



GeoZone Community Meeting: Developing Principles for New Geothermal

September 18, 2023 2:00pm-5:00pm, Cloverdale Performing Arts Center

Attendees

Allison Cook, Chevron New Energies
Barbara Lee, County of Sonoma
Bob Anderson, S Fitch
Brendan Sweeney, Rep. Mike Thompson's Office
Dan McCulloch, NorCal Carpenters Union
Danielle Seperas, Calpine
Eileen Mullinaux, Neighbor
Frank Arzo, Citizen
Geof Syphers, Sonoma Clean Power
Indigo Bannister, Russian River Keeper
Joe Greco, Calpine
Josh Garcia, NorCal Carpenters Union
Kate Brandenburg, Brandenburg Group
Laura Seidenberg, Citizen
Mario Santacruz, Northern California Millwrights Local 102
Mathew Densmore, California Geologic Energy Management Division
Matthew Rothstein, County of Lake
Marcelo De Camargo, Chevron New Energies
Neena Hanchett, Cloverdale Chamber
Neil Ethier, Eavor
Patricia Morris, Sonoma Clean Power Community Advisory Committee Chair
Richard Greene, Citizen
Rob Bamford, North Sonoma County Air Pollution Control District
Robert Penington, Permit Sonoma
Rody Jonas, Pure Power Solutions
Ryan Tracey, Sonoma Clean Power
Shauna Falvey, Chevron New Energies
Woody Hastings, The Climate Center

Link to Presentation

https://sonomacleanpower.org/uploads/documents/20230918_GeoZonePrinciplesMeetingPresentation.pdf

Introduction

Sonoma Clean Power (SCP) introduced itself as the local community-owned electricity provider with a core purpose of accelerating solutions to the climate crisis. SCP's Geothermal Opportunity Zone (GeoZone) partners Chevron New Energies and Eavor were present to represent their role in deploying technology and investment in growing local geothermal capacity in Sonoma and Mendocino Counties. Cyrq Energy is also a GeoZone partner but was unable to attend the meeting.

Background

SCP provided context for the GeoZone by walking through a key challenge in meeting California's Senate Bill 100 goal of reaching 100% renewable or carbon-free electricity by 2045: it is very difficult to provide year-round reliability using clean resources. This has led to delays to retiring natural gas power plants that disproportionately burden disadvantaged communities in the Los Angeles Basin and Central Valley. Flexible loads (such as participation in SCP's GridSavvy program and workplace EV charging) and paired solar with batteries increases clean reliability—but "clean firm" resources that generate throughout the year and through the nighttime are critical to cutting dependency on natural gas power plants.

SCP briefly shared the state's plans to increase the diversity of energy resources and add "clean firm" capacity, including this year's energy trailer bill (AB 1373) that created a mechanism for the state to construct large-scale offshore wind, an order by the California Public Utilities Commission for load serving entities to construct 1,000 MW of new geothermal by 2028, and proposals for out-of-state wind, pumped hydro projects, and Salton Sea geothermal development. SCP's presentation included a comparison of SCP and California's energy mix alongside a breakdown of resource adequacy (standby capacity) by source which clearly demonstrated the high dependency of the current grid on natural gas resources. Meanwhile, SCP shared that load is projected to grow by 40% by 2040 as the transportation sector and built environment are electrified.

SCP also provided a brief explanation of the mechanics of geothermal power. The earth's core provides a regenerating source of heat that can be tapped by drilling wells to produce live steam (as in the current Geysers) or harvest heat through circulating fluid. The produced heat is then used to drive a turbine—either directly through expansion of produced steam or by transferring heat to a separate working fluid. The viability of geothermal power generation is very high locally due to the Clear Lake Volcanic Field underlying the region.

GeoZone Progress

SCP shared recent progress in the GeoZone initiative, which was established in October 2021 to explore opportunities to deploy new technologies to grow local geothermal capacity that is compatible with community values. Following its formulation by the SCP Board of Directors, Sonoma County and Mendocino formally joined the GeoZone by January 2022 through a resolution passed by their Boards of Supervisors.

In Spring 2022, SCP released a solicitation for private partners for providing the technology, expertise, and capital to expand geothermal capacity in the GeoZone. In June 2022, the finalists from that solicitation participated in a public stakeholder workshop that included many of the same attendees. SCP explained that it moved forward with all three candidates because each proposal offered its own benefits and risks, and pursuing all three in parallel increased the overall chance of success in the GeoZone.

SCP also previewed a new map of the GeoZone showing the expected “Early Interest Area” which runs roughly from Healdsburg to Hopland, and concentrated east of Highway 101. The geothermal gradient is elevated in this region and there is reasonable access to existing transmission infrastructure. The boundary of the GeoZone encompasses all of Sonoma and Mendocino Counties, but the community may see early pilot projects concentrated in the “Early Interest Area” because of the known thermal opportunity.

Before introducing its development partners, SCP provided a brief summary of the cooperation agreements approved in March 2023. The cooperation agreements with all three partners follow a similar structure: SCP’s private partners agree to developing projects that minimize environmental impacts, support local workforce, have a strong potential to cost-effectively scale to 200 MW each, involve frequent stakeholder engagement, and support resource sustainability. In exchange, SCP commits upfront to purchasing power from the partners. Each agreement is setup with a pilot demonstration project of up to 20 MW that is expected to be higher cost and risk followed by a 200 MW scale-up. Partners are expected to complete several important milestones in progressing the pilot development by early 2026.

Chevron New Energies Presentation

Marcelo De Camargo, Geothermal Program Manager at Chevron New Energies, provided a presentation to attendees on Chevron New Energies’ proposal for the GeoZone. Marcelo started with providing his personal background as a Brazilian and past role as President at GeothermEx, a leading geothermal resource consulting firm. In early 2023, Marcelo shared that he decided to join the Chevron New Energies team, despite its association with oil and gas, because he appreciated their strong capabilities and genuine interest in scaling geothermal.

Marcelo provided an overview of the Chevron New Energies organization, which is an affiliate of the Chevron Corporation tasked with growing low-carbon businesses. Specifically, Chevron New Energies seeks to leverage the strengths of its parent corporation—which includes subsurface and project management expertise that translate to geothermal development. Marcelo shared that Chevron New Energies has a commitment to invest \$10 billion in lower carbon projects by 2028.

Chevron New Energies’ approach to scaling geothermal is a “pilots-to-projects” approach where multiple novel technologies will be tested to determine the best approach to growing geothermal in the GeoZone. In addition to its technical expertise

from innovating subsurface technologies for oil and gas, Marcelo shared that Chevron New Energies brings operational experience and a commitment to building relationships with the community.

Eavor Presentation

Neil Ethier, Vice President Business Development at Eavor, gave an overview of Eavor's Advanced Geothermal System (AGS) technology that is planned for deployment in the GeoZone. Unlike conventional geothermal development, Eavor's technology can generate power from rock that is impermeable and dry. Eavor drills two multilateral wells that create a subsurface radiator – see the slide for a visual that is something like two dinner forks that meet at the tips of the tines. Water is circulated through the radiator to transfer heat from the geologic resource to the surface, where it is used to drive a power cycle.

Neil walked through the evolution of Eavor's technology—starting with a technology prototype in Alberta commissioned in Alberta that confirmed Eavor's thermodynamic modeling, ability to join two wellbores in the subsurface, and the sealing mechanism used in the open hole radiator to protect against interacting with groundwater and to ensure the system operates as a closed loop with minimal water requirements. Eavor just started drilling the next iteration of its technology in Germany, which adds additional laterals to its subsurface radiator and will enable commercial heat and power production. The subsequent iteration of Eavor's technology involves drilling much deeper to increase the commerciality and expand the viability of the technology to other geographic areas. A well drilled in New Mexico in 2022 by Eavor demonstrated their capability to drill directionally at high depths and temperatures. This last iteration of Eavor's technology is what is planned for the GeoZone.

Neil shared some of the beneficial attributes of their technology: it does not require well stimulation, it is a completely closed-loop system with minimal water loss, and it does not have induced seismicity.

Cyrq Presentation

Although Cyrq was unable to attend the event, Ryan Tracey from SCP provided an overview of Cyrq's plan for technology deployment at the GeoZone. Ryan explained that Cyrq is planning on installing a thermal long-duration energy storage (LDES) system upstream of an existing geothermal power plant. Cyrq's technology involves heating a silo of sand using excess electricity on the grid during solar hours and then using the hot sand to superheat steam that is produced by the wellfield before it enters an existing steam turbine. Superheating the steam potentially allows the existing geothermal power plant to increase its output by 50% during high-need hours.

Ryan explained that Cyrq's technology offers a number of advantages over lithium-ion batteries: it can cost-effectively scale to long durations (Cyrq's system can discharge for 20 hours), it can recharge very quickly, it utilizes only readily-available non-toxic and recyclable domestic materials and avoids the geopolitical issues of rare earth minerals, and most of the investment will go towards on-site installation that leads to high

utilization of the local workforce. Unlike the proposals from the other partners, Cymq's technology requires no changes to the subsurface—which removes a lot of uncertainty and execution risk.

GeoZone Progression & Listening Tour

Following the presentations from GeoZone partners, SCP shared the expected progression of the GeoZone. Partners are currently focused on site acquisition and commercial agreements to host GeoZone pilot projects. After sites are secured, the next step for Chevron New Energies and Eavor will be to permit calibration and exploration wells to collect the necessary data to validate the feasibility of a pilot project. Permitting geothermal exploration wells in California is subject to the California Environmental Quality Act (CEQA) and will trigger a public process that assesses potential impacts. Meanwhile, partners will likely begin applying for grid interconnection for their pilots—which is a very lengthy process due to the backlog of renewable projects currently seeking to connect to the transmission system.

If the results of an exploration or calibration well are positive, GeoZone partners will then begin planning and permitting for pilot projects which may be up to 20 MW. Permitting the wells and power plant for the project will trigger a separate CEQA permitting process.

SCP provided a brief recap of a separate listening tour it completed in August as well. SCP met with community members throughout Lake County where people live much closer to geothermal facilities than in Sonoma or Mendocino Counties and are well acquainted with the impacts of geothermal power development. Themes from feedback received during the tour included the importance of transparency and early engagement, concern with induced seismicity, skepticism of hydraulic fracturing, interest in water issues, impacts like traffic and noise to rural communities, and past experience with unrealistic promises from developers on tax revenue and job creation. SCP shared a handout with attendees of the Cloverdale workshop, offering a more detailed summary of the listening tour that is also [available on the GeoZone webpage](#).

Pre-Project Principles Discussion

SCP kicked-off the discussion of geothermal development principles with a recognition that having this kind of discussion before a specific project location or technology is proposed is unique, and while it helps increase transparency and community input early on, it may also be difficult for the community to evaluate impacts and benefits. Therefore, the goal of the discussion was to collect early-stage pre-project community input that can inform GeoZone partners in identifying better projects, and that the private partners should expect significantly more community input once they propose specific projects.

Early Community Engagement

Considerations for expanding community engagement was the first theme opened for discussion. A participant provided recognition that community engagement before a project site is known was unusual, but very beneficial. The commentor recommended

holding meetings in an accessible place where communities already meet (examples included libraries and recreation centers) at a convenient time (evening meetings or weekends to accommodate work and family schedules). Making accommodation for Spanish language was also recommended. A separate participant shared the importance of providing childcare or a location with activities for children to encourage participation by families.

Other comments were made on recording meetings and allowing feedback through surveys and e-mails rather than relying on in-person attendance. Participants also stressed that you can't communicate too much on a project the scale of GeoZone, and SCP should continue to frequently present information on the project and in diverse formats.

Energy Equity Concerns

SCP acknowledged a core tenet of the GeoZone is improving equity by providing a workable solution to stop Sonoma and Mendocino County exporting air and water pollution to less fortunate regions in California. Participants stressed the importance of promoting equity through GeoZone employment by requiring local hire agreements. There was recognition that there is a lot of workforce capability in Sonoma, Mendocino, and Lake Counties but GeoZone developers should also work with labor organizations on creating training and apprenticeship opportunities.

An example was shared of a participant working on an environmental clean-up project where the local community did not only want the project to occur, but they also wanted to be employed to perform the work. In partnership with local government, contractors, and unions, the project was able to stand-up an apprenticeship program to equip locals to perform the work. Other participants shared MCE's Solar One project and RichmondBUILD as examples of projects that were successful in promoting development of the local workforce.

Participants recognized that developing geothermal locally to benefit communities elsewhere in the state may be difficult politically. Although GeoZone could offer Sonoma and Mendocino County "equity bragging rights" by reducing local pollution elsewhere, SCP and its partners should still endeavor to deliver net benefits to the local community (such as new job pipeline and a green circular economy).

One participant stated that SCP is already demonstrating its commitment to equity through its engagement in Lake County and interest in understanding the impacts of the project on all people. Telling the holistic story on the GeoZone will be important in seeking community buy-in. During this discussion, it was noted that Lake County is not recognized as a disadvantaged community by the state despite its significant population living in poverty and important contribution to the state's energy needs by hosting substantial transmission lines and the existing Geysers operation. A final comment in the equity discussion highlighted the need to reach out to tribes in the region.

Impact on Close Neighbors

SCP shared some of the impacts of geothermal development it heard during the listening tour in Lake County, including induced seismicity, noise, traffic, and air and water quality. Participants provided other important impacts to consider such as visual (height and size), light pollution, and biodiversity.

A community member mentioned one concern is the impact on home insurance. Homes in the region are already more difficult to insure due to high wildfire risk and significant natural earthquakes (seismicity). Layering on more seismicity risk from nearby geothermal operations could be problematic. The same community member also shared concerns on the water impact of geothermal development: wells in the region are drying-up due to climate and increased demand from agriculture. The participant also shared that unincorporated areas are not as well represented in local political processes and are at a disadvantage in representing their concerns. Other comments acknowledged issues with road deterioration from construction traffic.

A high-level suggestion was offered by a participant to provide an ombudsman or liaison to the community to increase accessibility and avoid getting just blanket or muffled responses.

Impacts on Region

SCP articulated a few of the regional impacts it's heard through its early GeoZone work including employment, tax benefits, and water demand. A stakeholder shared the importance of enabling the region to directly benefit from generating clean power locally versus only asking the region to contribute to a statewide goal. It was noted that when Lake County supervisors were invited to consider joining the GeoZone, this was a key consideration—without SCP service, GeoZone power would not directly flow to them.

One commentor noted that community acceptance of a project is not considered in isolation, but permitting usually is. To obtain buy-in, a project developer should consider the different lenses that will be used to view the project by the community and assess cumulative impacts. Another participant highlighted the importance of providing transparency on how community feedback is influencing decision making.

Stakeholders highlighted the importance of avoiding areas that already have a constituency advocating for an alternative use (e.g. areas targeted for conservation). A constraints analysis looking at biological impacts (California Tiger Salamander), water impacts, etc. could be used to identify more acceptable sites.

One comment shared the challenge of advocating for energy project development in a region struggling with high power bills and poor power reliability (e.g., Public Safety Power Shutoffs or Fast Trip Shutoffs). SCP should articulate what its doing to address these concerns and demonstrate that they will not be compounded by GeoZone development.

Community Concerns

SCP started the discussion of community concerns by acknowledging proposed development employing hydraulic fracturing technology will be subject to increased scrutiny and recognizing that the local community is not necessarily well-versed in geothermal development, given the last power plant was constructed in 1989.

A local community member voiced concern on the water source for geothermal development, as well as the potential impact to the productivity and water quality of local groundwater resources. Geothermal development that would impact water quality or disrupt flow (example of seismicity) would be concerning. The same community member expressed the potential for geothermal development and negative impacts to reducing the value of local properties.

Community Aspirations

SCP shared potential aspirations for the GeoZone, including coordinating GeoZone with other local energy projects, providing 100% 24/7 renewable energy to the region, reducing dependency on natural gas power plants, and reducing energy costs. There was discussion that conversations on aspirations should happen in the communities near proposed sites. The audience shared an interest in keeping the lights on, given the local region's experience with poor power reliability.

Miscellaneous

In opening-up the discussion to other comments, one stakeholder asked if odor was a concern (produced fluids can contain hydrogen sulfide). Another participant stressed the importance of responsiveness—if there is a community concern during development and operation, there needs to be clarity on responsibilities and a timely response. Participants also asked for more detail on timing and the size/scale of facilities when they are available. Since these comments are probably best addressed once a specific project location and technology are proposed, these were recorded as guidance for future community meetings.

Written Comments

Following the meeting, SCP allowed meeting participants and any members of the public to submit written comments to be incorporated into the record of the meeting. SCP received one written submission included as Appendix #1. The public is welcome to provide input at any time at one of SCP's monthly Community Advisory Committee meetings or by e-mailing geozone@sonomacleanpower.org.

Appendix #1 – Written Comment from Michelle Robson, Local Resident

Please provide answers. I live on Highland Ranch Road.

1. I would like to know if any of the Sonoma Clean Power employees live near this new potential project and if they are ok with their family being exposed to the additional potential earthquakes? What will SCP do for those of us/our homes if we suffer damage from ADDITIONAL fracking? We already deal with this as it is.

2. Water Usage and Contamination: EGS operations require significant amounts of water for injection and circulation, potentially competing with local water resources. There's also a risk of contaminating groundwater with chemicals used in the process. Tell me how you plan to address this given our water crisis and the goal to minimize environmental impacts by injecting more chemicals into the earth/water?

3. High Costs: Developing EGS projects can be expensive due to the drilling and stimulation techniques involved. The costs associated with drilling deep wells and managing reservoirs can be prohibitive. Will we be paying for this? Are passing this cost onto customers?

4. Technical Challenges: EGS requires precise knowledge of underground geology, and drilling deep wells can be technically challenging. Maintaining the integrity of the boreholes and ensuring efficient heat exchange is not always straightforward. How much more extensive is this project? Will there be light pollution? What noise pollution can we expect? Everyone in Cloverdale should be mailed the pros and cons of this project.

5. Environmental Concerns: Beyond induced seismicity and water usage, EGS can raise environmental concerns related to land disturbance, habitat disruption, and noise pollution during drilling and fracturing operations. What are you doing to protect our precious environment?

6. Energy Return on Investment (EROI): Achieving a positive EROI can be challenging for EGS projects, especially when considering the energy needed for drilling and reservoir development versus the energy produced. How will you do this and how long will it take? Is it worth it? Destroying more precious resources in a pristine area?

8. Long Development Times: EGS projects often have long lead times due to the complexity of drilling and reservoir creation, making them less suitable for addressing immediate energy needs. How long will it take?

Michelle Robson