

Geothermal in Nevada -From Water Law to Mineral Law, Its History and Production

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Key Federal Acts Relating to Geothermal Development

- The Geothermal Steam Act, enacted in **1970**, provided the Secretary of the Interior with authority to lease public lands for geothermal exploration and development in an environmentally sound manner; USGS was delegated authority.
- The Geothermal Energy Research, Development and Demonstration Act of 1974 institutes the Geothermal Loan Guaranty Program which provides investment security to develop technologies to exploit geothermal resources.

• Following the 1973 oil crisis, the Department of Energy Organization Act of **1977** consolidated the Federal Energy Administration, the Energy Research and Development Administration and the Federal Power Commission. Since then, numerous DOE grants and projects have been and continue to be, instrumental in furthering geothermal development, particularly in Nevada.

U.S. Geothermal Resource Map



Source - U.S. Department of Energy, 2004

• In 1975, the NV legislature passed Senate Bill 158 to:

- Define geothermal resource as the "heat or other associated geothermal energy found beneath the surface of the earth."
- Authorize the State Engineer to adopt regulations necessary to ensure the "proper development, control and conservation of Nevada's geothermal resources."

• Clarify that "any water and steam encountered during geothermal exploration is subject to the appropriation procedures of NRS 533 and 534."

- In 1981, the NV legislature passed Senate Bill 164 which:
 - Amended the definition of geothermal resource in NRS 534A to be "the natural heat of the earth and the energy associated with the natural heat, pressure and all dissolved minerals that may be obtained from the medium used to transfer that heat, but excluding hydrocarbons and helium."
 - The same amended definition was added to NRS 322 (Use of State Lands) and NRS 361 (Property Tax).
 - At this point, Nevada has essentially linked geothermal, as a tangible asset, to the mineral estate.

- In 1983, the NV legislature passed Assembly Bill 335 to:
 - "Promote the efficient, orderly and economical conduct of the various activities for the encouragement, advancement and protection of mining and the production of geothermal energy, oil, gas, and coal in this state."
 - "Achieve an equitable and reasonable balance between mineral and other legitimate interests in the realistic utilization of the public land and its surface and subsurface resources."
- The bill created the Commission on Mineral Resources and the Department of Minerals and abolished the Department of Energy.
- On public lands, the delegated authority was transferred from USGS to BLM.
- Two regulatory agencies involved with permitting on public lands, with BLM acting as lead.



- The bill amended NRS 534A (Geothermal Resources) to:
 Clarify geothermal ownership, "The owner of real property owns the right to the underlying geothermal resources unless they have been reserved or conveyed to another person."
 - Authorize the Dep't of Minerals, <u>upon approval of the State</u> <u>Engineer</u>, to issue a permit to drill or operate a geothermal well and collect a fee.
 - Clarify that "any consumptive use of water brought to the surface outside of a geothermal well is subject to the appropriation procedures of NRS 533 and 534."
- The bill also amended NRS 362 (Taxes on Proceeds of Minerals) to include "proceeds of all operations extracting geothermal steam for profit," as part of net proceeds of all operating mines.

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Geothermal Ownership

- Prior to the Stock-Raising Homestead Act (1916), federal conveyances attempted to segregate mineral lands from agricultural lands; creating numerous split estates thereafter.
- The Geothermal Steam Act (1970) has been applied to embrace all those split estates and reserve energy resources to the US.
- If there is any uncertainty as to federal ownership, review the language in original land patent (<u>glorecords.blm.gov</u>).
- Regarding private party conveyances, in Nevada, a geothermal resource is included in the term "mineral" unless specifically addressed and separated.
- Fractional interests are a distinct possibility and require detailed research; a good resource is <u>www.nvlandman.org</u>.
- The geothermal resource ownership is separate from water rights and any consumptive use of water is still subject to appropriation procedures of NRS 533 and 534.

Associated Mineral Ownership

- Federal 43 CFR 3200.0-5 Definitions Geothermal resources means geothermal steam and associated geothermal resources which include...
 - 1) any mineral or minerals (exclusive of oil, hydrocarbon gas, and helium) which are found in solution or in association with geothermal steam and which have a value of less than 75 per centum of the value of the geothermal steam or are not, because of quantity, quality, or technical difficulties in extraction and production, of sufficient value to warrant extraction and production by themselves, and (2) commercially demineralized water.
 - If byproduct minerals capable of being produced in commercial quantities are leasable and the leasehold is primarily valuable for the production thereof, the lease may be converted.
 - If byproduct minerals are not leasable and are locatable then location of mining claims required.
- Nevada (non-federal) no distinction, "...and all dissolved minerals that may be obtained from the medium used to transfer that heat, but excluding hydrocarbons and helium," unless otherwise reserved or conveyed.

- In 1985, the NV legislature passed Senate Bill 354 to:
 - Clarify that consumptive use does not apply to:
 - "water removed from an aquifer or geothermal reservoir to develop and obtain geothermal resources if the water is returned to or reinjected in the same aquifer or reservoir; or
 - The reasonable loss of water during a test of a geothermal well or because of the temporary failure of a system for reinjection."
 - Eliminate the State Engineer approval requirement for a permit, however copies of the application for a permit must be shared with the State Engineer, NDEP and NDOW.
 - Amend the geothermal component of Taxations' net proceeds of all operating mine to "Operations extracting geothermal resources for profit, except an operation which uses natural hot water to enhance the growth of animal or plant life."



Renewable Portfolio Standards

- In 2001, the NV legislature passed Senate Bill 372 requiring electric service providers to generate or acquire 15% of the total amount of electricity sold from renewable energy systems by 2013, starting with not less than 5% in 2003 and increasing 2% biannually.
- In 2009, the NV legislature passed Assembly Bill 387 which increased the requirement to 25% by 2025.
- In 2019, the NV legislature passed Senate Bill 358 which increased the requirement to 24% in 2021 and increasing to 50% by 2030.
- California's RPS program was established in 2002 with 20% by 2017, increased in 2015 to 50% by 2030, and increased again in 2018 to 65% by 2030.



- The regulations adopted by the Commission on Mineral Resources in 1985 govern how the Department (now Division) of Minerals apply the statutes created by the legislature.
- The 1985 regulations remained largely unchanged until 2019 when they were amended to clarify definitions and procedures as well as eliminate some outdated practices.
 - One significant addition was, "Natural heat of the earth means energy obtained from any medium used to transfer heat, the temperature of which is greater than 85 degrees Fahrenheit at the surface." To provide for the exclusion from permitting requirements the increasing desire for use of ground source heat pumps.
 - Many of the requirements routinely added as Conditions of Approval to permits were added to the regulations to provide up-front guidance to operators.

3 Primary Methods of Electrical Generation from Geothermal

- All require:
 - Multiple wells
 - High permeability
 - Favorable brine chemistry
 - Accurate understanding & (often) remodeling of the resource reservoir



Figure 1. Electrical generation from geothermal energy. Source: U.S. Geological Survey.

NV Geothermal Production Temperatures



Average Production Temperatures



Geothermal Field

Binary systems are key to efficient production of resources in Nevada

• Average temperature of a NV geothermal field ~277° F

Beowawe (BEO), Brady Hot Springs (BHS), Blue Mountain (BLU), various commercial wells (COM), Desert Peak (DPK), Dixie Valley (DXV), Elko Heat Co. (ELK), FORGE (FRG), Hot Sulfur Springs (HSS), Jersey Valley (JVP), McGinness Hills (MGH), Moana (MOA), New York Canyon (NYC), Patua (PTA), Salt Wells (SW), San Emidio (SEM), Soda Lake (SDL), Steamboat Hills (STB), Stillwater (STW), Tungsten Mountain (TMT), Wabuska (WAB), Wild Rose/Don Campbell (WRS)



Geothermal Electrical Generation Plants - Timeline & Nameplate Capacity (MWh)



Plant Types: Flash, Binary, No Longer Operating

- Geothermal exploration started in late 1970s
- Binary introduced to the US in 1981 by Ormat (DOE grant)
- Commercial/Domestic heating plants not shown on timeline, include:
 - Elko Heating Company 1982; Moana Utility District, Reno 1983; Peppermill Casino, 2010

Geothermal Electrical Generation Plants - Timeline & N



*Data from Ayling, Stanford University Workshop, 2020; the Nevada Division of Minerals; and other published res

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Nevada Geothermal Wells by Type







NV Geothermal Revenue 1989-2019





