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Exploration Risks and Geothermal Resource Characterization

*California Energy Commission
Integrated Energy Planning Report Workshop
July 9, 2026*

*Jeremy Lancaster PG CEG
Director and State Geologist
California Geological Survey*

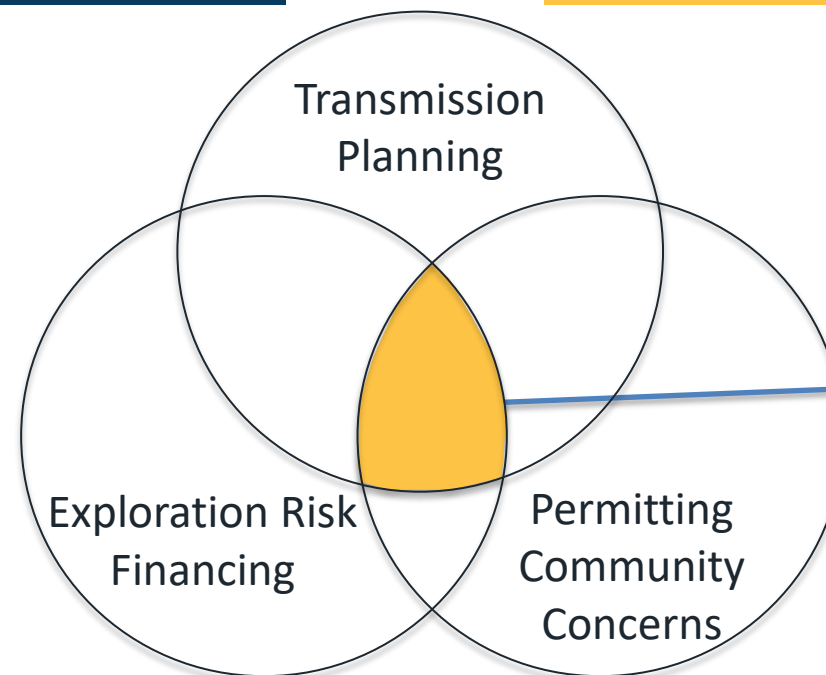
CHALLENGES AND OPPORTUNITIES

Ranked Challenges from June 18 IEPR Poll

1. Permitting
2. Transmission and Interconnection
- 3. Exploration Costs and Risks**
4. Financing
5. Community Concerns

Exploration Costs and Risks

- Front-loaded exploration costs
- Amounting to 40% of the project cost
- Risks systematically lower the potential for financing and capital expenditure, and,
- Geothermal development in the state



GEOTHERMAL DATA
Priority Areas
Prospectivity
Known and New Resources

Success Stories - Geothermal Data

With support from the federal government (\$10 million), Nevada has acquired the basic data and technology to advance geothermal exploration.

Nevada Play Fairway – Geothermal favorability



ABOUTRESEARCHLEARNEXPLORENEWSCONTACT

Research

Two-Meter Temperature Surveys

GBCOE affiliates pioneered the two meter temperature measurement technique. The method involves pounding a steel rod into the ground, inserting a resistant temperature device into the rod, and then measuring the temperature after a short equilibration period. This method has successfully identified thermal anomalies in areas without other surface geothermal indicators (i.e., blind geothermal systems).



PHD student Kurt Kistal records a GPS location on a 2-meter temperature probe that is in place in Granite Springs Valley, Nevada.

Fluid Geochemistry & Reservoir Characterization

GBCOE researchers measure temperature and collect water and gas samples from geothermal springs and wells in the Great Basin region. Geochemical data are used to evaluate resource conceptual models, and to estimate reservoir temperatures using geothermometry relationships. Such efforts are critical in guiding exploration efforts.



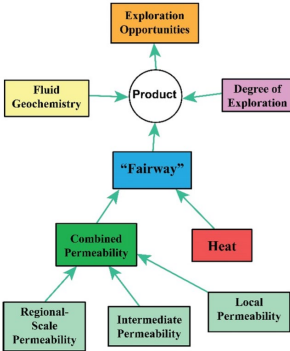
Collecting a water sample from a warm spring in the Black Rock Desert, Nevada (June 2020)

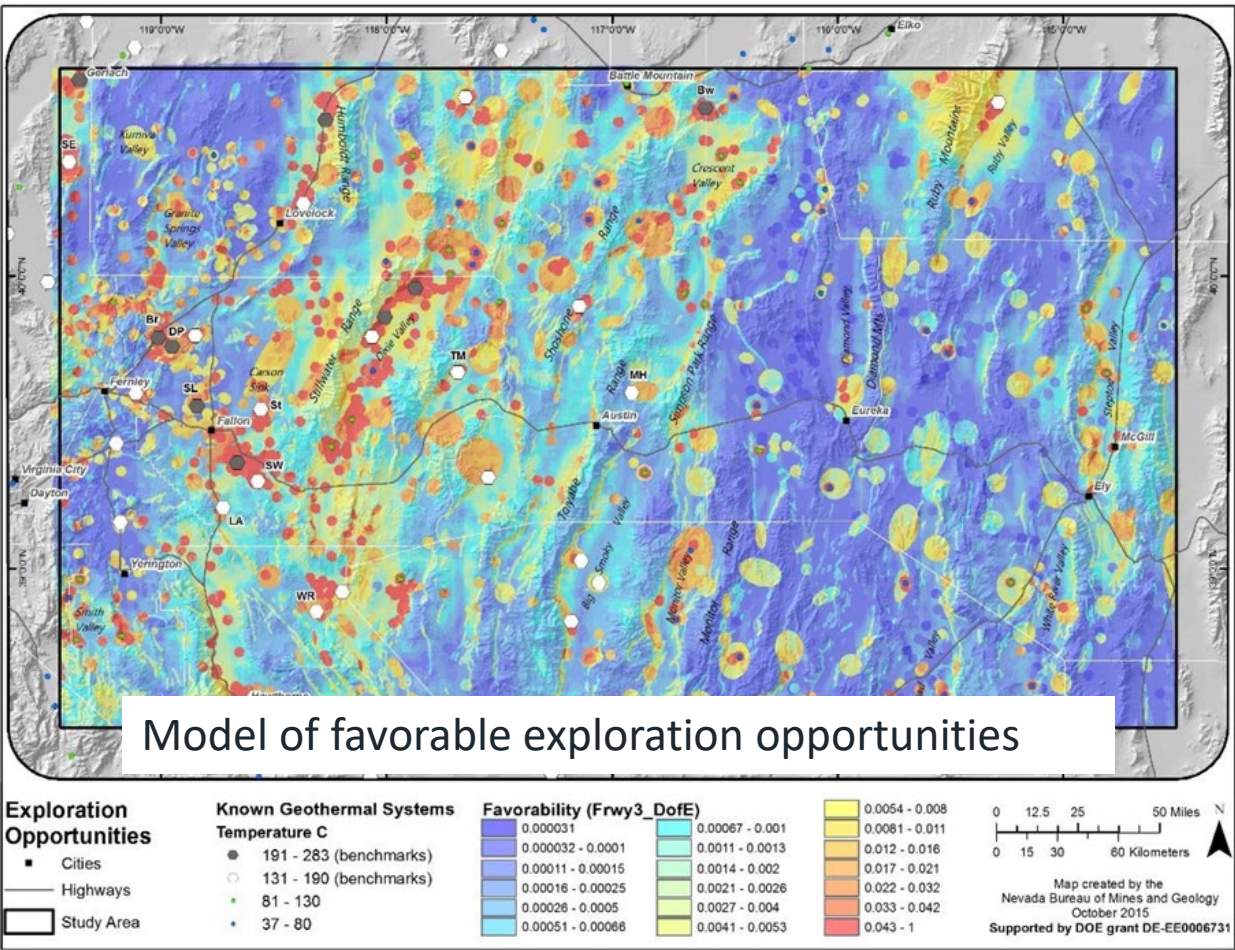
Geophysical Data Collection & Analysis

GBCOE affiliates use historical geophysical data, and collect new data in the field. Gravity and magnetics data are processed and used to create maps and models.



Paul Schweier uses a gravimeter during geophysics field camp near Pyramid Lake.





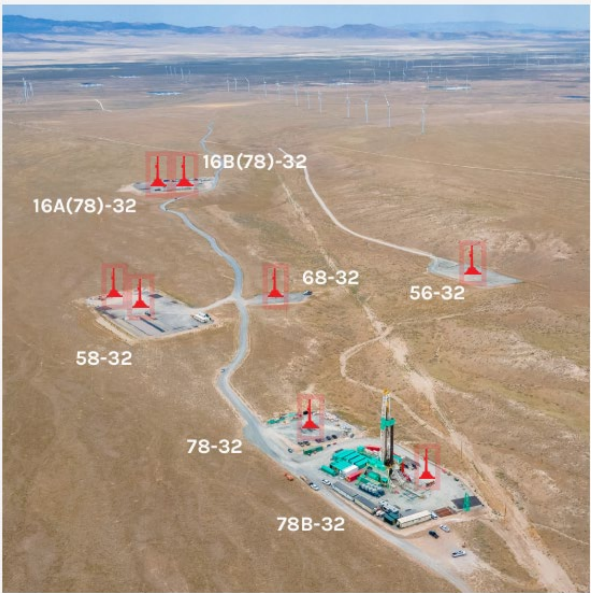
Success Stories - Geothermal Data

With support from the federal government (~\$300 million), Utah has acquired the basic data and technology to advance geothermal exploration.



Well Data

Explore the Utah FORGE wells. Find general data below, or click on the image markers to learn about each individual well.



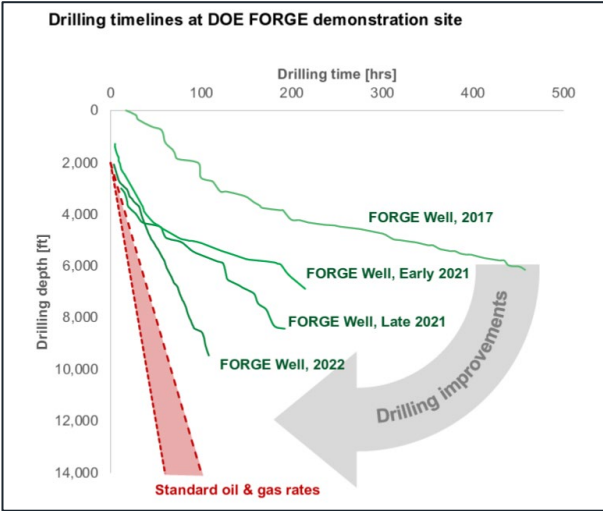
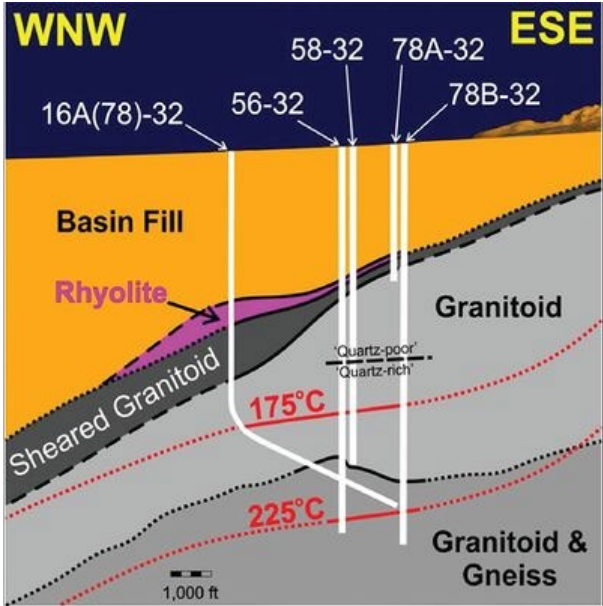
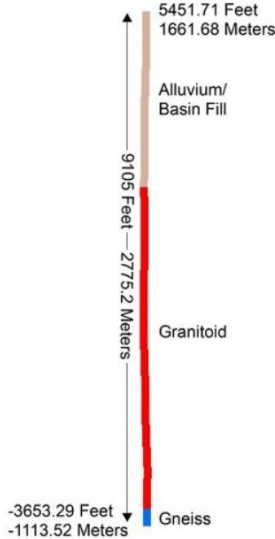
Overview Geology Water Chemistry/Ground Water Geophysics Earth/Fracture Modelling

Seismicity GIS Data/Maps R&D Projects Wells 16A&16B Stimulation Reports

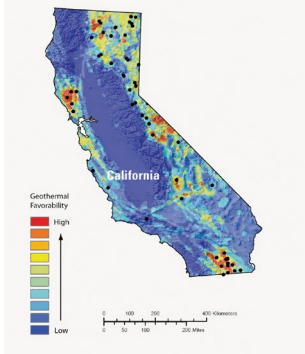
Well 58-32 Well 78-32 Well 78B-32 Well 68-32 Well 56-32 Well 16A(78)-32 Well 16B(78)-32 Wells General



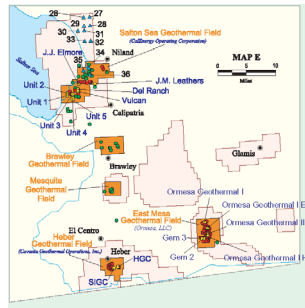
Seismic Monitoring Well 56-32



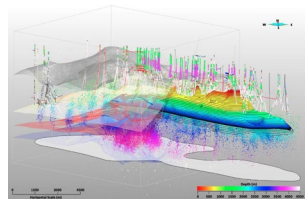
What Has California Done?



Geothermal Favorability
(USGS, 2008)



KGRA -Wells and Springs
DOC 2002



Monitoring reservoir processes
Alumbaugh et al., 2026

National and Regional Favorability Assessments

(2004 - present)

- Heat Flow, Temperature at Depth, Favorability
- Ongoing efforts by USGS, Universities

Geothermal Data Maps and Compilations

(1970s - 2014)

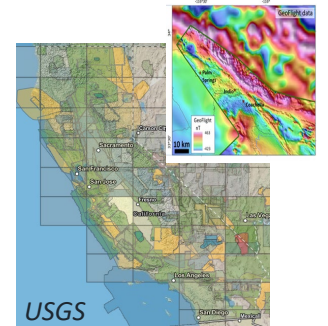
- Statewide spring/geothermal feature maps, and geologic data compilations (e.g. 2004 PIER, 2014 NGDS)
- Historical partnerships between DOE, USGS, CA state govt., National Labs, Universities, Industry

Geothermal Field and Reservoir Characterization

(1950s – present)

- Hundreds of exploration, drilling, and reservoir modeling studies (esp. Geysers, Salton Sea, Coso, Long Valley)
- Collaborative efforts (DOE, USGS, National Labs, Universities, CEC, Industry)

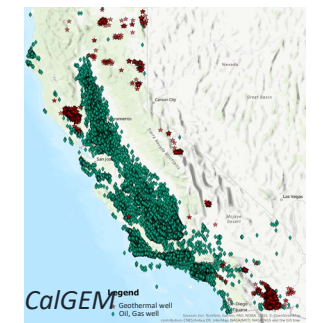
Unified Compilation?



USGS
>200 historical airborne geophysical surveys, new high-resolution surveys



DWR
Water quality/water
>35,000 wells



CalGEM
>240,000 oil and gas wells,
>4,000 geothermal wells

California Geothermal Data Collaborative

Integrated Geologic Characterization Data Powering Smarter Geothermal Decisions

