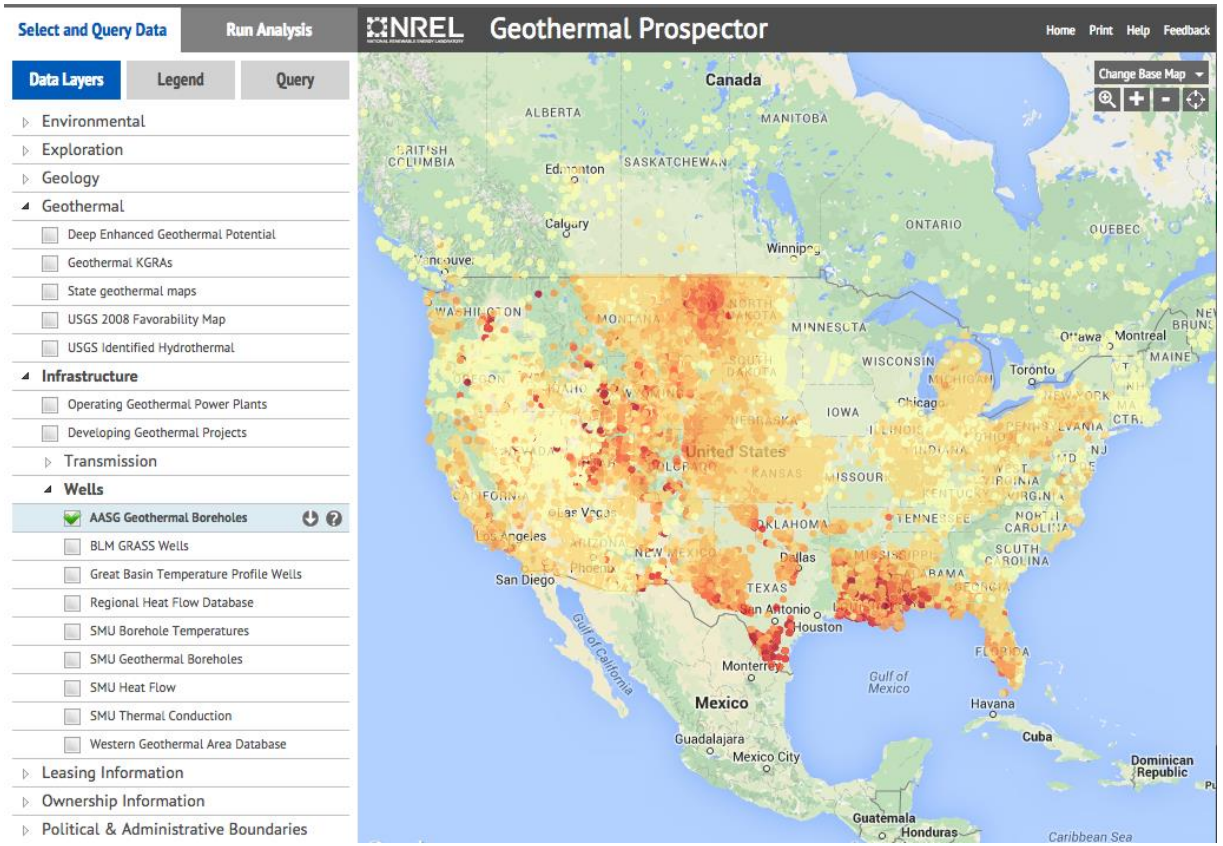

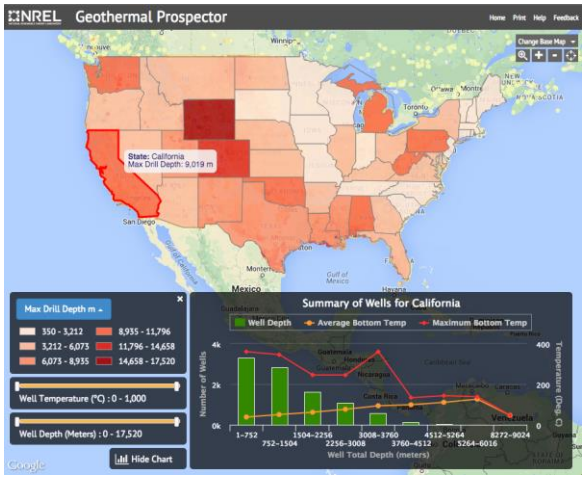

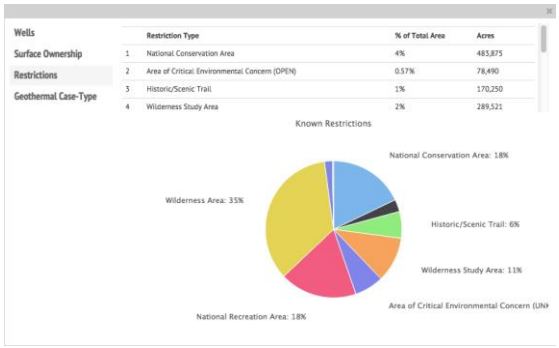

Geothermal Prospector

Project Officer: Arlene Anderson

Total Project Funding: $157,000

May 11, 2015

PI: Dan Getman

National Renewable Energy Laboratory

Systems Analysis, Resources Assessment, Data System Development & Population, Education

Relevance/Impact of Research

4.6.2.1 Data and Analysis Tools (Geothermal Prospector)

Objective

- The Geothermal Prospector provides access to explore, query, visualize, and download data necessary for understanding the costs, risks, and potential for geothermal renewable energy.

- Reduce the inherent cost in finding and formatting data necessary for geothermal exploration by
  - Providing a venue where users can find the best data and analysis that can be freely provided by the federal government.
  - Providing a tool to identify areas with high geothermal potential with minimum of access constraints

GTO Goals

Systems Analysis:

- Lowering risks and costs of development and exploration
- Providing the geothermal industry with information necessary to make informed decisions on exploration and development.
- Assist in identification of large commercial uses are near geothermal resources to spur direct use applications.

Hydrothermal:

- Assist in identification of new play fairways

EGS:

- Identify areas where EGS demonstrations could come online or where transmission is available for geothermal.

Relevance/Impact of Research

4.6.2.1 Data and Analysis Tools (Geothermal Prospector)

Challenges Addressed

- Lowering costs and risk in exploration through the provision of data and analysis capabilities representing a large portion of the available spatial data related to geothermal exploration that can be provided for free by the US government.

Industry/GTO Impact

- Geothermal Prospector will assist accelerating near-term geothermal growth by providing industry and researchers with the capability to identify potential exploration sites by integrating geologic and land use/access data sets.
- Geothermal Prospector provides a coordinating piece in the GTO suite of tools including NGDS and GDR by supporting the provision of spatial datasets to the NGDS (as a Node) as well as providing a venue to view and query data listed on the NGDS and served from other institutions.

Integration

- Prospector provides an analysis platform with selected data to be drawn from NGDS and other data sources.
- Shapefiles acquired by NREL for analysis not currently available in NGDS will be made available to the NGDS as standards based web services.

Technical Approach

- Tenants of our Technical Approach
  - Integrative (as opposed to duplicative)
    - The Geothermal Prospector is built on the OpenCarto framework. OpenCarto was built by NREL to support web based GIS applications. It utilizes open source libraries and currently supports more than 14 individual applications focused on various RE technologies. Each project shares data, resources, and analysis capabilities which reduces short-term development costs and long-term maintenance costs.
  - Interoperable
    - Through the utilization of standards based data services, the Geothermal Prospector application is very much interoperable with the NGDS. This interoperability is key in our efforts to visualize data listed in NGDS within the prospector application and in the development of a catalog search that allows prospector to actually search datasets in the NGDS.
  - User Focused
    - User needs are the main driver in the development of the Geothermal Prospector. The new version of this application is focused on streamlining tools to focus on data download and visualization of complex data; both of which are direct requests from our user community.

Technical Approach

- User Feedback and Engagement
  - The Geothermal Prospector is filling an important role for geothermal stakeholders, but there is great potential to increase its impact
  - Addressing this concern in FY 2015
    - Peer Review Presentation
      - Very much interested in feedback on
        - » Which datasets would be good to add and maintain in the prospector?
        - » Which projects can benefit by including their research in the prospector?
        - » Analysis and visualizations that can be added to support GTO activities?
      - Live demonstration and discussion planned for the end of this session
    - GRC Presentation
      - Looking for feedback from other researchers and industry in these same topics
    - Webinars
      - Making sure people know about the tool, how to use it, and that it is available for their use in accessing data as well as providing data to other researchers
    - Videos
      - Providing training on how to use the tool

Accomplishments, Results and Progress

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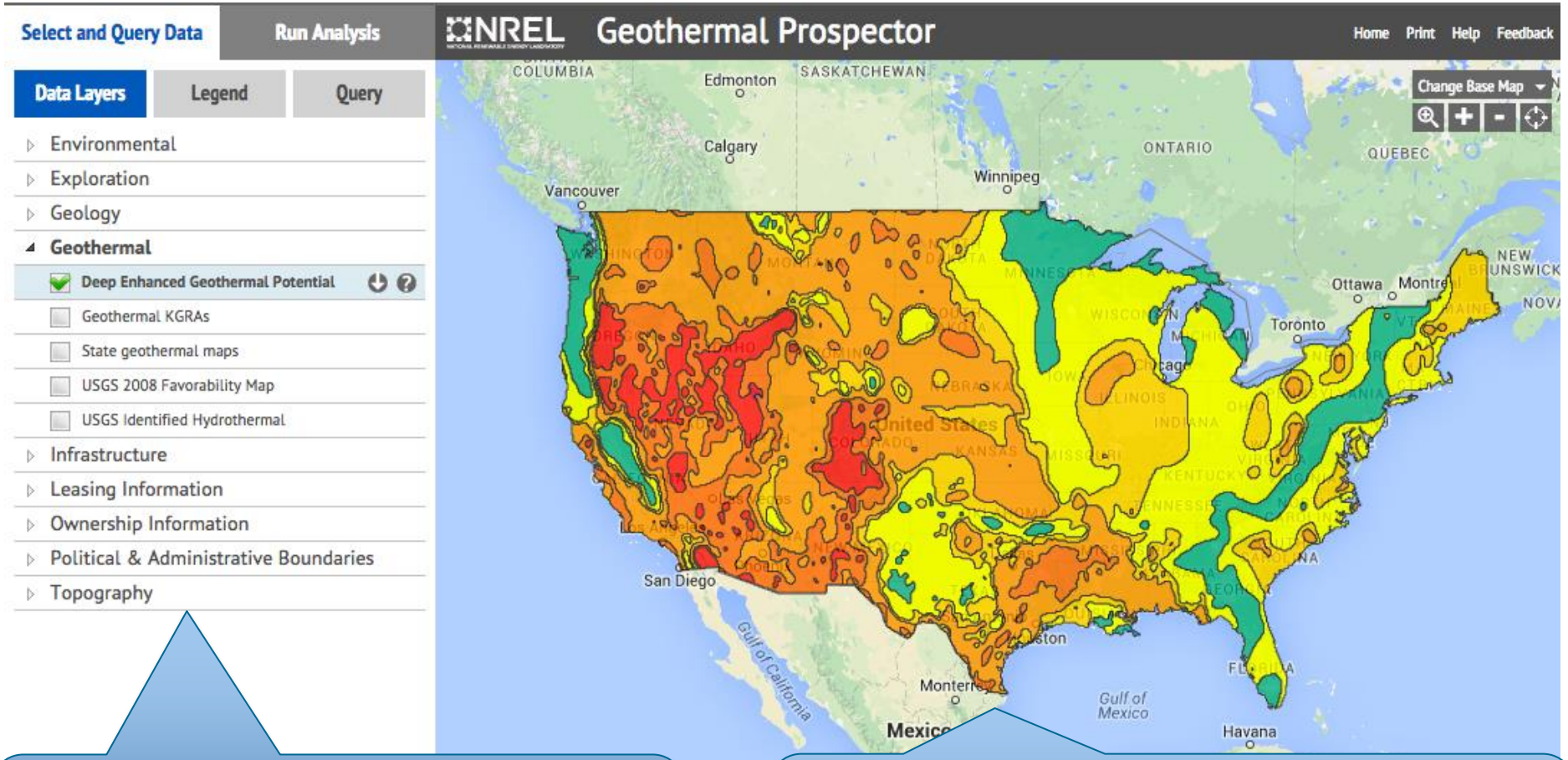
Original Planned Milestone/ Technical Accomplishment	Actual Milestone/Technical Accomplishment	Date Completed
Version 1 of Geothermal Prospector completed and delivered to DOE	As described	9/2012
Enhanced analysis capabilities and additional datasets added to the application and delivered to DOE	As described	9/2013
Initial integration with NGDS released	As described	4/2014
Prototype of Multivariate (Wells) Visualization capability released	As described	9/2014
Beta version of new OpenCarto architecture update to Geothermal Prospector released	Delayed: Was due 3/31/2014	9/2014
Final version of OpenCarto architecture update to Geothermal Prospector released	Delayed: Was due at the EOFY 2014	4/2015
FY 2015 Milestone and Decision Point: To present the Geothermal Prospector at the DOE annual peer review and receive feedback on its usefulness to geothermal research community.	As described	5/2015
Present the Geothermal Prospector at the GRC summit and receive feedback on its usefulness to geothermal research community.	As described	8/2015
Present the Geothermal Prospector at the GRC annual meeting and receive feedback on its usefulness to geothermal research community.	As described	9/2015

Accomplishments, Results and Progress



The interface has been completely redesigned based on user feedback to be simpler and more intuitive to use

Data storage, data services, and all hardware are new and fit within an architecture that improves both performance and reliability

Accomplishments, Results and Progress

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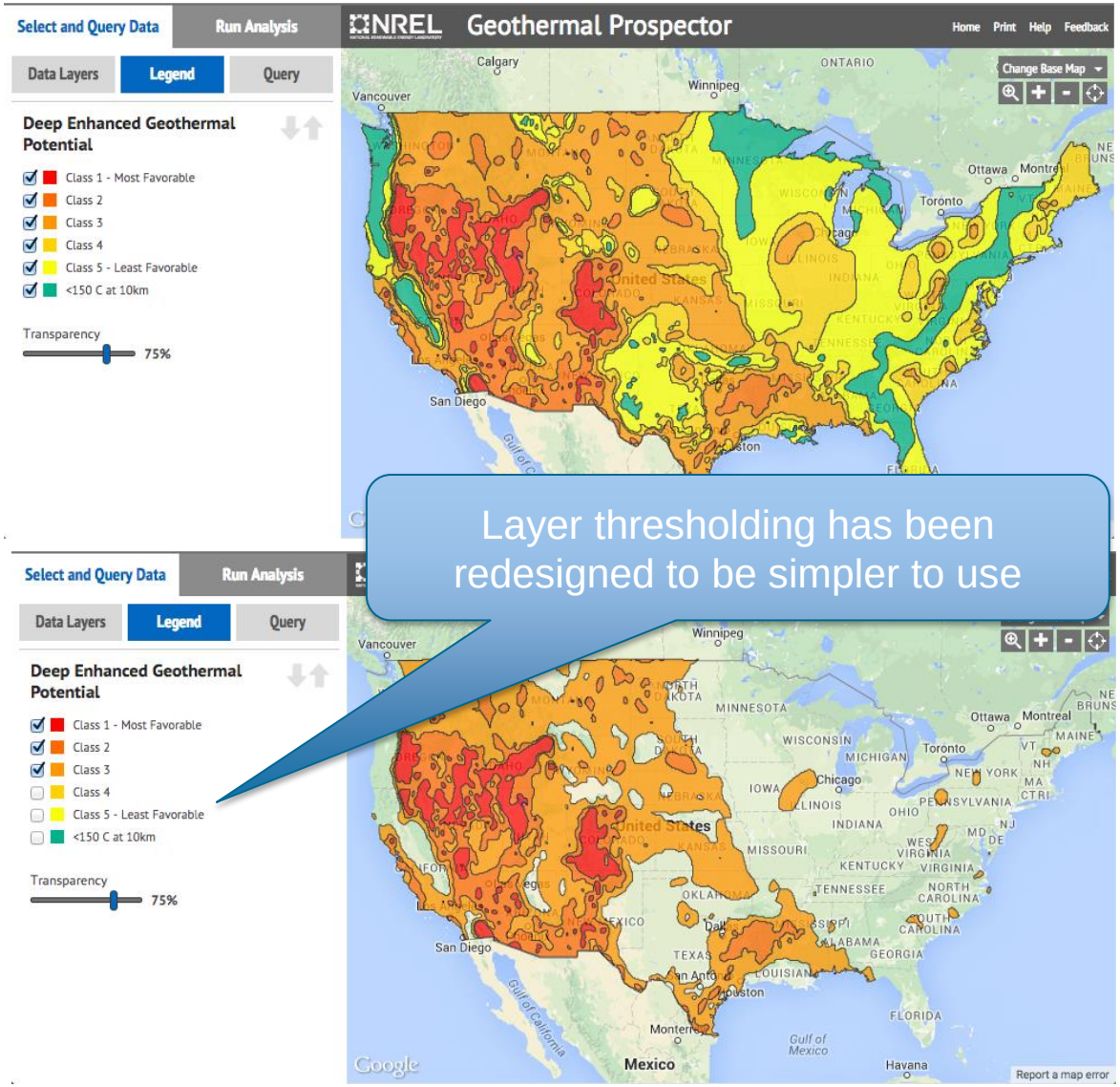
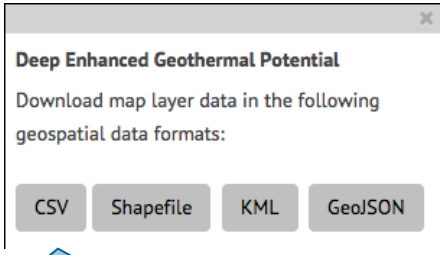
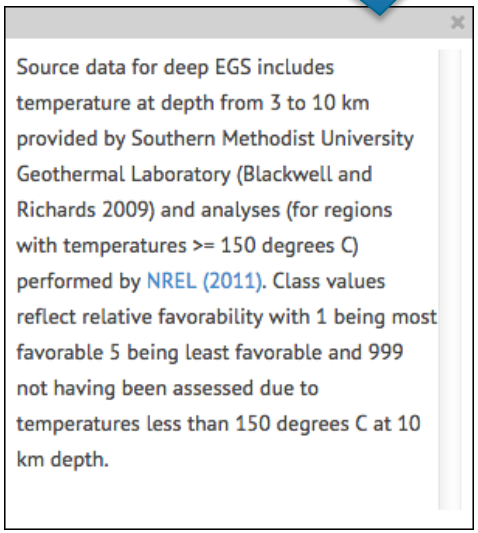


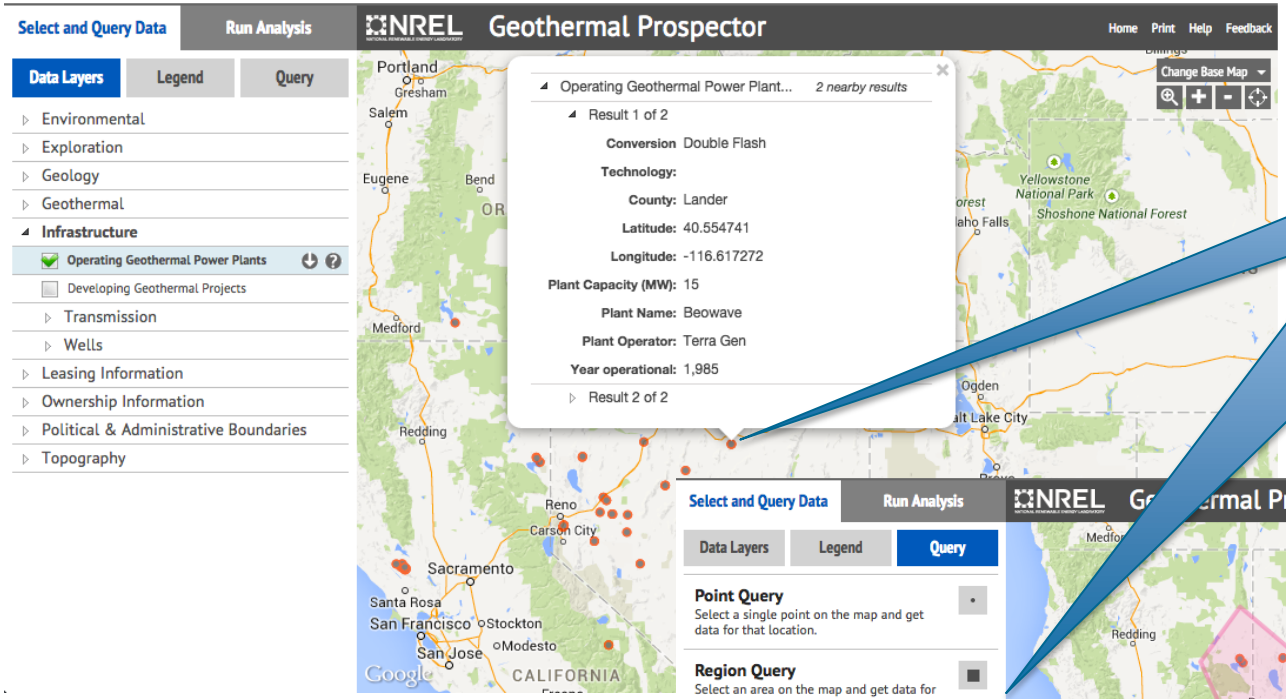
Layer thresholding has been redesigned to be simpler to use



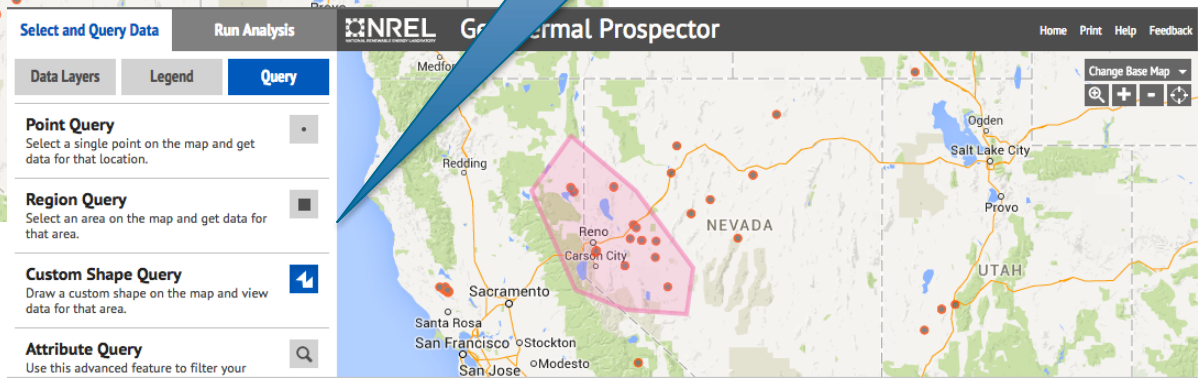
Downloading the datasets and accessing metadata are exceedingly simple



Accomplishments, Results and Progress



Users can query by point, box, polygon, or attribute



Results are available to download as CSV

Operating Geothermal Power Plants

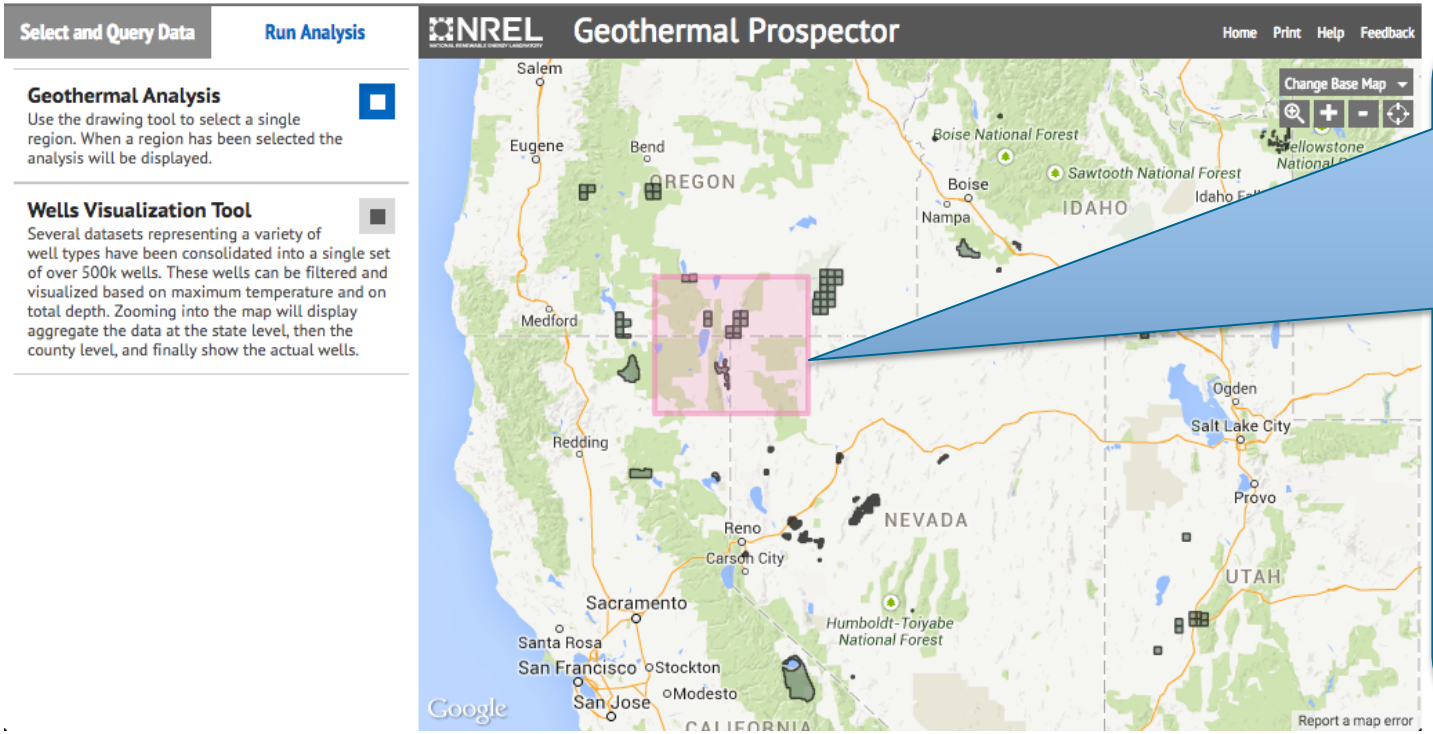
Close

Download Query Results

Plant Name	Plant Operator	Conversion Technology	Plant Capacity (MW)	County	Year operational	Latitude	Longitude
Wabuska I	Home Stretch Geothermal	Binary	1.2	Lyon	1,984	39.164456	-119.180797
Wineagle	Wineagle Development	Binary	0.7	Lassen	1,985	40.356934	-120.25641
Steamboat I	Ormat	Binary	6.9	Washoe	1,986	39.394003	-119.753659
San Emidio	US Geothermal	Binary	4.8	Washoe	1,987	40.369215	-119.405712
Soda Lake 1	Magma Energy	Binary	1.1	Churchill	1,987	39.555398	-118.838285

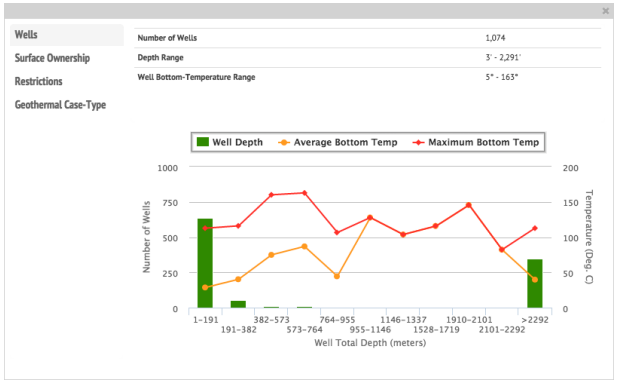
Accomplishments, Results and Progress

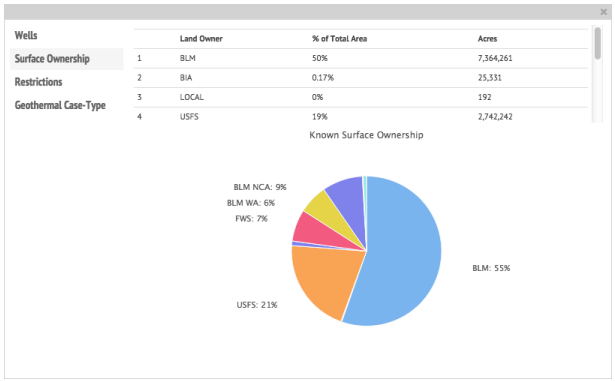
U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

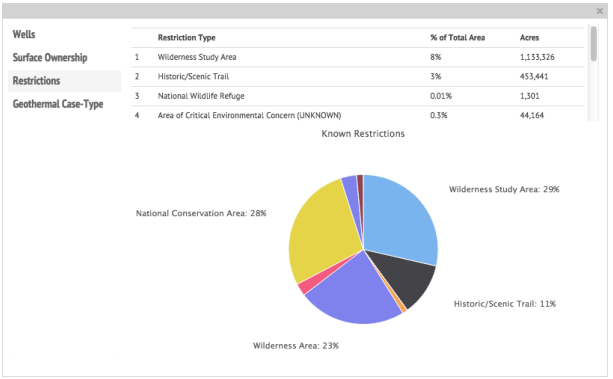


Summary analysis for a user specified region provides summary of:

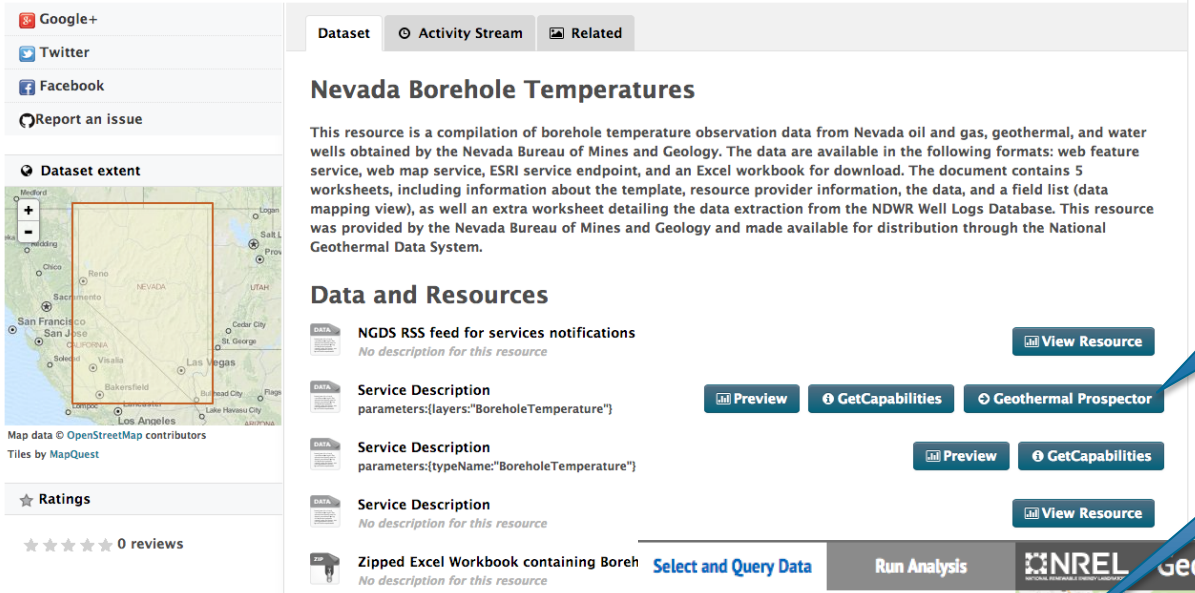
- Available wells
- Land Ownership
- Land Use Restrictions



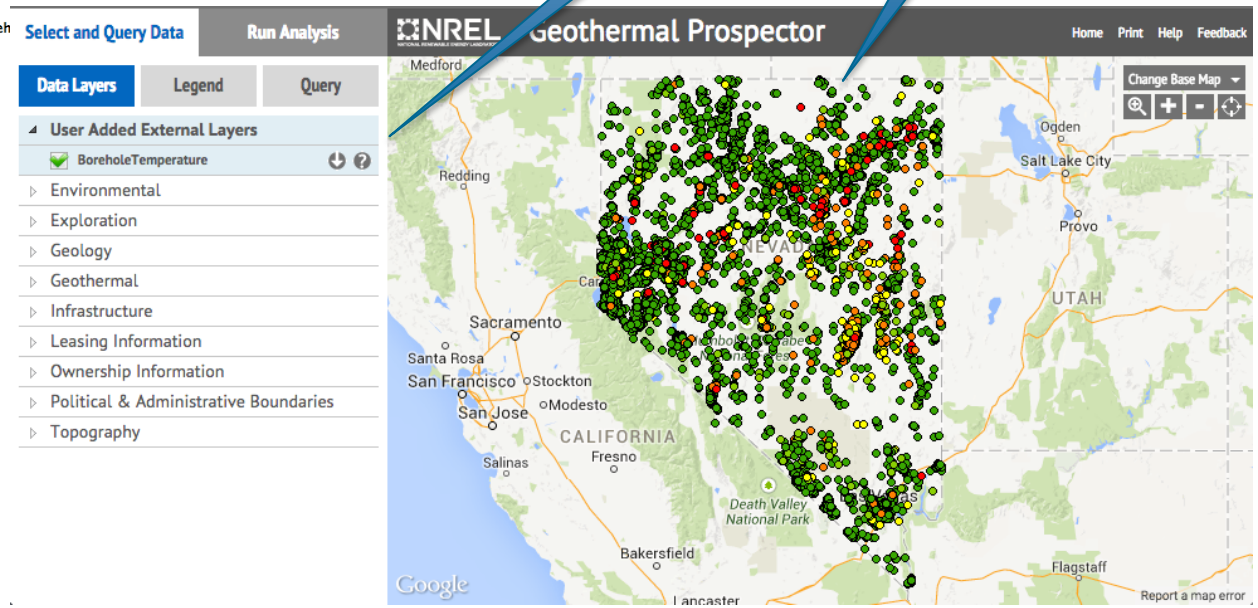




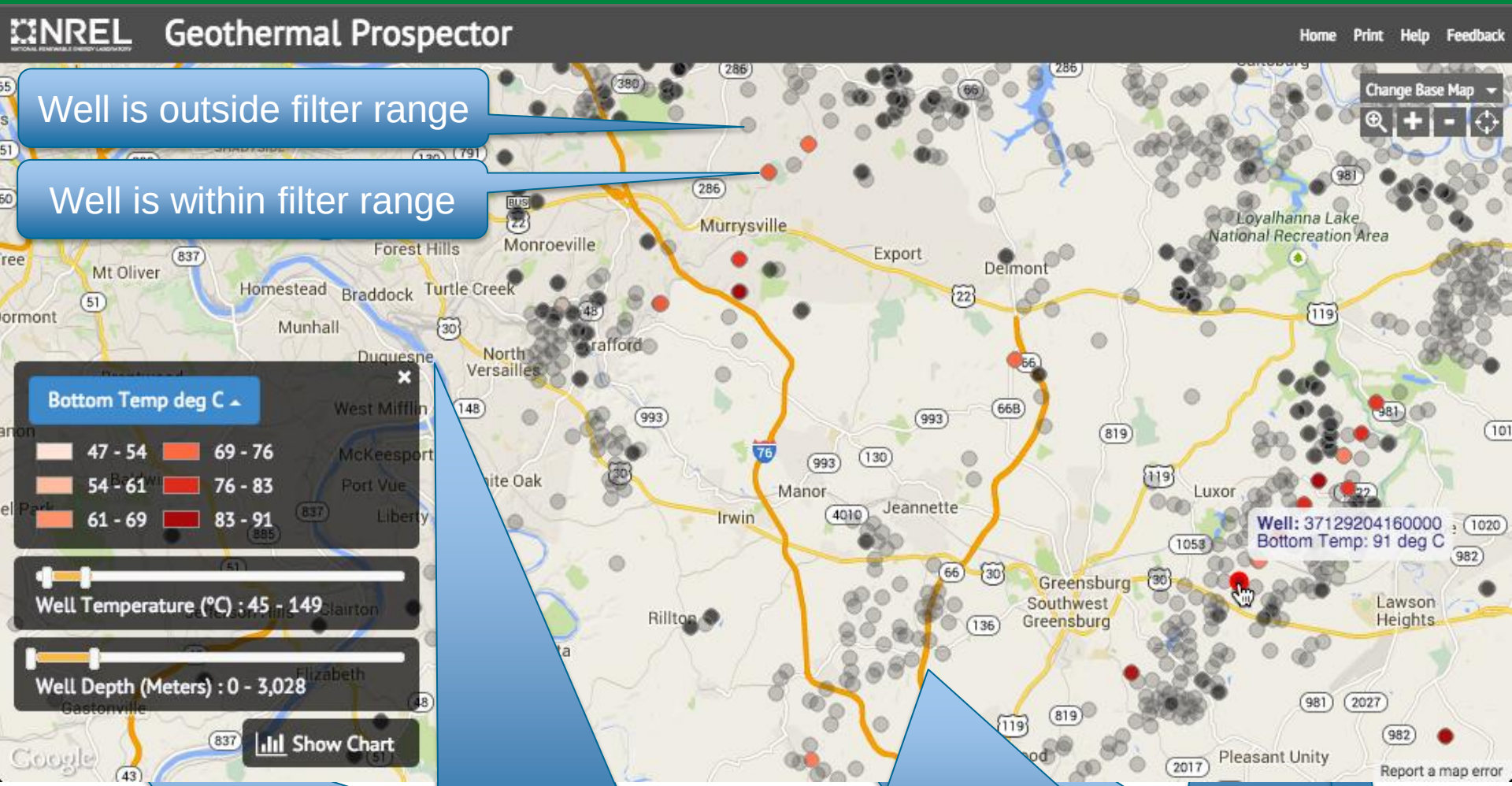
Accomplishments, Results and Progress



Integration with NGDS allows users to launch the GTP with data listed in the NGDS catalog



Through developments in collaboration with USGIN, the Geothermal Prospector will be capable of searching the NGDS and loading data directly form that catalog.



Filters and charts also apply at this level of detail

Zooming in further shows the actual wells data points

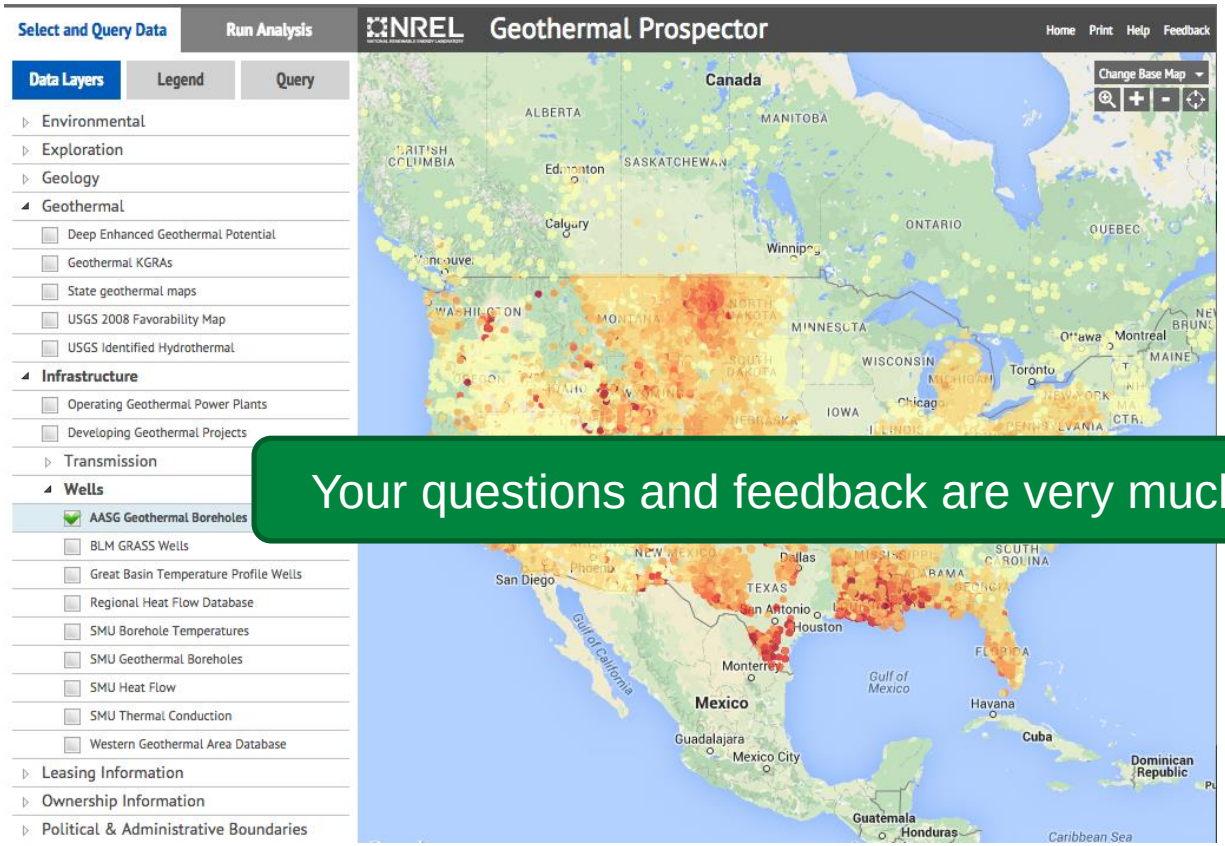
Future Directions

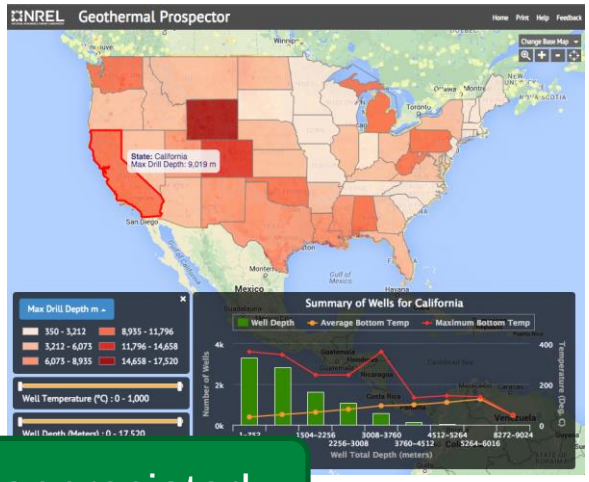
- Future plans, beyond FY 2015, for the Geothermal Prospector will be focused in four areas
  - User feedback
  - Data enhancements and maintenance
  - Systems integration and interoperability (NGDS and GDR)
  - Development of new analysis and visualization focused on enhancing GTO efforts in play fairways and other analysis focus areas

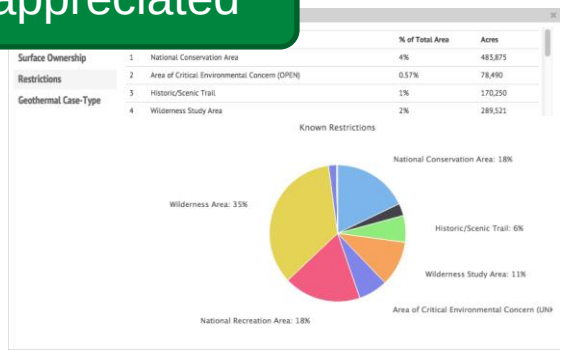
Milestone or Go/No-Go	Status & Expected Completion Date
FY 2015 Milestone and Decision Point: To present the Geothermal Prospector at the DOE annual peer review and receive feedback on its usefulness to geothermal research community.	5/2015 – Meetings will occur based on feedback from this presentation and follow on conversations

Summary

- Geothermal Prospector helps GTO meet its goals and objectives of lowering the risk and cost of geothermal exploration by providing current relevant geothermal data and tools to a wide group of stakeholders
- Geothermal Prospector currently supports several important needs in the geothermal research community
  - Provides access to explore, query, visualize, and download data necessary for understanding the costs, risks, and potential for geothermal renewable energy.
  - Provides a venue for spatial datasets resulting from DOE funded research to be shared with the public, research communities, and industry
  - Provides a visualization capability that can be used to explore complex datasets
  - Fills an important role in the GTO tool set, currently comprised of the NGDS, the GDR, and the Geothermal Prospector
- There is a direct need to ensure stakeholders are aware of the application and GTO project participants are using it to download and provide access to their own data







Your questions and feedback are very much appreciated

Geothermal Prospector

Project Officer: Arlene Anderson

Total Project Funding: $157,000

May 11, 2015

http://maps.nrel.gov/gt_prospector