REQUEST FOR INFORMATION

Sonoma Clean Power

For

Sonoma/Mendocino Geothermal Opportunity Zone Development Partners

https://sonomacleanpower.org/geozone

Sonoma Clean Power Authority Responses Due April 29, 2022 5:00pm PDT

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Introduction

Sonoma Clean Power (SCP) is issuing this Request for Information (RFI) to select entities to enter a public-private partnership. The purpose of this partnership will be to accelerate development of incremental geothermal resources in a Geothermal Opportunity Zone (GeoZone) spanning Sonoma and Mendocino counties. SCP ultimately seeks to enable 500 MW of incremental local geothermal development while maintaining existing regional geothermal capacity.

SCP has an interest in entering into a partnership agreement with selected entities to collaborate on transmission planning, community engagement, regulatory advocacy, public education, and state and federal grants to enable development of additional geothermal capacity in the GeoZone. SCP is also interested in opportunities that sustain the longevity and efficiency of existing resources. SCP's intent is to be the off-taker for as much as 150 MW of the capacity from resources developed through the partnership and will leverage its relationship with other load-serving entities to assist marketing all GeoZone output.

Background

Sonoma Clean Power

SCP is a public power provider operating a Community Choice Aggregation or "CCA" serving Sonoma and Mendocino counties. SCP provides electricity to over 229,000 customer accounts with 2,200 GWh of annual sales. Key objectives of SCP include reduction of greenhouse gas emissions, promoting development of local renewable energy resources that are reliable and sustainable, and stimulating the local economy.

Since starting service in 2014, geothermal has constituted a significant portion of SCP's supply portfolio. SCP currently contracts for 50 MW from the Geysers that provides clean and reliable energy to SCP's portfolio and serves an essential role in powering SCP's 100% local renewable 24/7 premium energy product called 'EverGreen.'

SCP's history includes successful development of new renewable energy projects, including 76 MW of currently online solar and 46 MW of online wind capacity. SCP is also currently contracted for development of new solar and storage resources.

SCP partnered with seven other CCAs in forming California Community Power (CCP) in 2020, a Joint Powers Agency (JPA) enabling collective procurement of large resources. Now comprised of ten CCAs, CCP provides over 3 million customers with over 36,000 GWh of annual power.

In 2022, SCP received an investment-grade credit rating of 'A' from S&P Global Ratings in recognition of its financial management, lack of debt, and liquidity. SCP is interested

in exploring shared ownership and other financing arrangements for future projects, including those in the GeoZone, when conditions are right.

Motivation

SCP recognizes the opportunity for a large resurgence in geothermal resource development, particularly in California. An increasing penetration of intermittent renewables, ambitious environmental targets, and retirement of nuclear and natural gas plants are creating an attractive market for the reliability and capacity attributes of geothermal power. Meanwhile, technology transfer from the oil and gas sector, expanding research and development activities related to geothermal resource assessment and power generation technologies, and increased public and private investment provides the potential to greatly expand the application of geothermal power and reduce costs.

Recent geothermal development has been concentrated in other regions of the world specifically Turkey, Kenya, Indonesia, and Philippines. In the United States, Nevada has been the focus of most recent geothermal development because the resource types are easier to characterize. Despite world-class geothermal properties and the need for geothermal resource characteristics in the California grid, local development of geothermal resources has been stagnant. SCP seeks to reinvigorate local geothermal development through a focused initiative to address the barriers for geothermal resource development, such as by providing an off-taker and building community support for preferred projects.

As part of this initiative, SCP is pursuing the following activities in parallel with this solicitation:

- Directly engaging current geothermal operators, developers, and technology companies to survey the state of the industry and understand barriers to development;
- Undertaking an enhanced assessment of the geothermal resource within the area of interest;
- Briefing county staff and elected officials on the scope and objectives of the initiative;
- Discussing the capability of current transmission in the region with the California Independent System Operator (CAISO).

Geothermal Opportunity Zone (GeoZone)

In October 2021, the SCP Board of Directors passed a resolution creating a GeoZone that invited local counties to join SCP in exploring the opportunity to accelerate regional geothermal development. The County of Mendocino passed a resolution formalizing their membership in the GeoZone in December 2021 and Sonoma County passed their resolution to join the GeoZone in February 2022. The resolutions are attached as Appendix A to this document. Member counties will be engaged in the solicitation of private partners to proactively identify compatibility with community values.

The initial extent of the GeoZone spans the county boundaries of its members, although it is subject to significant technical, practical and political refinement. Figure 1 shows an overview of the boundary overlaid on modeled temperature data from the National Renewable Energy Laboratory (NREL), current transmission lines, the current Geysers plants, and existing well penetrations. The GeoZone includes part of the existing Geysers field and other prospects with the permeability and temperature required for conventional hydrothermal development. It also encompasses areas with elevated geothermal temperatures and diverse characteristics that make it an inviting location for evaluating emerging geothermal technologies.



Figure 1. Map of Geothermal Opportunity Zone (GeoZone)

SCP's objective for the GeoZone is to adequately address the environmental, transmission, permitting, water and public education needed to enable 500 MW of incremental geothermal development in the region. This will require close coordination with the local jurisdictions, air quality boards and wastewater districts, technical evaluation of regional transmission constraints with CAISO, and significant private and public investment.

Given its favorable geothermal characteristics, the GeoZone has been the focus of significant technical study and exploration. The Technical References section of this document contains links to resources respondents unfamiliar with the region's geology might find useful. SCP is also including a technical study it commissioned in 2021 that spanned the GeoZone and adjacent Lake County as Appendix B to this document.

Community Choice Aggregation (CCA)

SCP is the second CCA started in California in 2014. As a CCA, SCP is the default electricity provider for customers in Sonoma and Mendocino counties. SCP's board is composed of elected officials from the two counties and communities within its territory. CCAs operate as not-for-profit governmental entities and use electricity revenues for procurement of power that aligns with local environmental policy and to provide incentives to customers who help create flexible loads or reduce emissions.

CCAs now serve over 11 million customers in California and 20% of the statewide load. In the past decade and going forward, CCAs have been a key tool in driving California's transition to a renewable and carbon-free electric grid. Collectively, CCAs have contracted for over 3.8 GW of new solar, 1 GW of new wind, and 1 GW of new storage.

CCAs are invested in applying new technologies and maturing different resource types to meet the climate and reliability objectives of the future. SCP's geothermal initiative and this solicitation itself closely follow the approach the Redwood Coast Energy Authority (RCEA), the CCA for Humboldt County, pioneered to solicit private partnership to develop offshore wind.

Partnership

Objectives

The goal of this solicitation is to identify entities for SCP to consider entering into a public-private partnership agreement to accelerate development of geothermal resources in the GeoZone with a target of adding 500 MW in incremental capacity. While SCP is interested in moving as quickly as possible, the agency recognizes that this effort is not on the same timeline as the State's current procurement orders for

providing reliability or backfilling capacity when Diablo Canyon nuclear power plant closes. The timeline for reaching 500 MW is not yet established.

SCP is especially interested in geothermal development with the following characteristics:

- **Minimal water usage:** The dry steam plant technology currently employed at the Geysers requires a significant input stream of treated wastewater to maintain reservoir pressure. Given concerns about the scarcity of water and current drought conditions; and the expected water scarce future, surface and subsurface technologies that require minimal water usage are desirable.
- **Reduced footprint:** SCP is seeking resources that utilize relatively small-scale surface equipment, and limited site disturbance. Directional drilling from shared well pads with smaller modular facilities are anticipated, but other solutions for minimizing site disturbance are welcome.
- Potential for low cost when built at scale: Although the market value of geothermal energy and capacity is increasing for the California grid, the net cost of geothermal energy is still significant. SCP aspires to reduce the long-term supply cost of geothermal in the GeoZone to align with the current market value of its attributes through the application of new technologies, supporting solutions to transmission constraints, advocating for public grant funding, and reducing offtaker risk. SCP is interested in supporting technologies that have a significant potential to need little to no subsidy when built at large scales. In the near-term, SCP recognizes that some geothermal development may need to occur at higher costs to advance the low-water objective, and may partner with developers to pursue grants, the formation of a Special Economic Zone or targeted tax credits to bring the net cost down to a commercial level.
- **Improved resource management:** Application of new resource modeling and monitoring can improve the outcome of prospective development by reducing the risk of identifying suitable drilling targets, increasing the recovery of heat from the resource, and improving the efficiency of water and land use.

Mitigating Development Barriers

The ultimate objective is to develop incremental geothermal resources in the GeoZone, but the partnership will initially be focused on identifying and proactively addressing barriers to large-scale geothermal development in the region. SCP will share resources with selected Partners in pursuing the following activities, while noting that any one Partner may participate in only some.

- 1. **Opportunities for Quick Development:** Identify potential sites that have existing facilities that may provide a location that allows streamlined permitting for testing and building new technologies.
- 2. Regional Transmission Study: Provide CAISO with necessary inputs to evaluate existing transmission capacity and necessary upgrades to allow 500 MW of new generation in the GeoZone (operating parameters, prospective locations, etc.). Collaborate on identifying synergies between the GeoZone development, Humboldt offshore wind transmission, and grid resiliency investments. Enter prospective projects into CAISO Cluster 15 interconnection study or identify options to use existing queue positions or independent studies to obtain deliverability.
- 3. **Programmatic EIR:** Collaborate with local jurisdictions on potential process for development of a programmatic Environmental Impact Report (EIR) covering geothermal development within the GeoZone. Provide resources required to complete documentation and environmental studies required for the California Environmental Quality Act (CEQA).
- 4. **Grant Solicitation:** Identifying and applying for grants from the California Energy Commission (CEC), Department of Energy (DOE), Department of Agriculture, and other sources to fund the above-market costs of new technologies.
- 5. **Resource Evaluation:** Coordinate on resource evaluation within the GeoZone and identification of any exploration requirements. Scope exploration plan to fully characterize potential resource to enable 500 MW of incremental capacity.
- 6. **Site Control:** Evaluate options to use public parcels for development. Develop strategy for leasing surface and mineral rights, including possible solicitation for leases from Bureau of Land Management (BLM) and private transactions. Share information and costs to complete analysis of property ownership. Invest in ownership options or rentals to de-risk projects sufficiently to facilitate interconnection process and energy contracting.
- 7. **Community of practice:** Create a network that fosters collaboration between private and public entities in the GeoZone to capture best practices, identify research priorities, and develop robust resource management plans. While fully respecting Partner intellectual property, SCP has an interest in accelerating the development of promising geothermal technologies well beyond the boundaries of the GeoZone through partnerships and information sharing.

SCP will be evaluating responses to assess the capabilities of each respondent in advancing these initiatives.

Project Development

SCP expects selected Partners to work towards completing engineering and design, construction, and operating projects within the GeoZone. SCP anticipates serving as off-taker for as much as 150 MW of the power and capacity from developed resources. The details on the financing and ownership structure for projects will be negotiated as part of developing partnership agreements arising from this solicitation. SCP may consider issuing municipal debt to finance the construction of prospective projects, particularly in situations where the availability of tax credits is limited.

The California Public Utilities Commission (CPUC) recently ordered load serving entities like SCP to collectively procure 1 GW of incremental capacity from geothermal resources or firm clean resources with similar characteristics by 2026. Although SCP recognizes additional value in potential projects in the GeoZone that could apply against its 12.5 MW share of the CPUC mandate, fulfilling that obligation is not a primary driver of this solicitation. SCP fully expects commissioning of many projects in the GeoZone to occur after 2026. Thus, this solicitation is outside of that procurement mandate.

In evaluating responses, SCP will be looking for Partners with successful development experience and technology that is on a trajectory to meet the characteristics desired in the GeoZone. The following details are relevant to this assessment:

- 1. **Experience:** commissioned geothermal projects and current development queue, including proven track record or staff experience in addressing permitting, transmission constraints, and other challenges.
- 2. **Financing Capability:** current financial position and capability to finance design, construction, and operations of a large-scale development in the GeoZone.
- 3. **Technology:** capability of technology to minimize water input, reduce land use, potential to achieve cost competitiveness at scale, potential to meaningfully contribute to 500 MW development goal, potential for grant funding to cover any above-market costs.

Multiple Partners

Depending on the scope of responses received by this solicitation, SCP may select multiple entities to join the public-private partnership or separate partnerships. This could involve SCP working with different entities with well technology, surface technology, development experience, site control, geothermal resource targets, or other capabilities required for the GeoZone. Accordingly, potential respondents contributing to only a subset of the objectives described in this solicitation are still encouraged to respond. Respondents are also welcomed to proactively identify prospective Partners and submit a joint team proposal.

If multiple Partners are selected, SCP will endeavor to mitigate direct conflicts of interest. This could involve dividing participation geographically or by function. SCP will collaborate with respondents on developing these boundaries consistent with applicable law and best practices.

Partnership Agreement

Selected Partners will enter into a public-private partnership agreement with SCP. SCP will collaborate with Partners to craft the exact details of this agreement. Respondents should expect the partnership agreement to include the following components:

- 1. **Partnership Structure:** Establishes the scope of the geography, capacity, and phasing for development within the GeoZone targeted by Partners. Assigns responsibility amongst Partners for site control, project management, design & engineering, stakeholder engagement, transmission interconnection, financing, political advocacy and other key deliverables. Establishes expectations on SCP's power offtake from GeoZone projects..
- 2. **Project Execution:** Creates execution plan, including timeline and budget for phases of development in the GeoZone. Below is an example of a potential schedule, but note this is subject to evolution after discussion with Partners:
 - a. Opportunity Identification: establish resource evaluation strategy, ownership reconnaissance, and pursue preliminary site control in late 2022; apply in CAISO interconnection queue for pilot projects in April 2023; contract with resources to support required permitting for pilots/exploration and apply for any available state, federal, or private grants to mitigate risk and high cost of pilots and secure financing by 2023; conduct stakeholder engagement and collaborate with GeoZone member county staff on validating alignment with county values throughout this phase; finalize off-taker agreement for any generation from pilot projects
 - b. Pilot/Exploration: complete permitting and design for pilots and exploration wells and necessary contracting by early 2024; execute pilots and exploration wells in 2025; initiate programmatic EIR for commercial GeoZone development and complete by 2026; build economic model, secure financing, and solicit additional off-takers for commercial development by 2026; complete site control through options, purchases, or participating in lease sales for commercial development and CAISO interconnection applications by 2026; start contracting for construction, drilling, water, or any other needed contracts to support commercial development by 2026

- c. **Commercial Development:** drilling and construction for commercial-scale development in 2027 and 2028 with commissioning in 2029
- d. **Operations:** operation of commercial-scale development including maintenance, optimization, surveillance, infill drilling, and expansion
- e. **Decommissioning:** abandonment of wells and surface facilities at end of life and any required environmental monitoring
- 3. **Exclusivity:** Commitments by members of partnership to not engage in activities that potentially conflict with achieving the objectives of the GeoZone
- 4. **License:** Defines any license for proprietary technology or intellectual property from member Participants and/or SCP and any associated fee or royalty
- 5. **Term and Termination:** Establishes the term of the partnership and appropriate causes for termination of agreement between participants
- 6. **Governance:** Outlines how key decisions will be made for the partnership, including coordination with other potential partnerships
- 7. **Dispute Resolution & Indemnification:** Provisions to specify the resolution of differences and mutual indemnification of participants

Confidentiality

By default, all material included in solicitation responses will be considered public domain. This will allow SCP to freely engage technical consultants and public stakeholders with information during the evaluation process. As a public entity, SCP is also subject to Public Record Act requests.

If respondents wish to include information in their response that they believe is pertinent to the evaluation but is commercially sensitive or contains proprietary intellectual property, they should include that information in a separate attachment and execute a non-disclosure agreement with SCP in advance of submitting their response. SCP's standard non-disclosure agreement is attached as Appendix C to this document if respondents will require an agreement.

Process

The schedule SCP has established for the solicitation is documented in the table below. Following release of the RFI document, SCP will host an informational webinar to present the objectives and process for the solicitation to potential respondents. Respondents are encouraged to register in advance for the webinar at <u>https://us06web.zoom.us/webinar/register/WN_v_1eWlagRo6pBWRE5AsB7A</u>. SCP will answer questions during the webinar and will accept written questions sent to GeoZone@sonomacleanpower.org until April 8, 2022.

Event	Date		
RFI Released	March 14, 2022		
Informational Webinar	March 31, 2022 10:00am PDT		
Deadline to Submit Questions	April 8,2022		
Answers to Questions Posted on Website	April 15, 2022		
Responses to RFI Due	April 29, 2022 5:00pm PDT		
Anticipated Notice of Shortlisted Respondents	May 23, 2022		
Interviews & Presentations of Shortlisted	June 6-10, 2022		
Respondents			
Anticipated Notice of Selected Respondents	June 27, 2022		

After the solicitation due date, SCP will review submissions and plans to shortlist respondents in late May. These shortlisted participants will be required to participate in interviews and presentations in June that will inform final selection of respondents. If selected, respondents will then enter negotiations in forming one or more partnerships for developing the GeoZone with SCP in Summer 2022.

SCP reserves the right to alter the schedule, objectives, and selection criteria for this solicitation at any time. SCP may cancel this solicitation or reject all submissions in its sole discretion.

Submissions

SUBMISSIONS TO THIS RFI SHOULD BE SUBMITTED BY EMAIL TO GEOZONE@SONOMACLEANPOWER.ORG NO LATER THAN 5:00 PM PACIFIC TIME ON APRIL 29, 2022.

Although SCP is not prescribing an exact format for responses to this solicitation, respondents are encouraged to include the components enumerated below in their submission:

- 1) **Cover Letter:** a cover letter with the contact information of the respondent, proposed structure for the partnership with SCP, and list of materials in response signed by an officer or agent of the respondent
- 2) **Executive Summary:** a brief description of the capabilities and experience of the respondent in partnering with SCP to meet the objectives in the GeoZone

- 3) **Company Description:** background information on the firm including size, financial position, legal structure, and staff qualifications
- 4) Development Experience: catalog of completed projects and current development queue with details on location, size, off-takers, technology, and permitting, exploration, and transmission challenges; specific employees or technical consultants with their expertise listed
- 5) **Technology:** a detailed description of current and potential technologies respondent would employ on the surface and subsurface for development in the GeoZone with operational envelopes (temperatures, depths, flow rates)
- 6) **Conceptual Project in GeoZone:** a description of an actual or conceptual project within the GeoZone including surface and subsurface footprint, water requirements, depth/temperature of resource target, estimate of hourly generation output, and photos or schematics of the surface facility to visualize the surface impact
- 7) Commerciality: viable contract price in \$/MWh for conceptual project and sensitivity of pricing to restoration of tax credits, subsurface characteristics, development scale, grant funding, and technology maturity. This price is understood to be an estimate and is not binding on future contract negotiations.
- 8) **GeoZone Development Plan:** a proposed timeline and scale of geothermal exploration and development within the GeoZone including maps of viable acreage and an estimate of total potential capacity

Evaluation

A team comprised of SCP staff and contracted technical experts will evaluate submissions. The team will be tasked with selecting Partners that are well-suited to both address current barriers to geothermal development and successfully build new capacity in the GeoZone.

Responses to the solicitation will first be screened for clarity and completeness. SCP reserves the right to reach out to respondents for clarifications during the evaluation. Submissions that the evaluation team believe offer a viable path to meeting the objectives of the solicitation may be shortlisted for interviews. The team's decision will be based on the respondent's experience, the viability of the technology and development plan, and alignment with the objectives of the GeoZone.

If held, interviews will offer the evaluation team the opportunity to clarify details in the submission, understand the team dynamics of respondents, and explore the options for best structuring a partnership. Following these interviews (if any), the team will select entities to enter into negotiation for forming a partnership agreement. The

recommendation of the evaluation team will be presented to SCP's Board of Directors for approval.

Technical Resources

SCP has identified several resources that may be valuable for potential respondents in understanding the geothermal resource in our region. These resources are not exhaustive nor can SCP attest to their accuracy.

CALIFORNIA DEPARTMENT OF CONSERVATION, ENERGY MANAGEMENT DIVISION, WELL FINDER

https://maps.conservation.ca.gov/doggr/wellfinder/

CALIFORNIA DEPARTMENT OF CONSERVATION, ENERGY MANAGEMENT DIVISION, GEOSTEAM WELL RECORDS, PRODUCTION, AND INJECTION DATA

https://geosteam.conservation.ca.gov/

CALIFORNIA DEPARTMENT OF CONSERVATION, DIVISION OF MINES AND GEOLOGY, GEOTHERMAL RESOURCES INVESTIGATIONS OF SONOMA VALLEY AREA, SONOMA AND NAPA COUNTIES, CALIFORNIA

http://repository.stategeothermaldata.org/metadata/record/98ddf901b9782a25982e01af 3b0739d4/file/ofr_84-29_report_8plates.pdf

GEOTHERMAL RESOURCES COUNCIL, THE GEYSERS GEOTHERMAL FIELD UPDATE 1990-2010

https://www.osti.gov/servlets/purl/1048267

FIFTY YEARS OF POWER GENERATION AT THE GEYSERS GEOTHERMAL FIELD, CALIFORNIA – THE LESSONS LEARNED

https://pangea.stanford.edu/ERE/pdf/IGAstandard/SGW/2011/sanyal3.pdf

LOS ALAMOS NATIONAL LABORATORY, GEOTHERMAL REGIMES OF THE CLEARLAKE REGION, NORTHERN CALIFORNIA

https://www.osti.gov/servlets/purl/663361

UNITED STATES GEOLOGICAL SURVEY, RESEARCH IN THE GEYSERS-CLEAR LAKE GEOTHERMAL AREA, NORTHERN CALIFORNIA

https://pubs.usgs.gov/pp/1141/report.pdf

ARGONNE NATIONAL LAB, GEOTHERMAL GEOCHEMICAL DATABASE V2.0

https://www.osti.gov/dataexplorer/biblio/dataset/1149726

UNITED STATES GEOLOGICAL SURVEY, AEROMAGNETIC AND AEROMAGNETIC-BASED GEOLOGIC MAPS OF THE COASTAL BELT, FRANCISCAN COMPLEX, NORTHERN CALIFORNIA

https://pubs.usgs.gov/sim/3188/sim3188_pamphlet.pdf

APPENDIX A

Sonoma Clean Power

Sonoma & Mendocino County Resolutions Joining GeoZone

RESOLUTION NO. 21-188

RESOLUTION OF THE MENDOCINO COUNTY BOARD OF SUPERVISORS ESTABLISHING COUNTY MEMBERSHIP IN THE SONOMA-LAKE-MENDOCINO GEOTHERMAL OPPORTUNITY ZONE

WHEREAS, the Sonoma Clean Power Authority (SCPA) established the structure for a Geothermal Opportunity Zone ("GeoZone") on October 7, 2021; and

WHEREAS, SCPA has invited the County of Mendocino to join the GeoZone to partner in exploring opportunities to accelerate the development of renewable energy and reduce greenhouse gas emissions; and

WHEREAS, SCPA is a local government entity governed by representatives from the Counties and Cities of Mendocino and Sonoma Counties and an electricity provider serving customers in Mendocino County; and

WHEREAS, a world class geothermal resource exists in Sonoma, Lake, and Mendocino Counties with significant potential to provide clean baseload renewable energy that operates 24 hours per day 365 days per year; and

WHEREAS, Mendocino County recognizes that new more water-efficient technologies for generating geothermal power are needed; and

WHEREAS, Mendocino County wishes to explore geothermal power projects which provide benefits to its local community and do not exist solely to benefit people outside of Mendocino County; and

WHEREAS, the County of Mendocino recognizes the high cost of electricity in California and supports opportunities to reduce energy cost through promoting technology development, identifying efficiencies of scale, and leveraging state and federal grant funding; and

WHEREAS, the County of Mendocino owns and controls property which may have development potential for baseload renewable energy projects; and

WHEREAS, the County of Mendocino recognizes the long permitting and development timelines for geothermal power projects; and

WHEREAS, the County of Mendocino is well acquainted with the potential consequences to the environment and community of new resource development and expects to be directly engaged in the selection of projects with the aim of mitigating adverse impacts; and

WHEREAS, the County of Mendocino shall retain its full rights to review and approve any project located within its jurisdiction; and

WHEREAS, the County of Mendocino has an interest in sharing information and working collaboratively together with the SCPA and the Counties of Sonoma and Lake; and

WHEREAS, the County of Mendocino wishes to join the geothermal opportunity zone as set forth in this Resolution.

NOW, THEREFORE, THE BOARD OF SUPERVISORS OF THE COUNTY OF MENDOCINO HEREBY RESOLVES AS FOLLOWS:

- 1. The above Recitals are true and correct and incorporated by this reference.
- 2. The County of Mendocino joins the Sonoma Lake Mendocino Geothermal Opportunity Zone ("GeoZone") established by SCPA. The boundary of the GeoZone in the County of Mendocino will initially include the full territory of Mendocino County. The GeoZone shall be used to explore the potential development of geothermal energy resources within its boundaries. These activities may include identifying potential sites for new geothermal energy production and for the research of new and emerging geothermal technology, collaboratively sharing information among the Counties, soliciting developers to propose new geothermal and other clean power resources, exploring a programmatic environmental impact report to reduce development risks and timelines, seeking federal and state funds and changes in policy to support geothermal development, and facilitating the use of the renewable energy output by customers in the Counties.
- 3. Activities shall not include any final commitment to develop geothermal energy resources at any site, which shall only be made by the Counties, and other applicable regulatory agencies after necessary environmental and similar review.
- 4. County staff is hereby authorized to take such administrative actions necessary to implement the GeoZone.
- 5. For the reasons set forth above, the adoption of this Resolution is not a "project" requiring environmental review pursuant to State CEQA Guidelines § 15060, subdivision (c)(3) and §15378, subdivisions (a) and (b)(2), (b)(4) and (b)(5). Alternatively, the actions are statutorily exempt from CEQA review pursuant to State CEQA Guidelines § 15262 and exempt under the "common sense" exemption identified in State CEQA Guidelines § 15061, subdivision (b)(3). None of the exceptions to the use of the "common sense" exemption as identified in Government Code § 15300.2 exist.
- 6. This Resolution shall be effective immediately.

The foregoing Resolution introduced by Supervisor Haschak, seconded by Supervisor Williams, and carried this 7th day of December, 2021, by the following vote:

AYES: Supervisors McGourty, Mulheren, Haschak, Gjerde, and Williams NOES: None None ABSENT:

WHEREUPON, the Chair declared said Resolution adopted and SO ORDERED.

CARMEL J. ANGELO ATTEST: Clerk of the Board

DAN GJERDE, Chair

Deputy

Mendocino County Board of Supervisors

I hereby certify that according to the provisions of Government Code section 25103, delivery of this document has been made.

APPROVED AS TO FORM: CHRISTIAN M. CURTIS, **County Counsel**

in m. this

BY: CARMEL J. ANGELO Clerk of the Board

Deputy



Date: February 8, 2022

County of Sonoma

State of California

THE WITHIN INSTRUMENT IS A CORRECT COPY OF THE ORIGINAL ON FILE IN THIS OFFICE

ATTEST: February 8, 2022 SHERYL BRATTON, Clerk/Secretary BY Noelle Francis

Item Number: 5

Resolution Number: 22-0035

□ 4/5 Vote Required

RESOLUTION OF THE BOARD OF SUPERVISORS OF THE COUNTY OF SONOMA, STATE OF CALIFORNIA, ESTABLISHING MEMBERSHIP IN THE SONOMA LAKE MENDOCINO GEOTHERMAL OPPORTUNITY ZONE

Whereas, the Sonoma Clean Power Authority (SCPA) established the structure for a Geothermal Opportunity Zone ("GeoZone") on October 7, 2021; and

Whereas, SCPA has invited the County of Sonoma to join the GeoZone to partner in exploring opportunities to accelerate the development of renewable energy and reduce greenhouse gas emissions; and

Whereas, SCPA is a local government entity governed by representatives from the Counties and Cities of Sonoma and Mendocino Counties and an electricity provider serving customers in Sonoma County; and

Whereas, a world class geothermal resource exists in Sonoma, Lake, and Mendocino Counties with significant potential to provide clean baseload renewable energy that operates 24 hours per day 365 days per year; and

Whereas, the County of Sonoma recognizes that new more water-efficient technologies for generating geothermal power are needed; and

Whereas, the County of Sonoma wishes to explore geothermal power projects which provide benefits to its local community and do not exist solely to benefit people outside of Sonoma County; and

Resolution #22-0035 Date: February 8, 2022 Page 2

Whereas, the County of Sonoma recognizes the high cost of electricity in California and supports opportunities to reduce energy cost through promoting technology development, identifying efficiencies of scale, and leveraging state and federal grant funding; and

Whereas, the County of Sonoma owns and controls property which may have development potential for baseload renewable energy projects; and

Whereas, the County of Sonoma recognizes the long permitting and development timelines for geothermal power projects; and

Whereas, the County of Sonoma is well acquainted with the potential consequences to the environment and community of new resource development and expects to be directly engaged in the selection of projects with the aim of mitigating adverse impacts; and

Whereas, the County of Sonoma shall retain its full rights to review and approve any project located within its jurisdiction;

Whereas, the County of Sonoma has an interest in sharing information and working collaboratively together with the SCPA and the Counties of Mendocino and Lake; and

Whereas, the County of Sonoma wishes to join the geothermal opportunity zone as set forth in this Resolution;

Now, Therefore, Be It Resolved

- 1. The above Recitals are true and correct and incorporated by this reference.
- 2. The County of Sonoma joins the Sonoma Lake Mendocino Geothermal Opportunity Zone ("GeoZone") established by SCPA. The boundary of the GeoZone in the County of Sonoma will initially include the full territory of Sonoma County. The GeoZone will be used to explore the potential development of geothermal energy resources within its boundaries. These activities may include identifying potential sites for new geothermal energy production and for the research of new and emerging geothermal technology,

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> collaboratively sharing information among the Counties, soliciting developers to propose new geothermal and other clean power resources, exploring a programmatic environmental impact report to reduce development risks and timelines, seeking federal and state funds and changes in policy to support geothermal development, and facilitating the use of the renewable energy output by customers in the Counties.

- Activities shall not include any final commitment to develop geothermal energy resources at any site, which shall only be made by the Counties, and other applicable regulatory agencies after necessary environmental and similar review.
- 4. County staff is hereby authorized to take such administrative actions necessary to implement the GeoZone.

Be It Further Resolved

- For the reasons set forth above, the adoption of this Resolution is not a "project" requiring environmental review pursuant to State CEQA Guidelines § 15060, subdivision (c)(3) and §15378, subdivisions (a) and (b)(2), (b)(4) and (b)(5). Alternatively, the actions are statutorily exempt from CEQA review pursuant to State CEQA Guidelines § 15262 and exempt under the "common sense" exemption identified in State CEQA Guidelines § 15061, subdivision (b)(3). None of the exceptions to the use of the "common sense" exemption as identified in Government Code § 15300.2 exist.
- 2. This Resolution shall be effective immediately.

Supervisors:

Gorin: Aye	Rabbitt: Aye	Coursey: Aye	Hopkins: Aye	Gore: Aye
Ayes: 5	Noes: 0	Absei	nt: 0	Abstain: 0

So Ordered.

APPENDIX B

Sonoma Clean Power

Technical Resource Study

NOTE: This study was commissioned prior to Lake County's decision to not be included in the initial scope of the GeoZone. Even though the study primarily focused on potential outside the GeoZone boundary, SCP believes it still may be a viable resource for potential respondents in understanding the regional geology and availability of data.

CHARACTERIZATION OF THE GEOTHERMAL SYSTEM IN THE VICINITY OF CLEAR LAKE

William E. Glassley Earth System Sciences LLC 2021

INTRODUCTION

The purpose of the research reported here is to develop a database that could be used for potential numerical modeling of the geothermal resource in the area outlined in Figure 1. In addition, this characterization will offer insight into the properties of the geothermal reservoir based on available data. The intent of this effort is to provide a quantitative description of the known geological properties in this region sufficient to support development of a geothermal opportunity zone (GOV), as envisioned by Sonoma Clean Power Authority (SCPA).



Figure 1. Study area (enclosed by red outline).

METHOD

The region of interest is one of California's most renowned geothermal settings. Power generation utilizing the geothermal resources here has a history extending into the early 1950s. Consequently, geological mapping and resource exploration through drilling has resulted in the collection and publication of data useful for the purposes of the research undertaken here. These include:

- Lithological units and their respective porosity, permeability, density, heat capacity, and thermal conductivity
- Fault locations and geometry
- Depth to relevant geological units
- Well locations and condition/state.

Key publications for relevant data include Chapman (1975), Donnelly-Nolan et al. (1981), Hearn et al. (1981, 1995), McLaughlin (1981) and Rutledge et al. (2002). Well data was obtained through the on-line database maintained by the California Department of Conservation accessed through the California Geologic Energy Management "Well Finder" (<u>https://www.conservation.ca.gov/calgem/Pages/WellFinder.aspx</u>).

The approach followed regarding well records was to first obtain the American Petroleum Institute well identification number (API number) by defining the area of interest in Well Finder. The resulting Excel spreadsheet provided the API number for 1,309 geothermal wells (commercial low temperature, developmental steam, exploratory steam, injection and temperature gradient wells). A subset of wells that were located in the primary areas of interest was identified and the well records reviewed. Since the well records are not digitally searchable, each record had to be down loaded and manually examined to determine if they contained useful information (e.g., temperature measurements, porosity, permeability, density, rock type). Of the several hundred wells considered, forty-two wells had adequate quality data for inclusion in this study. Although temperature data were reported for many more wells than this selected suite, they were not included in this study because they did not represent likely steady-state conditions. This can result from any of the following:

- Temperatures measured of drilling mud during drilling activity
- Well logging conducted shortly after drilling and before the well had been given sufficient time to return to steady-state conditions
- Air temperature measurements of air escaping from the well head.

Figure 2 shows the locations of wells for which records were examined as well as the locations of wells for which adequate quality data were obtained.



Figure 2. Well locations in the study area. Red dots indicate wells used to establish subsurface temperature distribution. Labelled lines A-A', B-B' and C-C' indicate locations of cross sections. The areas dominated by the Collayomi and Konochti fault zones are shown by the traces of major faults within them. The dotted circle outlines the surface projection of an inferred magma chamber that geophysical data suggests exists at a depth of approximately 10 km or deeper (Carter Hearn et al., 1981; Isherwood, 1981).

GEOLOGICAL FRAMEWORK

The area of interest consists of Franciscan Formation and Great Valley sequence rock units that have been invaded by magmatic rocks, with the consequent development of volcanic deposits.

The origin and history of these geological units reflects complex plate tectonic activity that has evolved over the last ca. 100 million years (m.y.). Although it is beyond the scope of this study to detail the sequence of events that resulted in the current geothermal system, an excellent summary of this history is available in U.S. Geological Survey Professional Paper 1141 (McLaughlin and Donnelly-Nolan, 1981). However, aspects of that history important for consideration of issues related to geothermal development are that between 5.3 m.y. and 10,000 years ago igneous rocks intruded the region, resulting in surface eruptions of volcanic rocks and emplacement of magma bodies at depths of about 10 km. The magma body is still present, and is the heat source that supports geothermal activity.

That magma body heats the groundwater that circulates through the region. Normally such a system would result in development of convecting hydrothermal fluids that would circulate to the surface. Although that is also the case in the area of interest, a complicating factor is that an impermeable rock unit at depth lies above at least a portion of the magma body, resulting in entrapment of heated fluids between it and the magma body. As a consequence, the trapped fluid is super-heated, resulting in the formation of a dry steam reservoir in the subsurface. It is this dry steam reservoir that has been the sustaining energy resource supporting geothermal power generation in The Geysers region. This unique set of circumstances, which is one of only two known and developed dry steam geothermal resources in the world, has played a key role in making The Geysers one of the most important geothermal resources in the United States.

Outside of The Geysers thermal springs and numerous wells drilled for exploration and development purposes attest to the presence of conventional geothermal resources in the region as well. It is the purpose of this study to elucidate the characteristics of this resource.

RESULTS

Shown in Figures 3 through 6 are cross sections corresponding to the labelled lines A through D in Figure 1. Each cross section extends to a depth of 3,500 meters (11,483 feet) and is 32.2 km (20 miles) long. All depths are recorded as distance from the ground surface.

Plotted in each cross section are temperatures obtained from individual wells that lie close to each line (Supplemental Database). Also shown in cross sections A through C are the approximate locations of the Collayomi and Konocti fault zones. Dozens of other faults also occur in the area but are too numerous to represent in the figures.



Figure 3. Cross section A-A' (see Figure 2 for location). In this and subsequent figures, all depths are measured relative to the ground surface. The thin horizontal lines indicate the location of temperature maps at depths of 1,000 feet, 3,000 feet, 5,000 feet and 7,000 feet (Figures 6 through 8).





Figure 4. Cross section B-B' (see Figure 2 for location).



Figure 5. Cross section C-C' (see Figure 2 for location).

Although the isotherms are drawn to fit the available temperature measurements as closely as possible, the paucity of wells with rigorous temperature measurements makes these fits only approximate. Consequently, the patterns that are evident must be considered preliminary until more data are available.

Nevertheless, several features are evident. First, within the central part of the study area, the region between the Collayomi fault zone and the Konocti fault zone tends to be a volume in which the temperatures are modest and consistent at any given depth. Irregularities in the isotherm depths is likely the reflection of fluid movement along faults. To the northeast of the Konocti fault zone and south west of the Collayomi fault zone temperatures significantly rise.

The highly elevated temperatures in the northeast are recorded in wells 00390287 (API number; well name Audrey A) and 03390162 (API number; well name Borax Lake 7-1). These wells fall in a region of numerous faults that have experienced movement within the last 2.0 m.y. (Bortugno, 1982). The presence of sulfur deposits and cinnabar mines in this same region suggest that the elevated temperatures reflect significant flow of hydrothermal fluids from depth in the 'geologically' relatively recent past. The high temperatures currently evident in this area suggest hydrothermal fluid flow is still occurring.

The elevated temperatures to the southwest of the Collayomi fault zone are also likely to be associated with hydrothermal fluid movement along faults. This region is along the northern margin of The Geysers geothermal field, and likely reflects fluid movement related to processes associated with that geothermal reservoir.

Shown in Figures 6 through 9 are the locations of isotherms at depths of 1,000 ft, 3,000 ft, 5,000 ft and 7,000 ft. The isotherms are located based on the measured temperatures in the wells located in each map, and the temperatures shown in the cross sections (Figures 3 through 6). Because the number of wells in the study area that had adequate temperature data is limited, the locations of the isotherms must be considered approximate.



Figure 6. Temperature isotherms at a depth of 1,000 feet (305 m).



Figure 7. Temperature isotherms at a depth of 3,000 feet (914 m).



Figure 8. Temperature isotherms at a depth of 5,000 feet (1,524 m).



Figure 9. Temperature isotherms at a depth of 7,000 feet (2,134 m).

OPPORTUNITIES FOR GEOTHERMAL DEVELOPMENT

The results of this assessment document the presence of significant geothermal energy resources that could support a variety of applications. Discussed below are possible uses of this energy, categorized by the technology required for use.

Power generation

Geothermal power generation, as demonstrated by The Geysers power stations, is an obvious technology for this region. For efficient power generation, fluids with temperatures in excess of 160° C are necessary. However, recent technological improvements are rapidly reducing the necessary temperature for economic power generation. Consequently, the entire area enclosed within the 150° C isotherms in Figure 9 potentially has temperatures sufficient to support power generation. At shallower depths, the areas within which temperatures are sufficiently high to allow power generation are more restricted. Note that power generation in The Geysers area commonly relies on wells deeper than 7,000 feet (commonly 8,000 to 10,000 feet), which implies generation may be possible in most of the region.

In order to achieve long-term power production at the design power outputs (i.e., name plate power production), it is also necessary that the required fluid extraction rates be sustainable. Evaluation of fluid availability will be undertaken in a later modeling phase of this study. However, it should be noted that the fluctuations in the isotherms depicted in the cross sections implies perturbation of the temperature field by fluid flow, which is likely to be occurring along some of the numerous faults in the region. This and the elevated temperatures would suggest that there are likely to be locations suitable for power generation in a number of locations throughout the study area.

Limitations for power generation that are specific to this region primarily reflect the consequences of two important factors:

- fluid compositions are highly variable, and sometimes include elevated concentrations of hydrogen sulfide, mercury and methane (Thompson et al., 1981)
- natural recharge rates are low and may decrease as drier conditions evolve related to climate change effects.

However, these challenges provide extraordinary opportunities for technology development that could revolutionize the geothermal industry globally. Such opportunities could include:

- innovative technologies that would eliminate emissions of certain contaminants during power generation
- development of closed-loop systems or other concepts to reduce water usage
- new heat transfer technologies and working fluids to improve generation efficiency
- next generation modeling and monitoring approaches in order to reduce risk in project development and operations.

Finally, because of the near-universal interest in managing energy in order to become a carbonneutral society, the opportunity exists to engage local and regional interest groups in order to develop the most flexible, community-driven development of energy use and generation. This could include developing research and communication activities in educational institutions in the region.

Direct Use

Direct use applications utilize the thermal energy available in geothermal fluids by transferring the heat from the heated groundwater to the end user. Shown in Figure 10 are some of the industrial applications that have made use of this approach.



Figure 10. Various industrial applications that have made direct use of geothermally heated groundwater (from Glassley, 2014).

These and many other applications have the potential to support significant economic growth in the region.

In addition, communities can make use of geothermal fluids directly by developing district heating systems which, when coupled with geothermal heat pumps, can heat and/or cool buildings directly. Such applications have been constructed and maintained for decades in numerous settings, including Denmark, Iceland, California and Oregon. Such systems are resilient, highly reliable and very cost effective, especially in regions that have the type of resource that is readily available in the study area.

Finally, utilization of heat from geothermally heated groundwater has significant potential for utilization in water treatment facilities.

It should be noted that many of these applications were initially developed some years ago. The region under consideration has the opportunity to design, develop, demonstrate and apply a new generation of such applications, that would improve efficiencies and reduce costs. As such, this area has the potential to become the "Silicon Valley" of the geothermal world.

CONCLUSION

Within the area of interest substantial variability exists regarding the subsurface temperature distribution. This variability is likely a reflection of fault-controlled movement of hydrothermal fluids and variation in the depth and location of the primary heat source. Preliminary examination of geological maps and published cross sections does not indicate that there is a strong correlation between rock type and the temperature distribution. However, recovery of more temperature data from well records would be needed to more rigorously substantiate this observation.

Fault-controlled fluid movement in geothermal systems is a common occurrence. The observed temperature variability suggests that fluid fluxes are likely to be particularly high in the north-eastern and south-western areas discussed previously. The occurrence of mineral deposits in the north-eastern area also suggests that hydrothermal fluid compositions are likely to be variable throughout the region. Previous reports of water compositions (Thompson et al., 1981) support this conclusion.

A wide variety of opportunities exist for utilizing the natural resources available in the area. Temperatures and tentative evidence regarding fluid fluxes, as well as the existing power generation infrastructure in the region, argue strongly that electricity production could be significantly expanded. In addition, numerous direct-use applications, which could dramatically reduce demand for electricity, could be sustainably developed. Given the richness of the resource, the area has the potential to become an even more prominent world leader in geothermal energy technology and production.

Recommendations

1. Because of the time required to manually review well records in the non-digitized CalGEM database, a significant amount of data remains to be reviewed that could significantly improve the resolution currently achieved in this study. It is recommended that, before any modeling be undertaken, the review of available data be extended. The goal of that effort would be to increase by a factor of three the number of wells for which useful temperature profiles are recorded for the area.

2. The issue of water quality in the geothermal fluids can influence both exploratory drilling undertakings and project development. It is recommended that a database be developed of available of chemically analyzed water. This database could be used to identify areas in which mitigation may be necessary.

3. Initiate interactions with local institutions of higher education to mobilize faculty and student researchers to assist with data collection and analysis.

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APPENDIX C

Sonoma Clean Power

Non-Disclosure Agreement

NOTE: This agreement is <u>not required</u> unless respondents are submitting information in their solicitation response that they are requesting be considered confidential. The *Confidentiality* section of the RFI provides additional details on the confidentiality of responses to this solicitation.

Mutual Non-Disclosure Agreement

This Mutual Non-Disclosure Agreement ("Agreement") is made between:

"Participant:" [INSERT], and

"Sonoma Clean Power Authority:"

It is understood and agreed to that Participant and Sonoma Clean Power Authority (individually a "Party" and together the "Parties") would like to exchange certain information that may be considered confidential. The Party which discloses Confidential Information is the "Discloser" and the Party that is receiving the Confidential Information is the "Recipient."

To ensure the protection of such information and in consideration of the agreement to exchange said information, the Parties agree as follows:

1. The confidential information, which may be disclosed by either Party under this Agreement ("Confidential Information") can be described as and includes:

Technical and business information relating to either Party's proprietary ideas, patentable ideas, copyrights and/or trade secrets, existing and/or contemplated products and services, existing and/or contemplated strategic partnerships, software, schematics, research and development, production, costs, profit and margin information, finances and financial projections, customers, clients, marketing, and current or future business plans and models.

- 2. Confidential Information shall be marked as confidential (or with other similar designation) at the time of disclosure; and/or (b) disclosed by Discloser in any other manner and identified as confidential at the time of disclosure and is also summarized and designated as confidential in a written memorandum delivered to Recipient within thirty (30) days of the disclosure.
- 3. Recipient shall use the Confidential Information only for the purpose of evaluating potential business, partnership, and similar relationships with Discloser.
- 4. Recipient shall limit disclosure of Confidential Information to its directors, officers, partners, members, consultants, attorneys, and/or employees having a need to know and shall not disclose Confidential Information to any third Party (whether an individual, corporation, or other entity) without the prior written consent of Discloser. Recipient shall have satisfied its obligations under this paragraph if it takes affirmative measures to ensure compliance with these confidentiality obligations by its employees, agents, consultants and others who are permitted access to or use of the Confidential Information.
- 5. This Agreement imposes no obligation upon Recipient with respect to any Confidential Information that (a) was in Recipient's possession before receipt from Discloser; (b) is or becomes a matter of public knowledge through no fault of Recipient; (c) is rightfully received by Recipient from a third Party not owing a duty of confidentiality to the Discloser; (d) is independently developed by Recipient; or (e) is required to be disclosed by law or legal process.
- 6. Both Parties acknowledge that Sonoma Clean Power Authority is subject to the California Public Records Act and other laws which may require the release of Confidential Information. Sonoma Clean Power shall notify Participant if it receives a public records request for Confidential Information and believe it may be required to disclose the same prior to disclosure and with at least three (3) business days' notice to allow Participant to seek a protective order or similar. Participant shall defend, indemnify and hold Sonoma Clean Power harmless from any failure to disclose Confidential Information under the California Public Records Act.
- 7. Discloser warrants that he/she has the right to make the disclosures under this Agreement.
- 8. This Agreement shall not be construed as creating, conveying, transferring, granting or conferring upon the Recipient any rights, license or authority in or to the information exchanged, except the limited right to use Confidential Information specified in this Agreement. Furthermore, and specifically, no license or conveyance of any intellectual property rights is granted or implied by this Agreement.

- 9. Neither Party has an obligation under this Agreement to purchase any service, goods, or intangibles from the other Party. Furthermore, both Parties acknowledge and agree that the exchange of information under this Agreement shall not commit or bind either Party to any present or future contractual relationship (except as specifically stated herein), nor shall the exchange of information be construed as an inducement to act or not to act in any given manner.
- 10. Neither Party shall be liable to the other in any manner whatsoever for any decisions, obligations, costs or expenses incurred, changes in business practices, plans, organization, products, services, or otherwise, based on either Party's decision to use or rely on any information exchanged under this Agreement.
- 11. If there is a breach or threatened breach of any provision of this Agreement, it is agreed and understood that Discloser shall have no adequate remedy in money or other damages and accordingly shall be entitled to injunctive relief; provided however, no specification in this Agreement of any particular remedy shall be construed as a waiver or prohibition of any other remedies in the event of a breach or threatened breach of this Agreement.
- 12. This Agreement states the entire agreement between the Parties concerning the disclosure of Confidential Information and supersedes any prior agreements, understandings, or representations with respect thereto. Any addition or modification to this Agreement must be made in writing and signed by authorized representatives of both Parties. This Agreement is made under and shall be construed according to the laws of the State of California, U.S.A. In the event that this agreement is breached, any and all disputes must be settled in a court of competent jurisdiction in Sonoma County or the federal Northern District of California.
- 13. If any of the provisions of this Agreement are found to be unenforceable, the remainder shall be enforced as fully as possible and the unenforceable provision(s) shall be deemed modified to the limited extent required to permit enforcement of the Agreement as a whole.
- 14. This Agreement shall terminate with written notice by either Party and upon the return of Confidential Information by the Recipients.

WHEREFORE, the Parties acknowledge that they have read and understand this Agreement and voluntarily accept the duties and obligations set forth herein.

PARTICIPANT. SONOMA CLEAN POWER AUTHORITY

Name (print) of Authorized Representative

Name (print) of Authorized Representative

Title

Chief Executive Officer

Date

Date