



## GeoZone Pre-Project Stakeholder Input Meeting Summary

Two stakeholder workshops were held on June 28 and July 6, 2022 to elicit early stage input into SCP's efforts to eliminate dependence on natural gas power plants through the large-scale expansion of local geothermal power resources. Since no sites, technologies or projects were proposed at this early stage, public interest was modest. However, these meetings still provided high-quality community input that is helpful with informing the next phase of SCP's work. Significantly more public input will be sought when specific project locations and types are proposed. Detailed notes of the two events follow.

### June 28, 2022 1-5pm, SCP Advanced Energy Center

#### **Attendees:**

Charlene Wardlow, California Geologic Energy Management Division  
John McEntegart, IBEW Local 551  
Hunter Stern, IBEW Local 1245  
Frank Reardon, Plumbers and Pipefitters UA Local 38  
Woody Hastings, The Climate Center  
Michael Allen, Sonoma County Conservation Action & AFL-CIO North Bay Labor Council  
Rob Bamford, North Sonoma County Air Pollution Control District  
Justin Wriedt, Calpine  
Peter So, Calpine  
Kyle Swarens, NorCal Carpenters Union  
Mel Grandi, City of Ukiah Electric Utility Department  
Paul Brophy, EGS Inc.  
Robert Pennington, Permit Sonoma  
Mark Foster, Bamburgh Consulting  
Ryan Tracey, Sonoma Clean Power Authority  
Geof Syphers, Sonoma Clean Power Authority  
Cordel Stillman, Sonoma Clean Power Authority

Invitations were also sent to the Sierra Club's Sonoma Group of the Redwood Empire Chapter, Los Cien, Sonoma County Office of Equity, County of Mendocino, County of Sonoma, County of Lake, North Bay Leadership Council and the Sheet Metal Workers Local 104.

#### **Link to Presentations**

[https://sonomacleanpower.org/uploads/documents/GeoZone\\_PreProject\\_Stakeholder\\_Input\\_2022\\_Jun\\_28.pdf](https://sonomacleanpower.org/uploads/documents/GeoZone_PreProject_Stakeholder_Input_2022_Jun_28.pdf)

## ***Introduction***

Sonoma Clean Power (SCP) introduced the GeoZone for attendees with background on SCP's role as a public power provider and the need for baseload renewables in achieving California's climate goals. SCP also provided a high-level description of how geothermal power works, the history of the Geysers, and new geothermal technologies before explaining the solicitation process for private partners and the motivation for early pre-project stakeholder engagement.

Stakeholders asked SCP if the cost of different geothermal technologies is informing the GeoZone. SCP explained that costs for early deployment are likely high and may require grant funding for above-market costs, but the GeoZone ultimately endeavors to unlock cost efficiencies at scale that enable new local geothermal development without subsidy. Stakeholders also asked about comparative greenhouse gas emissions estimates, for which SCP explained are technology-dependent and the viability of different technologies would likely require additional information gathering such as the drilling of exploration wells or detailed technical review of existing datasets.

In response to SCP's description of offshore wind as a complementary resource to geothermal power in providing baseload power, stakeholders asked about the viability of onshore wind. SCP explained the difficulty of building new onshore wind in California, specifically citing experience with recent projects blocked by litigation or threats of litigation relating to bird strikes. Also, SCP shared that locally within its territory wind potential is confined to areas along the coast where permitting is not likely viable.

Following the SCP introduction, stakeholders received presentations from three potential private partners in the GeoZone.

## ***Eavor Technologies***

Neil Ethier, Director of Business Development – Americas  
Jeanine Vany, Executive Vice President, Geosciences  
Bailey Schwarz, Director of North America Projects

Eavor described its vision of leveraging its technology to enable local energy autonomy. Faced with the climate crisis and energy security concerns like those evident today in Europe with the Russian war on Ukraine, Eavor's technology offers communities the ability to source their energy locally. The presentation inventoried the potential benefits of an Eavor project: all materials and jobs sourced in North America, each project creates 100 direct and 300 indirect jobs, grid hardening benefits and taxes to local jurisdictions.

After sharing a favorable comparison of materials intensity, lifecycle greenhouse gas emissions, and land use between Eavor geothermal and other renewable energy sources, Eavor provided a comparison between its Eavor-Loop technology and other geothermal development strategies. Specifically, Eavor stressed that unlike other geothermal technologies, its approach requires no hydraulic fracturing of rock, does not induce seismicity, has no operating air emissions, and consumes minimal amounts of water. Eavor finished its presentation with a description of its Eavor-Lite demonstration project in Canada and upcoming commercial projects in Geretsried, Germany and the Southwestern U.S.

Stakeholders asked Eavor a number of technical questions on the Eavor-Lite pilot and ability of Eavor to drill in igneous rock versus the sandstone in Canada and Germany. Charlene Wardlow from the California Geologic Energy Management Division specifically asked about the casing design and ability to seal the radiator section of an Eavor well. Eavor explained that the sealant has been tested in its pilot, tested up to 600 degrees Celsius, and has been approved for use in Germany after regulators reviewed its composition and hazard classification. Woody Hastings of The Climate Center asked if the carbon emissions intensity was an empirical calculation from the pilot. Eavor clarified that its lifecycle emissions estimates were developed by a third party with experience in forecasting carbon intensity and include all Scope 3 emissions including those from construction, operation, and manufacturing.

Geof Syphers from SCP asked Eavor about the scale of projects. Eavor explained it would likely first drill a calibration well to ascertain the design parameters and commerciality of a project. The configuration of an Eavor-loop allows the size to be easily scaled. Mel Grandi representing the Ukiah Electric Utility Department asked about the dispersion of surface pads. Eavor explained that it can drill ten Eavor-loops generating 100 MW from a single surface location of approximately 40 acres and vertically stack the loops in the subsurface.

Stakeholders queried Eavor on its experience with engaging stakeholders. Eavor explained its Germany project benefited from significant stakeholder engagement that preceded Eavor's project when the original developer pursued a conventional geothermal project that failed. Eavor is considering options like building a visitor center as part of its Germany project to engage the community. For the GeoZone, Eavor recognizes the importance of SCP as a partner in facilitating proactive stakeholder engagement.

Mark Foster of Bamburgh Consulting asked Eavor to validate the comparison of water intensity between its technology and the existing Geysers operating facilities. Eavor cited an NREL study calculating an intensity of 1,796 gallons per MWh versus an estimate of 12 gallons per MWh for Eavor. Geof Syphers from SCP stressed that water intensity is an important consideration in the ability of the region to host new geothermal. Eavor also confirmed that its design for the GeoZone has always assumed air cooling, which is much less water intensive.

Michael Allen asked Eavor for more details on how they will engage with unions. Eavor explained that its technology is 100 percent built and sourced in North America, lending itself to both union labor and improving access during supply chain issues. Eavor also explained that it expects to engage in local practices, including the use of skilled and trained local labor for installations.

Hunter Stern from IBEW Local 1245 asked for more details on the source of Eavor's funding. Eavor explained that they raised 100 million dollars and its ownership includes a combination of oil majors (BP & Chevron), mining groups, venture capital, and angel investors. Approximately 50 percent of its funding is from a sovereign wealth fund from Asia. Eavor has no exclusivity and is independently owned and operated. Mark Foster also asked for details on Eavor's intellectual property. Eavor responded that its technology is protected by 21 patent families.

Geof Syphers from SCP asked Eavor to wrap-up with a vision for the full-scale implementation of their technology. Eavor cited a recent study that determined that 40 percent of the Western US electricity demand could be cost effectively met with Eavor-Loop projects and reiterated their interest in meeting the GeoZone's objective of 500 MW and even going beyond.

## ***Chevron New Energies***

Barbara Harrison, Vice President of Emerging and Offsets Business  
Srimonto Ghosh, General Manager – Geothermal  
Tanmay Chaturvedi, Program Manager,  
Jeff Nunn, Geologist / Geothermal Subject Matter Expert

Chevron New Energies (CNE) is a new organization formed to support the transition of Chevron into renewable energy sources and to accelerate low carbon solutions. CNE mentioned a commitment to spending ten billion dollars by 2028 and described its plan to scale a geothermal business through its historic role as a large operator of geothermal power plants, application of new technologies, and project development experience.

The development proposed by CNE for the GeoZone is phased based on permitting, land access, and geologic conditions. At this stage, CNE described itself as technologically agnostic and may consider conventional, enhanced geothermal systems, and advanced closed loops depending on the results of modeling, exploration, and pilot projects. An initial evaluation of the GeoZone by CNE suggests there is 500-700 MW of additional potential beyond the current Geysers operation, roughly confirming SCP staff's assessment.

CNE outlined three key considerations in GeoZone development: long-term scalability, minimal surface water usage, and reducing surface disturbance. A phased development approach may involve exploration in 2022 and 2023, pilots in 2024 and 2025, and scaled development by 2027 or 2028. In closing the presentation, CNE walked through several community benefits including clean energy, economic growth, and job creation.

CNE was asked by attendees whether their intent was to own and operate geothermal assets long-term and if the GeoZone might be construed as an offset to growth in their oil and gas business. CNE responded that they are committed to developing a sustainable geothermal business and not as an offset. They shared offsets they do pursue follow an integrity framework and strict protocols. Geof Syphers of SCP noted that CNE would have to convince SCP and local environmental organizations that their work with geothermal power in the GeoZone would never be used to offset emissions elsewhere in the world.

Attendees also questioned CNE on recent news of a closure of their headquarters in California. They clarified that they have a long-term commitment to being headquartered in California and the news was related to a real estate transaction where they divested several buildings due to new changes in employees working more from home.

Mark Foster of Bamburgh Consulting asked for CNE to elaborate on their experience with technologies in the proposal and their relative water use to Eavor's technology. CNE talked through a small pilot they are currently running in San Ardo field in Central California to generate power from the heat in an oil and gas field using an organic rankine cycle turbine. They specified that their technology in San Ardo and proposed for the GeoZone uses binary power plants and air cooling to minimize surface water usage. Stakeholders asked for a more precise comparison of water usage in the future.

Michael Allen asked for additional context for the presentations—are the presented proposals in competition? Geof Syphers clarified that SCP intends to enter into a partnership agreement with one or more of the proposing organizations and that the process is fluid as SCP learns more about the proposals and stakeholder interests and concerns. Michael Allen presented

CNE with the local “rule of three”: labor, environmentalists, and politicians need to be on the same page for local projects to move forward. Attendees later followed-up with a question on Chevron’s approach to working with unions. CNE explained that they work with organized labor across its current business and would support union labor in the GeoZone. CNE also mentioned Chevron just renegotiated a Project Labor Agreement for its Bakersfield operations.

Paul Brophy as a consultant for SCP asked CNE if their intent was to start exploration in higher risk areas or concentrate on the fringe of the Geysers. They explained that it would do a more detailed assessment of existing public data before deciding on prospective areas. CNE’s geologist did mention that his instinct was to start work in the west part of the Geysers and work further west.

SCP asked CNE for more details of the size and scope of development. CNE described the capital it committed to growing its low carbon business and vision of growing its geothermal fleet to the gigawatt-scale. In the GeoZone, it is too early to predict the size of CNE’s potential future development, which will be dependent on technology, exploration results, and economics.

Attendees also expressed concern for induced seismicity impacts from stimulating geothermal wells if CNE decided enhanced geothermal systems are the appropriate technology to apply in the GeoZone. They explained that they would be transparent and engage the community upfront. They also shared experience in Canada where a well stimulation project in proximity to a community involved proactive stakeholder engagement. CNE hosted a town hall, pursued alternative well designs, completed a risk assessment, and invested in enhanced monitoring. The result was the CNE completed the project with no induced seismicity observed in the community.

## ***Cyrq Energy***

Matt Rosenfeld, General Manager  
Susan Petty, Senior Advisor  
Patrick Walsh, Chief Operating Officer

Cyrq introduced itself as the second largest privately held geothermal company and provided an overview of its portfolio which includes six operating power plants in the Western United States. Cyrq also shared that their strategy is to be innovative but realistic and concentrated on opportunities with a high probability of success. The thermal storage technology proposed by Cyrq for the GeoZone was described as a unique opportunity that offers both large opportunity and low risk.

Cyrq’s proposal is to install thermal storage at existing operating plants at the Geysers. A case study performed for a Geysers resource several years back suggested superheating steam with thermal storage at a 10 MW plant could double the output when dispatched. Due to the higher efficiency of turbines in superheated conditions, the technology increases the total generation by 40%. Although superheating increases cooling requirements, the increased cycle efficiency enables water usage per MWh to be reduced by 20%.

Cyrq explained that the Geysers is an ideal candidate for thermal storage technology because many facilities are generating from steam near saturated conditions and there is likely excess transmission infrastructure available. The physical footprint of a thermal storage facility is

approximately 1/3 of an acre for a 130 MWh facility. Cyrq proposes to complete a technical case study in 2022 before proceeding with a pilot scale system in 2023 and scale-up in 2025.

Mark Foster of Bamburgh Consulting asked Cyrq for clarification on the technology Cyrq is employing and water usage compared to other GeoZone proposals. Cyrq explained that they are not proposing anything new in the subsurface and are instead proposing a facility on the surface to superheat steam. Cyrq also explained that overall water usage would be higher with its proposal given increased cooling loads, but the efficiency of the water that is used would be improved, so overall climate benefits per gallon of water would be significantly improved.

Charlene Wardlow from the California Geologic Energy Management Division cautioned that PG&E may have derated the transmission lines Cyrq is relying on to deliver the increased output from their proposal. Cyrq mentioned that once scaled up, their project would trigger CAISO to restudy the interconnection and available capacity, but that they are confident their project delivers a resource that is needed by the grid.

SCP asked Cyrq whether thermal storage changes the economics of geothermal development in the region. Cyrq sees the increased availability and flexibility of geothermal assets equipped with thermal storage as well aligned with market demand and would consider incorporating it in new construction projects as well as existing ones. Although the Geysers is well suited for thermal storage, Cyrq mentioned that the Imperial Valley or other resources producing steam are also viable candidates. They are also exploring applying it to binary cycles, although it is less clear-cut.

Attendees asked Cyrq for clarification on how thermal storage can heat the steam to 850 degrees Fahrenheit. Cyrq offered an analogy one of its prospective technology providers (Siemens) uses: the system is basically a giant hair dryer—a high power electric resistance heater with a fan. Excess grid power and local geothermal power during peak solar output times would be used to heat a thermal mass. That heat would then be converted back into electricity later when the sun sets and power is more needed on the grid. In effect, the Cyrq technology is an alternative to the lithium-ion battery storage system, with advantages that its components are not dependent on imported materials.

Follow-up questions clarified that the system does not have adverse noise impacts to neighbors due to being fully enclosed. Also, a heat pump solution is not yet a viable technological alternative to the resistance heater due to the massive scale required. The heater is also downstream of the hydrogen sulfide treatment and will not impact the emissions profile of the cooling towers.

Rob Bamford of the North Sonoma County Air Pollution Control District explained the current process in the Geysers of interconnecting steam lines between plants for optimization and operational flexibility and asked whether thermal storage would be plant-specific. Cyrq was receptive to the idea of locating plants in the system in locations that added operational flexibility. However, they also mentioned that it is usually optimal to minimize the distance between the storage facility and the turbine to limit heat losses and required pipe upgrades.

SCP asked Cyrq to share more details of what an installation might look like and the types of jobs involved. Cyrq explained a significant amount of trades would be involved in the electrical, plumbing, and metal work for a new system—which would look a lot like installing a new power plant. Cyrq also clarified that they have a focus on using local labor for their projects. When

complete, the system would be operated by the same staff operating existing geothermal facilities.

Geof Syphers at SCP asked if Cyrq expected to be able to secure grant funding to subsidize any above-market costs for Cyrq's proposals. Cyrq replied it expects thermal storage to be a strong candidate for funding in the demonstration phase. Cyrq has also identified overlapping funding opportunities for both new geothermal technologies and long-duration storage. Cyrq's team has experience with successfully obtaining grants from state and federal sources.

Michael Allen asked for Cyrq to confirm his observation that their proposal could be executed fairly quickly—in maybe two to four years. Cyrq explained that unlike other geothermal proposals for the GeoZone, their approach is not reliant on subsurface work of any kind. This allows them to move fast.

***Event #2 – SCP hosted a virtual recap of the stakeholder engagement meeting for those unable to attend on July 6, 2022. Attendees and feedback received from the recap are documented below.***

**Attendees:**

Jennifer Livermore, Department of Energy  
Mike Turgeon, Friends of the Climate Action Plan  
Terry Crowley, City of Healdsburg Utility  
Jerry Salera, California Geologic Energy Management Division  
Joe Greco, Calpine  
John Mack, Permit Sonoma  
Ryan Tracey, Sonoma Clean Power Authority  
Geof Syphers, Sonoma Clean Power Authority  
Cordel Stillman, Sonoma Clean Power Authority

**Summary and Comments:**

Sonoma Clean Power provided attendees with an introduction to the GeoZone initiative with a focus on the challenges in planning a 100% renewable and carbon free grid and the potential role in geothermal power as an enabler for the energy transition. Staff also provided a synopsis of each of the three final proposals along with a recap of the themes of stakeholder input received on June 28<sup>th</sup> before allowing for open discussion amongst participants.

Mike Turgeon of the Friends of the Climate Action Plan asked for information on the financial ramifications of the GeoZone initiative to SCP. He also asked about the potential for multiple partners and an exit strategy for SCP if the partnership was no longer productive. SCP shared that they expect a modest level of direct investment from the agency to progress the partnership, along with a commitment to offtake generation from the GeoZone. SCP has not yet decided whether to pursue one or multiple partnerships and expects a partnership to allow for off-ramps for both itself and partners if necessary.

John Mack of Permit Sonoma cautioned that the existing geothermal projects mostly operate on approvals granted in the mid-1970s and the current biological and land use considerations, as well as the litigious environment, have significantly changed. He also stressed that approaches with a small surface footprint or low reliance on additional water are likely less risky to permit.

Terry Crowley from the City of Healdsburg Utility shared that his municipal utility currently is served by around 40% geothermal power and that Healdsburg like other municipal utilities is working on identifying resources to serve expected load growth from electrification and meet renewable and low carbon targets. Terry also noted that geothermal is still an expensive resource, but not necessarily compared to pumped hydro or other resources needed for the future grid. Geof Syphers noted that there may be an opportunity for joint procurement in the GeoZone involving municipal utilities and California Community Power (a joint procurement entity comprised of CCAs including SCP).

Joe Greco of Calpine flagged that Calpine is concerned that appropriate testing is performed before applying new technologies. He shared that Calpine is moving forward with innovations to local geothermal through projects like the closed-loop pilot they are hosting with GreenFire Energy.