10 GEOTHERMAL RESOURCES

Introduction

The Geothermal Resources Element establishes the goals, policies and implementation measures that will be used by the County regarding the promotion, protection, use, and education pertaining to geothermal resources that are present in the County. This element is divided into the following sections:

- Research and Development (Section 10.1),
- Environmental Protection (Section 10.2),
- Resource Utilization (Section 10.3),
- Collaboration and Public Outreach (Section 10.4), and
- Implementation Measures (Section 10.5).

Key Terms

The following terms and definitions apply to the Geothermal Resources Element.

Binary Systems. This system involves using heat from medium-temperature geothermal fluid to create a vapor phase of the secondary fluid that drives powerplant turbines to generate electricity.

Direct Use. This system involves the use of low-temperature geothermal fluid for direct heating and cooling purposes, including, but not limited to space heating, water heating, heat pumps, refrigeration, and industrial and agricultural processing.

Induced Seismicity. Induced seismicity refers to seismic events that are caused by human activities, such as fluid injection into and production from energy reservoirs that alter the stresses and strains in the Earth's crust.

Low Temperature Resources. These resources consist of heat (less than 194 degrees Fahrenheit) that is extracted from geothermal fluid for direct use, such as space heating and refrigeration.

Medium Temperature Resources. These resources consist of heat (194-302 degrees Fahrenheit) that is extracted from geothermal fluid for direct use, such as direct space heating and refrigeration, or for binary generation.

High Temperature Resources. High temperature geothermal fluid (302 degrees Fahrenheit or greater) is used for electrical power generation.

Quality of Life. Quality of life encompasses those aspects of the economic, social, physical, and natural environments that make an area a desirable place to live or conduct business.

Sensitive Receptors. Sensitive receptors are defined to include residences, commercial resort areas, hospitals, convalescent homes and facilities, schools, and other similar land uses as defined in the Lake County Zoning Ordinance.

Steamfields / Wellfields. In this element, both terms are used interchangeably as equivalent terms.

10.1 Research and Development

Goal GR-1	To promote research and develop innovative techniques to improve the use of geothermal resources as a sustainable energy source that benefits Lake County.

Policy GR-1.1 ***New Technology to Improve Efficiency***

The County shall support the use of new technological and operational measures which will better conserve geothermal resources and/or increase efficiencies in power generation.

Policy GR-1.2 ***Retrofitting of Existing Facilities***

The County shall encourage the retrofitting of existing facilities to improve overall efficiency.

Policy GR-1.3 ***Cooperative Study of Low Temperature End-Uses***

The County shall encourage public and private sector organizations to participate in the cooperative study and demonstration of low-temperature end-uses. This effort will be closely coordinated with local economic development efforts to retain or create employment opportunities or otherwise enhance local living standards.

Policy GR-1.4 ***Funding for Direct Use Implementation***

The County should actively participate in obtaining funds to evaluate resource exploration, utilization, and information dissemination for direct use projects.

Policy GR-1.5 ***Direct Use for Development Projects***

The County shall encourage evaluation of the feasibility of direct use for all new major projects, including residential, commercial, public, and industrial projects.

Policy GR-1.6 ***Data Collection and Monitoring***

The County shall establish and maintain a geothermal database which will include information submitted for project applications, economic information (employment, production, etc.), monitoring results, and other appropriate information.

10.2 Environmental Protection

Goal GR-2	To provide geothermal development that protects the local environment and enhances the quality of life.

Policy GR-2.1 Avoid Siting Near Sensitive Receptors

The County should avoid approving new geothermal operations near residences, commercial resorts, or other sensitive receptors where it can be reasonably expected to adversely affect their quality of life.

Policy GR-2.2 Development Near Geothermal Resource Areas

Developments proposed for residential, commercial resort, or other sensitive receptors shall be discouraged in the primary geothermal resource areas (see Figure 10-1) where there is reasonable likelihood of geothermal development in the future.

Policy GR-2.3 Siting of Facilities

Facilities (including transmission lines and pipelines) shall be sited consistent with the Geothermal Setback Ordinance and shall also be sited to minimize visual impacts by:

- Avoiding interference with scenic views and ensuring that facilities will be visually integrated with the surrounding setting to the greatest extent possible.
- Avoiding ridgelines or other visually prominent features.
- Using non-glare towers and non-specular lines, which more readily blend into the natural landscape.
- Reconstructing or consolidating existing transmission facilities and corridors to accommodate additional line capacity in an environmentally sound manner.

Policy GR-2.4 New Technologies to Reduce Environmental Impacts

The County will encourage the development and testing of new technologies to further reduce environmental impacts. Additionally, Naturally Occurring Asbestos shall be avoided where feasible, or otherwise mitigated as necessary to minimize the release of asbestos dust.

Figure 10-1. Primary Geothermal Resource Area

Figure 10-1, BACK

Policy GR-2.5 Directional Drilling

The County shall encourage resource developers to plan for and use directional drilling and other measures designed to minimize land disturbance wherever feasible and appropriate to avoid environmental impacts.

Policy GR-2.6 Avoid Use of Water Needed for Other Land Uses

The County shall ensure that geothermal projects do not adversely impact water needed for other beneficial uses.

Policy GR-2.7 Water Conservation and Recycling

The County shall encourage the development of generating technologies that have the potential to use less water and to increase the use of recycled water and wastewater.

Policy GR-2.8 Determination of Water Resource Needs

The County should coordinate with the geothermal industry and other interested agencies to determine long-term water needs of the geothermal industry for proper geothermal reservoir maintenance.

Policy GR-2.9 Prevention and Detection of Water Pollution

Geothermal operators shall utilize best available control technologies to prevent and rapidly detect water pollution.

Policy GR-2.10 Corrective Measures for Subsidence Issues

The County shall require corrective measures if sufficient evidence indicates that a geothermal operation has caused land subsidence that has created a hazard or significant adverse impact on the local environment. To determine monitoring and mitigation requirements, the County will consult with informed parties such as CDOGGR, BLM, the permittee, developers, and other experts as appropriate.

Policy GR-2.11 Geotechnical Investigations for Exploratory Drilling

Detailed geotechnical investigations shall be required prior to all exploratory drilling for geothermal resources.

Policy GR-2.12 Erosion Control and Soil Stabilization

Erosion control and soil stabilization techniques, including post-construction best management practices (BMPs), shall be implemented and continued throughout the life of each project.

Policy GR-2.13 Air Quality Monitoring Programs

The County shall promote the continued use of air quality monitoring programs, such as The Geysers Air Monitoring Program (GAMP), to develop and maintain the capacity to rapidly assess ambient air quality and detect air pollution events.

Policy GR-2.14 BACT Air Quality Measures for Geothermal Operations

Geothermal operations shall be planned and carried out using the best available air pollution control technology (BACT) consistent with the

requirements of the Lake County Air Quality Management District. Appropriate operating practices shall be used to minimize emissions, avoid vegetation damage and increased fog or haze conditions, prevent nuisance odors, and control dust.

Policy GR-2.15 Minimization of Air Emissions

Wherever practical, steamfields and power plants shall be intertied and equipped with automated supervisory control systems or other design measures to minimize air emissions during events initiated as a result of a forced outage, scheduled outage, startup, or curtailment. Steamfields shall only be connected and operated with power plants incorporating best available control technology (BACT) as determined by the Lake County Air Quality Management District.

Policy GR-2.16 Retrofitting of Existing Power Plants to Reduce Environmental Impacts

The County shall strongly encourage the retrofitting of older power plants with the best reasonably available air pollution control technology and other technologies that can reduce overall environmental impacts.

Policy GR-2.17 Preventative Noise Abatement Program

The County shall require a preventative noise abatement program incorporating BACT design features for construction, operation, and maintenance of pipelines, for all geothermal development, power transmission lines, and power plant projects and associated facilities and activities.

Policy GR-2.18 Update Emergency Plans

Emergency plans shall be prepared and updated for incidents related to geothermal operations, including but not limited to blow-outs, fluid spills, earthquakes, fires, and worker accidents, consistent with the policies and procedures of responsible public safety agencies. Specifically, the plans shall ensure that cooperation exists between industry security, medical and firefighting personnel and corresponding public safety agencies.

Policy GR-2.19 Minimize Generation of Hazardous Materials

Geothermal activities shall occur in a manner that minimizes the generation of hazardous materials and waste, and allows for their recycling whenever practical.

Policy GR-2.20 Minimizing Induced Seismicity

Geothermal operations shall be planned and carried out using appropriate technologies and operating practices to minimize the impacts of induced Seismicity on sensitive receptors.

Policy GR-2.21 Monitoring and Analysis of Induced Seismicity

The County shall request developers of geothermal operations to monitor and analyze seismic data to determine the effects of geothermal production and injection on the seismic activities associated with the development.

Policy GR-2.22 Development and Use of Access Roadways

Developers shall be responsible for providing access to operations from public thoroughfares via new or existing roads. New roads shall be built and maintained to acceptable safety standards.

Policy GR-2.23 Final Closure and Reclamation of Geothermal Operations

All aboveground geothermal facilities shall be removed or converted and the site(s) reclaimed upon completion of the life of the facility. Adequate financial assurances shall be submitted for approval as part of the project's final development plan.

10.3 Resource Utilization

Goal GR-3	To provide for the efficient utilization of geothermal resources while preserving its long-term sustainability.

Policy GR-3.1 Documentation of Sufficient Geothermal Resources

Prior to approval of new power plants, documentation shall be provided demonstrating sufficient geothermal resources to support existing and proposed power generation.

Policy GR-3.2 Lengthen Reservoir Life

The County should encourage cooperative activities between the County and other relevant local agencies to evaluate and implement appropriate geothermal resource conservation practices, such as injection programs designed to lengthen reservoir life.

10.4 Collaboration and Public Outreach

Goal GR-4	To provide opportunities for residents, industry, and agencies, to collectively participate in all phases of a well-defined and consistent geothermal planning process.

Policy GR-4.1 Involve Public on Permitting Procedures and Projects

The County shall provide information to the public regarding geothermal permitting procedures and current and proposed projects in a clear, timely, and comprehensive manner.

Policy GR-4.2 Coordinate Geothermal Resource Planning with Other Counties

County agencies shall maintain close contact with their counterparts in other counties to coordinate geothermal planning and management activities.

Policy GR-4.3 Coordinate with Federal and State Agencies

The County shall coordinate closely with federal and state agencies exercising local geothermal responsibilities to ensure their policies and regulations are consistent with the County's General Plan.

Policy GR-4.4 Staff Training on Geothermal Resources Planning

The County shall provide staff with on-going training opportunities to maintain their awareness of the latest technology and regulations affecting the geothermal industry.

Policy GR-4.5 Public Disclosure of Potential Geothermal Resource Areas

Existing owners and purchasers of property within or near potential geothermal areas should be advised of likely geothermal operations in the area by regularly updated maps available at the Lake County Community Development Department.

Policy GR-4.6 Geothermal Advisory Committee

The Geothermal Advisory Committee should be convened on a periodic basis to review geothermal issues and to explore opportunities for increased public and private partnerships that would promote economic development.

Policy GR-4.7 Off-site Measures to Enhance Tourism

To offset the cumulative effects of development, off-site measures to enhance tourism and recreational opportunities should be considered for geothermal projects, where appropriate.

Policy GR-4.8 Job Training and Hiring Programs

Geothermal developers should continue to cooperate with local job training and hiring programs, and should submit local hiring plans to mitigate impacts associated with schools and housing.

Policy GR-4.9 Wholesale Power to Local Agencies

The County should encourage the cooperative study of opportunities for providing wholesale power to local agencies such as community service districts from transmission lines constructed in their vicinity.

Policy GR-4.10 Local Supplies and Services

The geothermal industry is encouraged to use local contractors and services, and to purchase material, equipment, and supplies from in-County sources. The County should identify and support development of businesses and suppliers to the geothermal industry.

10.5 Implementation Measures

Table 10-1, Geothermal Resources Implementation Measures, identifies the measures the County will take to realize the goals and policies of this element. The table lists each implementation measure, a reference to which General Plan policy it supports, who is responsible for this action, and the timeframe.

Table 10-1. Geothermal Resources Implementation Measures

	Implementation Measure	Policy	Who is Responsible	Timeframe				
				2008-2012	2013-2017	2018-2022	2023-2028	On-going
1.0	The County shall work with the geothermal industry and appropriate State agencies to develop public education facilities and materials that will inform and encourage the public to implement direct use geothermal technologies in private construction.	GR-1.5 GR-4.1	Community Development Department					■
2.0	The County shall create a comprehensive geothermal database design for use in permit processing, resource conservation, monitoring activities, and public disclosure. The database design will: ▪ Guide the design of an efficient database storage system; ▪ Provide for efficient and timely database maintenance; ▪ Detail methods for the collection and incorporation of new information; ▪ Provide an index to available reports and maps; ▪ Provide a geographic information system (GIS) component for spatial analysis; ▪ Maximize public access to information on geothermal resources, current geothermal operations, monitoring, and proposed geothermal activities; and ▪ Provide on-line access to this information (as funding is available).	GR-1.6 GR-4.1 GR-4.5	Community Development Department	■				■
3.0	The County shall incorporate available low temperature resource data in the County geothermal database	GR-1.6	Community Development Department					■
4.0	Seismic data from the existing U.S.G.S. resource area monitoring network shall be analyzed for the purpose of updating information on seismicity and its relationship to resource development.	GR-1.6 GR-2.20 GR-2.21	Community Development Department, SMAC	■				■
5.0	The Board of Supervisors will consider the development or expansion of a committee(s) or programs to comprehensively assess the effects of induced seismicity and to develop mitigation recommendations.	GR-1.6 GR-2.20 GR-2.21	Board of Supervisors	■				

Implementation Measure		Policy	Who is Responsible	Timeframe				
				2008-2012	2013-2017	2018-2022	2023-2028	On-going
6.0	The County shall provide the public general information on its website that pertains to the development and utilization of geothermal resources in the County. Specifically, information on the latest technology, such as low temperature direct uses, should be made available on the website.	GR-1.6 GR-4.1	Community Development Department	■				■
7.0	To reduce impacts to visual resources and sensitive receptors, exterior lighting shall be shielded or otherwise directed to the maximum extent possible to reduce impacts to sensitive receptors and visual resources, including the night sky.	GR-2.12	Community Development Department					■
8.0	Prior to initiation of an expanded reservoir injection program involving the increased use of surface or groundwater, a cooperative study of current and future water needs of the geothermal industry for reservoir management and other beneficial uses shall be conducted.	GR-2.6 GR-2.7 GR-2.8	Community Development Department					■
9.0	The County shall require, as part of any approved operating plan, that the developer obtain and comply with waste discharge permits for drilling sumps (including the analysis of discharged material), and for geothermal releases to the air, water, or land, and consider technological solutions to further reduce environmental impacts.	GR-2.4 GR-2.9	Community Development Department					■
10.0	The County shall require geothermal operators to monitor subsidence detection networks and establish other monitoring programs in order to determine the extent of induced subsidence in areas that could be affected by permitted project activities.	GR-2.10	Community Development Department					■
11.0	To minimize soil erosion, revegetation efforts shall ensure adequate ground coverage utilizing native and other desirable perennial plant species..	GR-2.12	Community Development Department					■
12.0	Revegetation shall be employed in a timely manner to reduce erosion, and to restore and enhance habitat for indigenous and critical species of plants and animals.	GR-2.12	Community Development Department					■
13.0	Ongoing monitoring and characterization of geothermal noise sources shall be conducted over the life of the geothermal project.	GR-2.17	Community Development Department					■
14.0	All geothermal project sites shall have sufficiently detailed signs to facilitate the provision of emergency services, and warn the public of potential hazards.	GR-2.18	Community Development Department					■

Implementation Measure		Policy	Who is Responsible	Timeframe				
				2008-2012	2013-2017	2018-2022	2023-2028	On-going
15.0	Construction inspection should be conducted to evaluate the design, installation and maintenance of all associated roads and other improvements for geothermal operations.	GR-2.22	Community Development Department					■
16.0	The utilization of existing roads and trails for geothermal projects shall be encouraged whenever feasible.	GR-2.22	Community Development Department					■
17.0	The County will petition for Lead Agency status for exploratory projects.	GR-4.1 GR-4.3	Community Development Department	■				
18.0	The County will work with geothermal operators to hold community meetings to gain input on geothermal issues and disseminate information on planned and on-going geothermal operations.	GR-4.1 GR-4.3 GR-4.4	Community Development Department	■				■

Please see the next page.