical Problems and Solutions**

**Regulatory and Environmental Issues**

**DOE Involvement**

**Future Plans**

**References**

- ↑ 1.0 1.1 1.2 "Electrical Power Generation in the Roosevelt Hot Springs Area - The Blundell Geothermal Power Plant"
- ↑ 2.0 2.1 "An Overview of Environmental Issues: Roosevelt Hot Springs KGRA, Utah; Geothermal Noise Effects"

Category: Geothermal Resource Areas

**QUERIES:** queries of related data are provided in tabs including a count of items returned in query

**AREA DATA:** most immediate grouping listed here (as a link to the Active Sensors page)

**AREA INFORMATION:** expandable boxes provide information about the area.

**CATEGORIES:** all categories of which this page is a member are listed at bottom of page



# EXAMPLE: EDIT WITH FORM

<http://en.openei.org>

OpenEI | OPENENERGYINFO Welcome Kyoung | Log out

Wiki | Datasets | Linked Data

Browse | Page Actions | View | Get Involved | User | Help

Page | Discussion | **Edit with form** | History

Go Search

Share this page on [f](#) [t](#) ...

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## Roosevelt Hot Springs Geothermal Area

**Name \***

**Location \***

**Region \***

**Development Phase \***

**Geothermal Map**  [Upload file](#)

**Coordinates**   Use address

Map Satellite Hybrid Terrain

POWERED BY Google 2000 ft 500 m Map data ©2012 Google - Terms of Use

**Resource Estimate**

**Mean Reservoir Temperature**

**Estimated Reservoir Volume (km<sup>3</sup>)**

**Mean Estimated Capacity (MW)**

**RED STAR:** required input

**BLUE QUESTION:** pop-up tip with description of data to be entered by user

# EXAMPLE: EDIT WITH FORM

<http://en.openei.org>

The screenshot shows a web form for editing a page. The form is divided into several sections:

- Text Boxes:** A large text area at the top contains text about geothermal noise sources and DOE involvement. A callout box explains: "TEXT BOXES: for longer data entry; no content limit".
- DOE Involvement:** A section with a text area containing details about a 2000 DOE R&D grant for the Kalina Cycle. A callout box explains: "WATCH: can add a watch to this page from this form".
- Future Plans:** A section with a text area containing details about a double-flash plant. A callout box explains: "PREVIEW: can preview changes before saving".
- References:** A section with a table for adding references. It includes fields for Title, URL, and Name. A callout box explains: "REFERENCES: can add as many references as needed." Below the table is a "+ Add reference" button and a "Use advanced syntax" checkbox.
- Help:** A "Help ?" button is visible in the References section. A callout box explains: "HELP: get help with wiki formatting, semantic queries, etc.".

At the bottom of the form, there is an "Edit history:" field, checkboxes for "This is a minor edit" and "Watch this page", and buttons for "Save page", "Show preview", "Show changes", and "Cancel". A link for "Editing help (opens in a new window)" is also present.

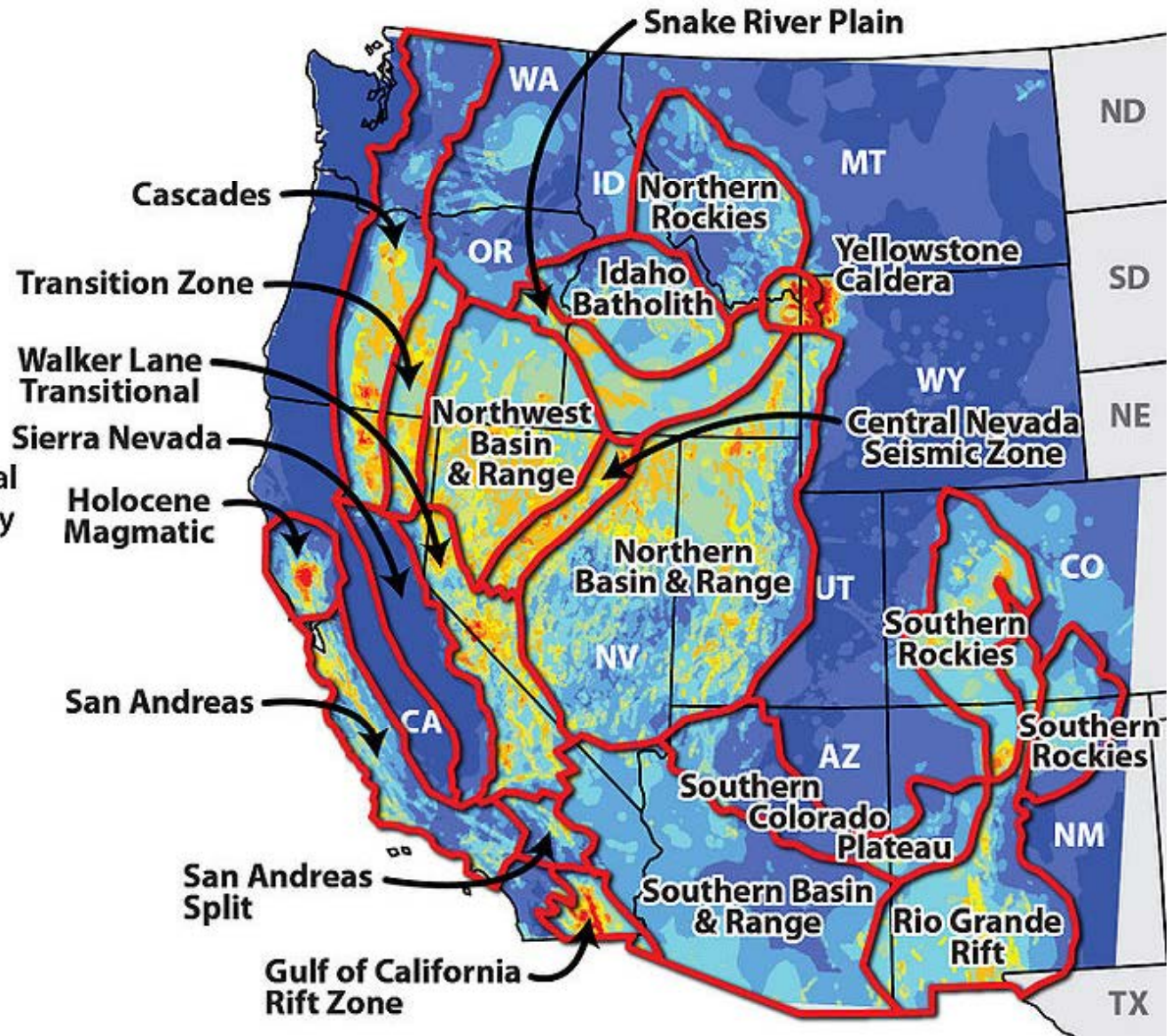


# GEOHERMAL REGIONS

<http://en.openei.org>

The base map for this figure is the 2008 USGS Geothermal Favorability Map showing relative favorability for the presence of geothermal systems in the western United States. It is an average of 12 models that correlates different geological and geophysical factors of moderate (90-150°C) to high (>150°C) temperature geothermal systems. Exploration regions outlined in red were derived for this study from USGS physiographic regions of the contiguous states.

Data source: United States Geological Survey  
Map Credit: Billy Roberts



# GEOHERMAL REGIONS

<http://en.openei.org>

Exploration Region		Region Size	Installed Capacity <i>(GEA website)</i>		Planned Capacity <i>(GEA, 2011)</i>			Resource Estimate <i>(USGS, 2008)</i>	
			Installed Capacity	# of Plants Installed	Planned Capacity	# of Planned Plants with Capacity Estimate	# of Planned Plants with Unknown Capacity Estimates	Identified Capacity	Un-discovered Capacity
1	BR: Central Nevada Seismic Zone	28,863	97	3	100	2	15	378	744
2	BR: Northern Basin & Range	327,187	68.8	5	134	6	18	358	3,741
3	BR: NW Basin & Range	137,091	214.36	9	161	6	9	1,044	2,238
4	BR: Southern Basin & Range	217,012	0	0	100	2	2	9	830
5	BR: Walker-Lane Transition Zone	81,265	431.1	16	244	7	9	763	1,130
6	Cascades	124,543	0.28	1	30	1	2	608	1,057
7	Gulf of California Rift Zone	20,044	658	21	388.6	8	0	3,147	8,790
8	Holocene Magmatic	25,977	1,587	19	26	1	3	1,128	316
9	Idaho Batholith	72,883	0	0	49	2	2	218	500
10	Northern Rockies	101,604	0	0	0	0	0	71	415
11	Rio Grande Rift	130,309	0.24	1	15	1	1	227	1,137
12	San Andreas	69,192	0	0	0	0	0	17	480
13	San Andreas Split	18,246	0	0	0	0	0	7	101
14	Sierra Nevada	58,554	0	0	0	0	0	0	26
15	Snake River Plain	61,320	0	0	0	0	1	130	778
16	Southern Colorado Plateau	92,142	0	0	0	0	0	0	274
17	Transition Zone	40,705	0	0	0	0	2	53	693
18	Yellowstone Caldera	11,842	0	0	0	0	0	44	210
19	Southern Rocky Mountains	128,454	0	0	0	0	0	0	1,010
20	Alaska	1,717,854	0.73	1	25	3	1	677	1,788
21	Hawaii	28,311	35	1	0	0	1	181	2,435
	Other (outside region boundaries)	---	0.25	1	---	---	---	0	1,341
<b>Table Totals</b>		<b>3,493,398</b>	<b>3,093</b>	<b>78</b>	<b>1,273</b>	<b>39</b>	<b>66</b>	<b>9,060</b>	<b>30,033</b>



## EXPLORATION TECHNIQUES & ANALYSES

<http://en.openei.org>

### Exploration Techniques

- Because information in this study was destined for the knowledge exchange, a structure was needed to categorize exploration techniques.
- Exploration techniques were categorized into exploration groups, such as field methods, geochemistry, geophysics, and remote sensing (see next slide for structure)

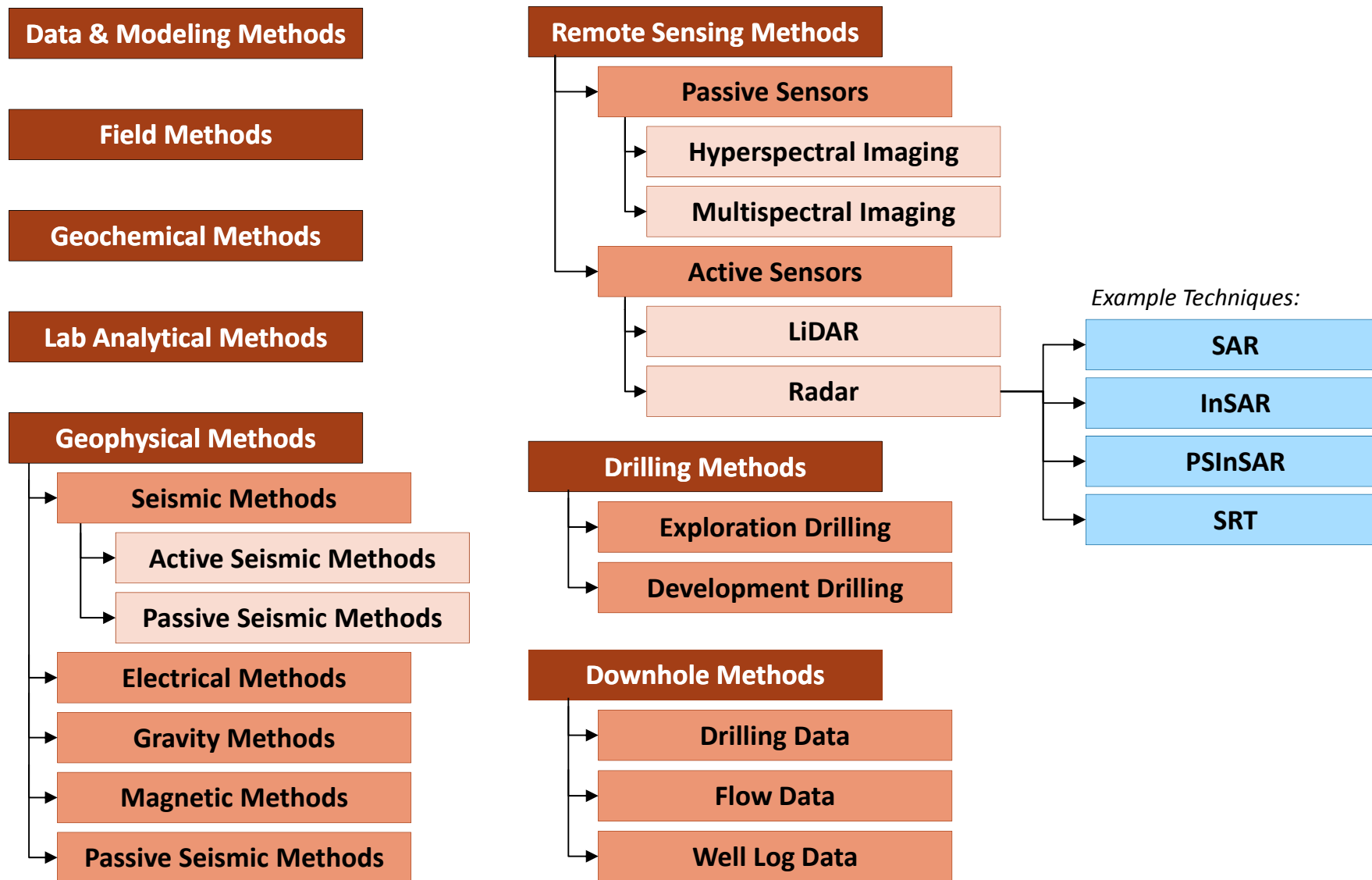
### Exploration Analyses

- Four different types of exploration analyses were identified:
  - Lithology
  - Stratigraphic/structural
  - Hydrological
  - Thermal
- Each technique can be described in terms of the data it could provides for each type of analysis.
- See the data on OpenEI for a full listing of exploration techniques and the data that could be provided for each analysis.

Example Technique	Exploration Analysis			
	Lithology	Stratigraphic /structural	Hydrological	Thermal
<b>Field Mapping</b>	Map surface geology	Map fault and fracture patterns, kinematic information	Map surface manifestations of geothermal systems	Map surface temperature
<b>Trace Element Sampling</b>			Map permeable structures connected to geothermal reservoir	
<b>Geo-thermo-metry</b>				Estimate temperature of hydrothermal reservoir

# EXPLORATION TECHNIQUES CATEGORIES

<http://en.openei.org>



EXAMPLE: EXPLORATION TECHNIQUE PAGE

<http://en.openei.org>

**OpenEI | OPENENERGYINFO** Welcome Kyoung | Log out

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Page Discussion Edit with form History

**GEOTHERMAL ENERGY** Geothermal Home

## Exploration Technique: LiDAR

Details Activities (10) Areas (5) Regions (3) Sensors

**DEFINITION:** independent entity, pulled into this technique template and semantically linked to external definitions, such as Wikipedia and Reegle

**QUERIES:** queries of related data are provided in tabs including a count of items returned in query

**EXPLORATION GROUP:** most immediate grouping listed here (as a link to the Active Sensors page)

**BEST PRACTICES:** as described in the paper, results from the expert interviews are populated here; log in to add your contributions and help to flesh out these sections.

**ANALYSIS INFORMATION:** provided in upper right table

Exploration Technique Information	
Exploration Group	<a href="#">Active Sensors</a>
Analysis Information	
Lithology:	
Stratigraphic/Structural:	used to delineate faults, created high-resolution DEMS, quantify fault kinematics, develop lineament maps
Hydrological:	
Thermal:	

Categories: [Exploration Techniques](#) | [Remote Sensing Methods](#) | [Active Sensors](#)

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## EXAMPLE: QUERY RESULTS LIST PAGE

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## GEOTHERMAL ENERGY

Geothermal Home

### Exploration Technique: LiDAR

Details Activities (10) Areas (5) Regions (3) Sensors (0)

- [LiDAR \(Laney, 2005\)](#)
- [LiDAR \(Lewicki & Oldenburg\)](#)
- [LiDAR \(Lewicki & Oldenburg, 2004\)](#)
- [LiDAR \(Lewicki & Oldenburg, 2005\)](#)
- [LiDAR \(Monaster And Coolbaugh, 2007\)](#)
- [LiDAR At Chocolate Mountains Area \(Alm, Et Al., 2010\)](#)
- [LiDAR At Gabbs Valley Area \(Doe Gtp\)](#)
- [LiDAR At Glass Buttes Area \(Doe Gtp\)](#)
- [LiDAR At Twnty-Nine Palms Area \(Page, Et Al., 2010\)](#)
- [LiDAR At Twnty-Nine Palms Area \(Sabin, Et Al., 2010\)](#)

Categories: [Exploration Techniques](#) | [Remote Sensing Methods](#) | [Active Sensors](#)

What links here Related changes Special pages Printable version Permanent link Browse properties

**QUERY LIST:** example query with partial results displayed in a bulleted list format, properties included in parenthesis.

**ACTIVITY:** each query item links to an Activity page, which has links to the Reference page.

## FUTURE POTENTIAL

<http://en.openei.org>

### Planned

- Adding exploration Case Studies (as category)
- Adding geothermal Models (as category, can be assigned to Areas)
- Geothermal Developers' Permitting Checklist (federal, state)

### Potential Future Features

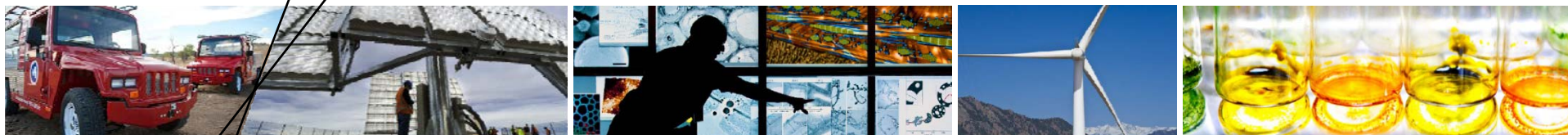
- Navigation – add tools, links, pages and forms that increase navigability of geothermal sites
- Search – increase search functionality
- Add graphical features (e.g. interactive maps, graphs, timelines)
- Additional Data, for example:
  - Pull data from EIA for power plants and graph historical data
  - Pull news feeds – link to Projects, Areas, etc.
  - Link to other available served data



NREL Photo



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