



43rd ANNUAL MEETING & EXPO

- Program & Registration Form -

PALM SPRINGS CONVENTION CENTER

SEPTEMBER 15-18, 2019 | PALM SPRINGS, CALIFORNIA | USA



GRC ANNUAL MEETING & EXPO

PALM SPRINGS CONVENTION CENTER | SEPT 15-18
PALM SPRINGS, CALIFORNIA | USA | 2019

COMING SOON!

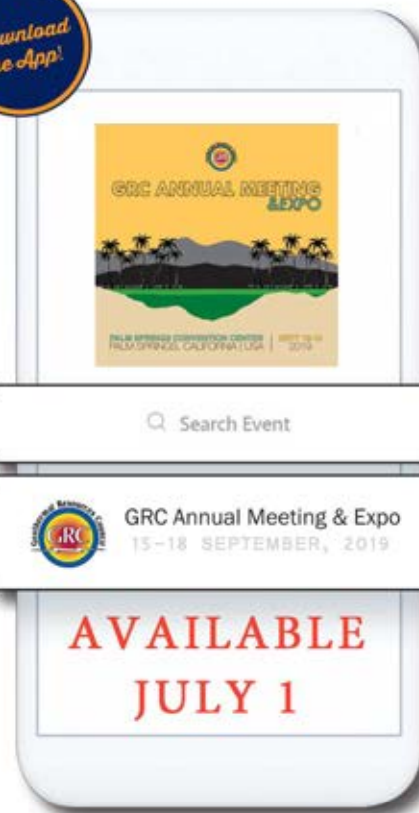


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The Lobby of the Palm Springs Convention Center.



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Geothermal Resources Council

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Come join the global geothermal energy community in Palm Springs - a beautiful oasis spa town in Southern California.

The GRC Annual Meeting and Expo promises to be the geothermal energy event of the year. Don't miss it!

Connect for the latest news and event information on GRC's website at www.geothermal.org

Registration Now Open

REGISTER ONLINE AT: www.geothermal.org

Register by JULY 31 and save up to \$150

GRC Annual Meeting & Expo Features:

Workshops

- New Frontiers in EGS Technology (2-days)
- Supercritical and Superhot Geothermal Resources (1-day)
- Geothermal 101 (special 2-hour workshop open to the public)

Fieldtrips

- ¹/₂ Day Jeep Tour of the San Andreas Fault
- ¹/₂ Day Hiking Tour of the Palm Canyons
- 2 Day Trip to The Imperial Valley
- 2 Day Trip to Coso Geothermal Operations and GreenFire Energy Closed-Loop Demonstration Project

Annual Charity Golf Tournament

Opening Session

Opening Reception followed by An After-After Party!

International Luncheon

International Session

Technical Sessions

Palm Springs Air Museum Monday Night Mixer

Poster Session and Expo Networking Reception

Membership Meeting & Honor's and Awards Presentation

Welcome Letter from Annual Meeting Co-Chairs

On behalf of this year's Annual Meeting Planning Committee, we offer you a BIG welcome to Palm Springs and sunny Southern California! The Geothermal Resource Council's Annual Meeting & Expo is yet again, the **best thing** on the geothermal energy industry calendar.

Here in Palm Springs, we are close to many geothermal fields, including Salton Sea, Cerro Prieto, Heber, East Mesa, North Brawley, Truckhaven, and Coso. The closest is the Salton Sea geothermal field with a current installed capacity of about 400 MW. It also has the greatest potential for future development, both for megawatt generation and mineral production. Along with being close to prolific geothermal energy production, this year's Geothermal Resource Council (GRC) Annual Meeting & Expo offers opportunities to learn about new advances in geothermal energy and to rekindle relationships with geothermal colleagues while taking in the resort lifestyle with the arts, surrounding mountains, sunny days, golf courses, lounging pools, tennis, hiking and many other activities.

The Palm Springs area has a long history of using geothermal resources directly, most notably at nearby Desert Hot Springs (a.k.a. California's spa city) where just east of the San Andreas Fault, hot spring water (up to 180°F) is used by numerous resorts to provide recreation and relaxation opportunities. Hot springs have also been used by the native Cahuilla tribe, and will be featured in the Agua Caliente Cultural Center (<https://www.palmspringslife.com/agua-caliente-hot-mineral-spring/>) under construction near downtown Palm Springs. Opening in 2020, the Center will feature a museum, outdoor oasis trail and gathering plaza, a bathhouse and day spa at the site of the Tribe's revered Hot Mineral Spring. You will pass the construction site close to the Palm Springs Convention Center as you walk toward Palm Canyon Drive for early morning coffee or evening dining. (If you are around extra days, Palm Canyon is closed off for cars on Thursday night from 7-10 pm for the Palm Springs VillageFest, an open air market featuring art, crafts and food for sale.)

Throughout the meeting, papers and posters highlighting geothermal development, research, and case studies will be presented, along with numerous panels and sessions with topics including Department of Energy sponsored research and minerals extraction. There will be an international session with the latest updates from Latin America, Indonesia, Canada, East Africa, China, Australasia/Pacific, Japan, and Europe. The exhibition hall is fast filling with service companies, agencies and research groups, and will be a dynamic venue for meeting new customers and collaborators, while learning about new products and services available within our industry.

This year, the pre-conference workshops on New Frontiers in Enhanced Geothermal Systems Technology and Supercritical and Superhot Geothermal Resources are being offered on Friday and Saturday. Be sure to sign up early!

Hosted in a golfer's paradise, the GRC Annual Charity Golf tournament, benefitting the GRC Scholarship fund, is a not-to-be-missed event this year. Taking place on the beautiful Celebrity

Course at the Indian Wells Golf Resort, golfers will enjoy many amenities including food, beverages, and great prizes thanks to our sponsors and participants.

Big plans are in the works to make the Monday night mixer the best yet – the GRC has exclusively booked the Palm Springs Air Museum. Enjoy networking with colleagues while sipping signature cocktails inspired by event sponsors and dancing among the airplanes—it'll be the social highlight of the meeting!

Two half-day pre-meeting field trips are set: One to touch the great San Andreas Fault and the other to experience the calming oases of Indian Canyons, not only home to a unique ecology, but a rich human history. There are also two post meeting field trips offered. One will provide participants with visits to geothermal power plants and sites in Imperial Valley, home of the Salton Sea geothermal field, showcasing young volcanism, some of the biggest production wells in the world, along with the challenges and prospective rewards brought by the fluid chemistry of the reservoir. On another field trip to the Coso geothermal field located at the China Lake Naval Air Warfare Station (NAWS), participants have the rare opportunity to explore operations, volcanic geology and hydrothermal features of the field, and witness a demonstration of new closed-loop geothermal power production technology being tested there.

Please join us for this year's Annual Meeting & Expo, celebrating geothermal energy and all that this Southern California region has to offer - the desert oases, Joshua Tree National Park, golf courses, the Salton Sea, the Sunnylands Annenberg Estate, the celebrity presence, architecture, wildlife and renewable energy touring. GRC has arranged a list of tours and sightseeing opportunities in the Palm Springs area to help with planning: https://geothermal.org/Annual_Meeting/Palm_Springs.html or visit the information kiosk inside the Convention Center.

The GRC very much looks forward to hosting this year's event. Thank you to all of the sponsors, the GRC Annual Meeting Planning Committee, volunteers, and the GRC staff for working together to ensure the success of this meeting.

Registration, the latest event information and a link to download the Event App is at www.geothermal.org.



Mary Mann
Chair, 2019 GRC Annual
Meeting Committee



Danielle Matthews Seperas
Co-Chair, 2019 GRC Annual
Meeting Committee

Welcome Letter from Palm Springs City Council



City of Palm Springs

City Council

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Tel: 760.323.8200 • Fax: 760.323.8207 • TDD 760.864.9527 • www.palmspringsca.gov

September 2019

On behalf of the City of Palm Springs, we are pleased to welcome the 43rd Geothermal Resources Council Annual Meeting and Expo “Geothermal: Green Energy for the Long Run” and the international geothermal energy community to Palm Springs where Green Energy is a priority.

We are sure you will find that Palm Springs is, “Like No Place Else,” with its classic midcentury modern vibe and stunning desert backdrop. The city has blossomed into a world class resort destination. Trendy bars and restaurants provide an excuse to get away from the convention center and stroll the downtown. Spend a leisurely time exploring vintage and home décor shops, many with a cool retro design unique to Palm Springs. If you want something more active, take a hike on one of the many trails in the San Jacinto Mountains that surround the City or explore the neighborhoods on a cruiser. Evenings are alfresco, with classic cocktails, innovative menus and creative chefs.

Our City is committed to a sustainable future including increasing use of renewable energy. We are lucky to be near one of the biggest geothermal energy resources in the world at the Salton Sea. Hosting the global geothermal energy community provides an opportunity to focus on the tremendous potential of clean, dependable renewable energy that will help provide for our future power needs.

We hope you enjoy your stay. We wish you a successful conference and an enjoyable time exploring Palm Springs.

Best wishes for an amazing 43rd Geothermal Resources Council Annual Meeting!

Robert Moon, Mayor

Geoff Kors, Mayor Pro Tem

Christy Holstege, Council Member

Lisa Middleton, Council Member

J.R. Roberts, Council Member

Post Office Box 2743 • Palm Springs, California 92263-2743

SPONSORS & CONTRIBUTORS

The success of the Geothermal Resources Council Annual Meeting depends on the generous sponsorships and contributors of corporate and individual members. The GRC would like to thank the following for their generous support.

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INTERNATIONAL LUNCHEON



MIXER



Controlled Thermal Resources

MEDIA



COSO GEOTHERMAL FIELDTRIP



BEST STUDENT POSTER PRIZE



A complete list will be posted at the Annual Meeting and on the Event App. If you would like to make a contribution to the GRC 2019 Annual Meeting, please contact Anh Lay at (530) 758-2360 ext. 100 or E-mail at alay@geothermal.org. We are still accepting sponsorships and contributions!

ANNUAL MEETING COMMITTEE

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scenic overlooks
INSPIRE
sunny outlooks.

Surrounded by sand, the Salton Sea glistens like a jewel in California's crown. Experience the many wonders and mysteries you won't find anywhere else. Your conference will not only be eye-opening, but leave you truly inspired.


GREATER
palm springs
find your oasis.



Welcome, GRC Annual Meeting & Expo.

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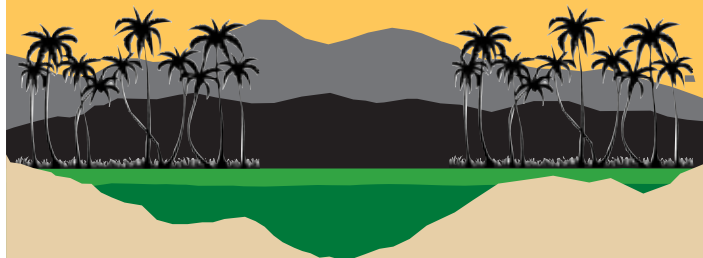
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REGISTER NOW!



GRC ANNUAL MEETING & EXPO



PALM SPRINGS CONVENTION CENTER | **SEPT 15-18**
PALM SPRINGS, CALIFORNIA | USA | **2019**

WORKSHOPS

FRIDAY & SATURDAY, SEPTEMBER 13 & 14

NEW FRONTIERS IN EGS TECHNOLOGY

Room: Smoketree AB 8am - 5pm
Cost: \$650 (Member), \$750 (Non-Member), \$225 Student

Organized by: Sabodh K. Garg (Geologica Geothermal Group), Azadeh Riahi (Itasca Consulting Group), William M. Rickard (Geothermal Resource Group), and Will Pettitt (Geothermal Resource Council)

High-temperature geothermal resources are the manifestations of cooling magmatic intrusions, which are vertically zoned. Beneath the low-permeability cap and the hydrothermal circulation volume, there exists a zone of limited permeability where meteoric fluid does not circulate freely, and thus engineering intervention is required to enhance permeability and fluid circulation.

It is estimated that roughly 90% of the geothermal power resource reside in Enhanced Geothermal Systems (EGS). While realization of EGS development on the 100+ GWe scale would make EGS a significant component of the renewable energy portfolio, numerous technological challenges remain in accessing and characterizing, creating, monitoring, operating, and sustaining engineered reservoirs.

Development of cost-effective EGS technology is critical to the long-term viability of the world-wide geothermal industry. This workshop is the third in a series of EGS-focused workshops sponsored by the GRC (previously held in 2012 and 2016), focusing on the latest research findings and practical experiences in geothermal reservoirs. The workshop instructors are experts from geothermal and petroleum industry, academic institutions, and U.S. national laboratories.

The workshop is composed of following four sessions:

- **Session 1 - Experimental Studies:** Advances in understanding of fracturing mechanisms and heat and mass transport at the laboratory (e.g. block experiments), intermediate (e.g. Collab), and field scale (FORGE) will be covered in this session.
- **Session 2 - Reservoir Engineering:** Common Practice and Technical Challenges: This session will overview engineering approaches to some of the EGS projects. Challenges associated with site characterization, stimulation, assessment of stimulated volume, and induced microseismicity will be discussed. Simulation of EGS processes at various scales, and novel numerical techniques such as discrete element modeling, will be presented.

- **Session 3 - Drilling:** Issues unique to EGS (e.g. zonal isolation) will be discussed. Topics include: casing and wellbore design considerations for EGS wells; directional drilling in extremely hard rock; use of PDC (Polycrystalline Diamond Compact) bits and MSE (Mechanical Specific Energy); Stimulation, how do we do it and what is important from a completion perspective; zonal isolation, and; cementing considerations.
- **Session 4 - Panel Discussion:** The technical and commercial viability of EGS is investigated in this session through objective debate across a panel of experts, and using interactive Q&A with the audience, to get to the heart of how we turn the EGS concept into commercial reality

In addition to formal presentations, ample time will be allowed for questions/discussion between participants and workshop presenters.

Space is limited early enrollment is recommended.



View from the MAR, by Robert Zierenberg. View from the Mid Atlantic Ridge (MAR) spreading center where it comes ashore on the Reykjanes Peninsula. The drill rig Thor in the distance is drilling the Iceland Deep Drilling Project - 2 drill hole, to a target depth of 5 km, in search of black smoker fluids formed under super-critical T-P conditions. GRC Photo Contest 2016.

PLEASE NOTE: Schedules and other information are subject to change. Refer to the GRC website for the latest information.

WORKSHOPS *continued*

SATURDAY, SEPTEMBER 14

SUPERCRITICAL AND SUPERHOT GEOTHERMAL RESOURCES

Room: Chino AB 8:00am - 5pm
Cost: \$375 (Member), \$475 (Non-Member), \$175 (Student)

Organized by Wilfred Elders (Professor Emeritus, UC Riverside), with instructors from USA, Japan, and Iceland.

There is increasing interest in supercritical and superhot geothermal systems as wells penetrating such reservoirs could potentially yield an order of magnitude more power than that currently produced from typical geothermal wells. Such resources are likely wherever young volcanic rocks occur at drillable depths.

The topics of the workshop will include:

1. The enthalpy and flow characteristic of the supercritical state.
2. Economic advantages for power generation and downstream use (including metal & mineral extraction).
3. Environmental advantages.
4. Examples of current projects in Iceland and Japan.
5. Potential in the USA and worldwide.
6. Challenges of drilling and logging into high fluid temperatures and pressures.
7. Cementing, casing, and well completion challenges
8. Power production and fluid handling issues.
9. Overview and prospects for the future.

Several subject matter experts on the above topics will be presenting at the workshop, and ample time will be provided for workshop participants and presenters to engage in discussion to explore select topics in more detail.

Space is limited early enrollment is recommended.

Both of the above workshops includes lunches, and a networking reception on Friday evening.

REGISTER NOW!

WEDNESDAY, SEPTEMBER 18

GEOTHERMAL 101 - OPEN TO THE PUBLIC

Room: Primrose A 9:00-11:00am
Cost: Free to the general public and GRC Annual Meeting & Expo registrants

Presented by: Gene Suemnicht, EGS, Inc.

- 9:00 -10:00am - Visit the Expo trade show to view the booths of more than 80 exhibitors to understand the practical applications of geothermal energy.
- 10:00 -11:00am - Workshop explaining the basics of clean, dependable, renewable geothermal energy.

Geothermal energy has been described as the most reliable renewable and a sustainable green energy. What does it take to discover and develop a high enthalpy resource? How does it fit into the mix of renewable electricity generation for the future?



GRC Workshops are an opportunity to exchange ideas. Photo by Ian Crawford.



Learn about the latest geothermal energy science at a GRC Workshop.

FIELDTRIPS

SATURDAY, SEPTEMBER 14

SAN ANDREAS FAULT JEEP TOUR (Half Day)

Check-in and Breakfast: 6:30am - 7:30am
Depart Renaissance Hotel at 7:30am, returning to the hotel by 12:30pm
Cost: \$250 - Limited to 25 participants only
Led by: TBD



(Courtesy Red Jeep Tours)

A three-hour off-road jeep ride along the San Andreas Fault Zone with discussions about the local geology, plants, animals, and history of the California desert. A visit to a slot canyon and a natural palm oasis. There will also be a discussion about the culture and lifestyle of the Cahuilla Indians and how they used the desert's plants for food, medicine, tools, weapons, shelter, and more.



Explore a slot canyon. (Courtesy Red Jeep Tours)

SUNDAY, SEPTEMBER 15

PALM CANYON HIKING TOUR (Half Day)

Check-in and Breakfast: 6:30am - 7:30am
Depart Renaissance Hotel at 7:30am, returning to the hotel by 12:00pm
Cost: \$150 - Limited to 25 participants only
Led by: TBD



Palm Canyon is a photographer's delight.

An approximately two-mile hike to a beautiful Palm Oasis where the Agua Caliente (Hot Water) Band of Cahuilla Indians lived for generations. The guide will give an introduction to the Agua Caliente culture and how

they lived in this amazing place. The guided hike includes discussion on local plants, animals, geography and Native American history.

WEDNESDAY & THURSDAY, SEPTEMBER 18-19

IMPERIAL VALLEY FIELDTRIP (Two Days)

Depart from the Renaissance Hotel at 2:00pm and return about 6:00pm on Thursday.
Cost: \$250 - Limited to 50 participants only
Led by: Billy Thomas, Mike Kraemer and Sam Abraham.

This two-day fieldtrip will visit the Imperial Valley, home to the world renowned Salton Sea geothermal field. The tour begins with a stop at painted canyon in the Mecca Hills to observe the San Andreas Fault up-close where discussion of local structures will explain the unique geologic setting of the Salton Trough. The tour will continue with a stop at Red Hill, one of the Quaternary volcanos that make up the Salton Buttes, to discuss the geothermal activity in the area, as well as the Salton Sea and future development (including the potential for mineral extraction). Tours of the Hudson Ranch power plant, CalEnergy wellfield and nearby hot springs conclude the first day.

Day 2 begins with a drive near the US/Mexico border (and nearby solar farms) on the way to Ormat's Heber geothermal power plant and tour. Next, a drive north to "slab city" (just outside of the town of Niland) to see Salvation Mountain and

FIELDTRIPS *continued*



The Davis-Schripf Seep Field with mud-volcanoes with the John L. Featherstone geothermal power plant in the background. GRC Fieldtrip 2013. Photo by Ian Crawford.

a flowing hot well. The final stop will be along Highway 111, where the movement of a “mud pot” has created a dangerous situation for the integrity of the highway and Union Pacific railroad.

We look forward to having you join us on this trip to the Imperial Valley, which has become a significant hot spot for renewable energy – with production from geothermal, solar, wind and biofuel – and possibly soon to be one of the most important regions for lithium mining.

Cost includes transportation, some meals and Wednesday night lodging (double occupancy).

COSO GEOTHERMAL OPERATIONS & GREENFIRE ENERGY CLOSED-LOOP DEMONSTRATION PLANT (Two Days)

Depart from the Renaissance Hotel at 2:00pm on Wednesday and return about 6:00 pm on Thursday.

Cost: \$375

Led by: Dr. Andy Sabin, Navy Geothermal Program Office and Joseph Scherer, CEO GreenFire Energy.

This is a rare opportunity to explore operations, volcanic geology and hydrothermal features of the Coso geothermal field located at the China Lake Naval Air Warfare Station (NAWS), California.

Coso is known for its large and very hot geothermal resource. It has been producing power continuously since 1987. We will see Quaternary rhyolite domes and flows, Sierran basement rocks (geothermal resource host), a short-lived mercury mine, sinter terraces and fumaroles plus the Coso well field, power blocks and the central control room.

This tour will also include a visit to GreenFire Energy’s experimental project demonstrating closed-loop geothermal power production technology. GreenFire’s project has been tested using both water and supercritical CO2 as working

fluids and is designed to demonstrate usage in hot dry rock resources as well as to retrofit unproductive conventional geothermal wells to regain productivity. The Coso/GreenFire Energy project has been primarily funded by the California Energy Commission with additional support from Shell Oil, the Electric Power Research Institute, J-POWER and a variety of key suppliers, all of whom will have representatives on site for the tour.



Coso Geothermal Power Plant (Courtesy Coso Operating Company)

Cost includes transportation, some meals and Wednesday night lodging (single occupancy).

*Please note: All tour participants are required to carry a picture ID to enter the China Lake Naval Air Warfare Station. In addition, you will be required to provide copies of photo IDs or passports and/or green cards and to receive Navy security authorization prior to joining the tour. A Release & Waiver form will also have to be signed. Fax Photo IDs, copy of passport and/or green cards to the GRC office at (530) 758-2839. **Waiver form should be submitted by August 16.***

Dinner sponsored by



Please note: Fieldtrip itineraries are subject to change. Full schedules are available on the GRC Website.

All GRC Field Trips depart from Renaissance Hotel Lobby. Check-in is required 30 minutes before departure.

Please wear proper attire and closed-toe shoes.

Please Note: The Renaissance Palm Springs Hotel room block is only available from 14-22 September. Those attending pre-meeting workshops and fieldtrips and needing a room 12 & 13 September at the GRC rate will have to make a reservation at the Hilton Palm Springs Hotel where the room block is available 12-19 September. We apologize for the inconvenience.

ANNUAL MEETING SCHEDULE

SUNDAY, SEPTEMBER 15

ANNUAL CHARITY GOLF TOURNAMENT

6:30am - 2pm

Indian Wells Golf Resort

Cost: \$195 per individual or \$740 per foursome.

This 36-hole Palm Springs golf resort, minutes away from downtown Palm Springs, features a magnificent 53,000 square-foot clubhouse and is one of the few properties to have two courses ranked in the Top 25 "Best Municipal Courses in the United States" by *Golfweek Magazine*.

Golf architect Clive Clark's much anticipated Indian Wells Celebrity Course opened November 2006 to rave reviews. In addition to spectacular mountain views, the Par-72 Celebrity Course features undulating fairways, and flowing water in the form of streams, brooks, and split-level lakes connected by striking waterfalls, with vibrant floral detail. This California golf course is unrivaled in beauty and playability. From start to finish, the Celebrity Course offers an unmatched golf experience that will have players returning again and again.

Only 100 spots are available so sign-up early!

- 6:30 am - Registration and Breakfast
- 7:30 am - Shotgun Start
- 12:30 pm - Lunch and Awards presentations
- 2:00 pm - Return to the Convention Center

The tournament is a four-man scramble. Awards will be given for 1st, 2nd and 3rd place teams. Men's and Women's closest to hole and longest drive.

Tournament Fee Includes: Green Fee, Shared Cart, Range Balls, Tournament Service, Continental Breakfast and Awards Lunch.

Rentals: Golf rental clubs. \$55 per set – They are high end Callaway sets. Mulligan's can be purchased the day of the tournament; 2 for \$20.

Awards Luncheon Raffle

Each player will receive two (2) Raffle Tickets for participating in the Tournament. Additional Raffle Tickets will be sold for \$10 each. There is no limit on Raffle Ticket purchases!

All players must comply with the Club's dress code: Collared shirts are required, denim is not permitted, mid-length hemmed shorts are permissible, and soft spikes are required.

We encourage teams to bring a raffle prize! All proceeds will go to support the GRC Scholarship Fund.

Proceeds from the 2018 GRC Annual Charity Golf Tournament helped fund the following scholarships:

Undergraduate Awards (\$500 each):

- John Grill (Montana Tech University);
- Christ Quinicot (Negros Oriental State University) and
- Estefanía Ramírez Restrepo (University of Medellin);

Graduate Awards (\$2,500 each):

- Estefanny Dávalos-Elizondo (Oklahoma State University);
- Jonathan Ogland-Hand (The Ohio State University);
- Arna Palsdottir (Cornell University);
- Jared Smith (Cornell University) and
- Yuran Zhang (Stanford University).

Transportation: Individuals are responsible for their own transportation. No shuttle will be provided by the tournament. Uber and Lyft are readily available in the area. Conference hotel may be able to assist with transportation. Please check with the concierge if you have interest. The Indian Wells Golf Resort is 16 miles from the hotel. Please plan on arriving at least 45 minutes early to check in, grab some breakfast and head out for some practice swings before the 7:30am SHOTGUN START!

Questions? Contact the GRC's Golf Tournament Coordinator: Chris Ellis, E-mail: cellis@cosoenergy.com, cell: (760) 382-5118.



The Celebrity Course at the Indian Wells Golf Resort.

ANNUAL MEETING SCHEDULE *continued*

THANKS TO OUR GOLF SPONSORS:



SUNDAY, SEPTEMBER 15

GRC BOARD MEETING

12noon - 5pm
Room: Andreas

The GRC Board of Directors will discuss association matters.

OPENING RECEPTION

6 - 8pm
Room: Oasis Ballroom 1 & 2
Cost: Free with Registration

On Sunday evening, all registered meeting attendees are encouraged to join colleagues, friends and old acquaintances at this grand reception hosted in the Expo Hall.

OUTDOOR EXPO DISPLAY

8 - 9pm
Esplanade Area
Cost: Free with Registration

New this year the GRC will host an Outdoor Exhibit Showcase in conjunction with the usual indoor expo at the Palm Springs Convention Center. The outdoor expo will be located in the outdoor Esplanade area in front of the registration lobby of the convention center where exhibitors will have a covered and secure place to showcase their large equipment. Some spots still available. Contact Anh Lay.



Come visit TNG Energy.

AFTER-AFTER PARTY

9pm til' Late!
Room: Renaissance Poolside
Cost: Free with Registration

Party on!

MONDAY, SEPTEMBER 16

OUTDOOR EXPO DISPLAY

7:00am-1:30pm
Esplanade Area
Cost: Free with Registration

See description above.

Coffee will be available here before the start of the Opening Session.

ANNUAL MEETING SCHEDULE

OPENING PLENARY SESSION

8:00am - 12 Noon
Room: Primrose B, C & D
Cost: FREE

The session will consist of keynote addresses and panel debates with interactive Q&A between the speakers and audience. Visit website for an updated list of speakers.

INTERNATIONAL LUNCHEON & SESSION

Featured Speakers for both Luncheon and Session: (as of June 10):

- Africa, **TBD**
- Canada, **Catherine Hickson** – Tuya Terra Geo Corp
- China, **Song Xianzhi** – China University of Petroleum (CUP)
- Europe, **Thomas Kohl** – Karlsruhe Institute of Technology (KIT)
- Indonesia, **Riki Ibrahim** – Geo Dipa Enerji (GDE)
- Japan, **Hiroshi Asanuma** – National Institute of Advanced Industrial Science (AIST)
- Latin America & The Caribbean, **Christiaan Gischler** – Interamerican Development Bank (IDB)
- The Philippines, **TBD**
- South America, **TBD**
- South Pacific, **TBD**
- Turkey, **Tevfik Kaya** – Schlumberger

The final schedule will be available on the GRC website.

International Lunch

12 Noon - 1:30pm
Room: Primrose A
Cost: Lunch is included with full conference registration or at additional cost.

The 11th annual International Luncheon will bring together experts from around the world with U.S. private and public sector stakeholders to discuss geothermal energy developments in developing markets. Attendees will be able to meet and greet these experts, and explore partnership opportunities. All are invited!

Thanks to our sponsors:



International Session

1:30pm - 5:20pm
Room: Catalina
Cost: Free with Registration

Experts from around the world present the latest geothermal energy developments in regional markets: Australasia, Indonesia, Philippines, Japan, Middle East, Europe, South America, Central America, and North America.

**MONDAY, TUESDAY & WEDNESDAY,
SEPTEMBER 16, 17 & 18**

TECHNICAL SESSIONS

Monday 1:30pm - 5:40pm
Tuesday 8am - 5:10pm
Wednesday 8am - 12:10pm
Cost: Free with Registration

See pages 19-24 for more information



The community gathers to open the Expo at last year's event. Photo by Ian Crawford.

BOOK YOUR ROOM!

ANNUAL MEETING SCHEDULE *continued*

EXPO

Sunday 6 - 8pm
Monday 12 - 5pm
Tuesday 9am - 7pm
Wednesday 9am - 2pm

Room: Oasis Ballroom 1-2
Cost: Free with Registration

The worlds' largest gathering of vendors providing support for geothermal energy resource exploration, characterization, development, production and management. See page 27 for a listing of exhibitors.



The Expo has all the latest goods and services in the geothermal energy industry. Photo by Ian Crawford.

MONDAY, SEPTEMBER 16

POLICY COMMITTEE MEETING

3:30pm - 5pm
Room: San Jacinto

The Policy Committee of the GRC will meet to discuss matters that are critically important to the geothermal industry. Meeting is open to everyone.

MONDAY NIGHT MIXER

Palm Springs Air Museum
6:30pm - 10:00pm
Cost: \$75 includes drinks, appetizers, entertainment and access to the museum.

Sponsored by Calpine, Nalco Water and Controlled Thermal Resources.

A fantastic networking event at a unique location!

The Palm Springs Air Museum is a living history museum dedicated to educating the public about the role Air Power played in preserving American liberties and way of life. The



(Courtesy Palm Springs Air Museum)

Museum preserves, exhibits, and flies aircraft from World War Two, Korea, and the Vietnam Wars. Most of the aircraft are in flyable condition. A shuttle will be available to the Air Museum. Boarding will begin at 6:30pm from outside the Renaissance Hotel. **Cost includes drinks, appetizers, entertainment and access to the museum.**

TUESDAY, SEPTEMBER 17

TRIVIA CONTEST!
Presented by the GRC Student Committee

12:30pm - 1:30pm
Room: Primrose A
Cost: \$30 per participant (Free for Students)

What: Join us for a fun lunch at Tuesday lunch time! The Trivia contest is hosted by the GRC Student Committee and all proceeds from this events will go to fund upcoming Student Committee events and activities. Join in on the fun and a chance for prizes and most importantly, bragging rights!

Who: You and up to 5 colleagues against teams (plus a student paired by the GRC) from all over the world representing every sector of the industry.

Why: Enjoy friendly academic competition while contributing to the development of geothermal students across the globe! All proceeds will go to the GRC Student Committee to fund future student events and activities.

Prizes: TBD

POSTER SESSION AND NETWORKING RECEPTION

5pm - 7pm
Room: Lobby and Oasis Ballroom 1-2
Cost: Free with Registration

Meet with colleagues in the global geothermal community and view this year's selection of Posters. Please note: The posters are also available for viewing at all times during the meeting.

Student Poster Award sponsored by:



ANNUAL MEETING SCHEDULE

WEDNESDAY, SEPTEMBER 18

ANNUAL MEMBERSHIP MEETING & AWARDS LUNCHEON

12Noon - 2:00pm

Room: Primrose A

Cost: Lunch is included with full-conference registration or at additional cost.

The GRC will honor the best and brightest of the global geothermal community at its Annual Membership Meeting

OTHER EVENTS

THE U.S. WING TEAM PRESENTS:

SUNDAY, SEPTEMBER 15

Tip Your Hat To WING

6:00 - 8:00 pm

Room: Oasis Ballroom 1&2

Wear a hat (any kind!) to the GRC Opening Reception to get conversations started at this networking event and tip off your conference!

MONDAY, SEPTEMBER 16

WING Yoga

6:00 - 7:00 am

Room: Renaissance Poolside

Come join in on a yoga session to start off the annual meeting at your best! You are welcome to attend no matter what your level of experience. If possible, please bring your own yoga mat and we recommend bringing water.



TUESDAY, SEPTEMBER 17

WING Fun Run

5:45 - 7:00am

Room: Meet in the lobby of the Renaissance Hotel

Get out and explore Palm Springs on foot with an early morning fun run! WING will provide the guide and a route, you just need to bring yourself, ready to run! Illumination recommended. Looped course will allow for variable distances.

WING Speaker/Workshop

5:30 - 6:30 pm

Room: Primrose A

WING Awards Presentation to our Courageous, Empowering, Open, Caring colleagues! Nominated by WING membership we honor those who exemplify the WING core values in their day-to-day work.

~~~~~

Women in Geothermal (WING) is a volunteer, not-for-profit organization whose aim is to promote the education, professional development, and advancement of women in the geothermal community. Founded in October 2013 at the Geothermal Resources Council (GRC) Annual Meeting in Las Vegas, Nevada, WING is now represented in over 48 countries worldwide, with 14 dedicated Country Teams.

**REGISTER NOW!**

**GRC ANNUAL MEETING & EXPO**

**PALM SPRINGS CONVENTION CENTER**  
PALM SPRINGS, CALIFORNIA | USA

**SEPT 15-18**  
2019



# TECHNICAL PROGRAM

## Monday Afternoon

|                          | MOJAVE                                                                                                                                                                                                            | CATALINA                                          | MADERA                                                                                                                                  | PASADENA                                                                                                    |
|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|
|                          | LITHIUM RECOVERY PANEL<br>Chair:                                                                                                                                                                                  | INTERNATIONAL<br>Chair:                           | MODELING TECHNIQUES<br>Chair:                                                                                                           | EXPO SHOWCASE<br>Chair:                                                                                     |
| 1:30                     | Panel Discussion                                                                                                                                                                                                  | Africa                                            | Can Geologic Data be Used to Tell the Difference Between Productive and Non-productive Geothermal Wells? (Drew L Siler)                 | TBD                                                                                                         |
| 1:50                     | Panel Discussion                                                                                                                                                                                                  | Canada                                            | Multivariate Statistical Method Validation with Aqueous Geochemistry using Yellowstone National Park (Cary R Lindsey et al.)            | TBD                                                                                                         |
|                          |                                                                                                                                                                                                                   | China                                             |                                                                                                                                         |                                                                                                             |
| 2:10                     | Panel Discussion                                                                                                                                                                                                  | Europe                                            | Modeling Natural Steam Cap Formation in High-enthalpy Geothermal Systems* (Samuel Scott)                                                | TBD                                                                                                         |
|                          |                                                                                                                                                                                                                   | Indonesia                                         |                                                                                                                                         |                                                                                                             |
| 2:30                     | Panel Discussion                                                                                                                                                                                                  | Japan                                             | A Stochastic Evaluation of Geothermal Reservoir Potential for the Tuscarora Sandstone in Morgantown, West Virginia, USA (Jared D Smith) | TBD                                                                                                         |
|                          |                                                                                                                                                                                                                   | The Phillipines                                   |                                                                                                                                         |                                                                                                             |
| 2:50                     | Panel Discussion                                                                                                                                                                                                  | South America                                     |                                                                                                                                         | TBD                                                                                                         |
| 3:10                     | Panel Discussion                                                                                                                                                                                                  | South Pacific                                     |                                                                                                                                         |                                                                                                             |
|                          |                                                                                                                                                                                                                   | Turkey                                            |                                                                                                                                         |                                                                                                             |
|                          |                                                                                                                                                                                                                   | Subject to change. Go to GRC website for updates. |                                                                                                                                         |                                                                                                             |
| <b>3:10 – 3:40 Break</b> |                                                                                                                                                                                                                   |                                                   |                                                                                                                                         |                                                                                                             |
|                          | EGS<br>Chair:                                                                                                                                                                                                     | INTERNATIONAL<br>Chair:                           | TECHNOLOGY TRANSFER BETWEEN OIL & GAS AND GEOTHERMAL<br>Chair:                                                                          | CASE STUDIES<br>Chair:                                                                                      |
| 3:40                     | Summary of the Investigations Conducted Following the November 2017 Earthquake in Pohang, South Korea, and Implications for the Haute-Sorne Multi-stage-stimulation EGS Project, Switzerland (Peter Meier et al.) | (See above)                                       | The Integration Of Data Management And Geological Modelling In A Geothermal Subsurface Asset Team (Chris Hanton et al.)                 | McGinness Hills 3: A Successful Third-Phase Development* (John Akerley)                                     |
| 4:00                     | 6.1-km-to-Boiling: EGS Drilling and Stimulation in Finland (Peter E Malin)                                                                                                                                        |                                                   | Application of Oil and Gas Methodology to Geothermal Formation Evaluation: The Value of Data (Thomas J Bradley et al.)                  | The Repowering of Lightning Dock Plant in New Mexico (Joseph Bonafin)                                       |
| 4:20                     | Urban Close-Loop Enhanced Geothermal Systems with Deep Multi-Lateral Wells* (Aleksandr Vetsak)                                                                                                                    |                                                   | Successful Geothermal Operation Management: Technology Adoption of Oil and Gas Drilling Rig Systems (Catalin Teodoriu)                  | Yamagawa Binary Power Station Geothermal ORC Plant in Japan (Saki Kondo)                                    |
| 4:40                     | The Use of Advanced Percussion Drilling to Improve Subsurface Permeability for Enhanced Geothermal Systems* (Kang Lao et al.)                                                                                     |                                                   | Geothermal Reserves Valuation: A Benchmarking Method from the Petroleum Industry (Elliot N Yearsley)                                    | Case Study of the 3S Kale Incirliova Geothermal Project, Aydin Province, Turkey (James W Lovekin)           |
| 5:00                     | Parametric Study of Waterless Stimulation with Multiple Energetic Sources (Oleg Vorobiev et al.)                                                                                                                  |                                                   | An Introduction to Flow Control Devices (FCDs) and the Potential Benefits to Geothermal Applications (Brandon A Curkan et al.)          | The Potential for Binary Geothermal Power in the Williston Basin* (Will D Gosnold)                          |
| 5:20                     | Fluid Flow and Heat Transfer in Enhanced Geothermal Systems Based on Fractal Geometry Theory for a Bifurcate Fracture System (Xiaoxue Huang)                                                                      |                                                   |                                                                                                                                         | ESPs in Geothermal Applications; an Operational and Commercial Success Case Study in Turkey (Taylor Mattie) |
| <b>Adjournment 5:40</b>  |                                                                                                                                                                                                                   |                                                   |                                                                                                                                         |                                                                                                             |

\*Paper is also a poster presentation.

# TECHNICAL PROGRAM

## Tuesday Morning

|       | MOJAVE<br>MINERAL EXTRACTION<br>Chair:                                                                                                                         | CATALINA<br>GEOVISION 1<br>Chair:                                                                                                                                                                                                                             | MADERA<br>EMERGING TECHNOLOGIES<br>Chair:                                                                                                 | PASADENA<br>WELL INTEGRITY TECHNOLOGY 1<br>Chair:                                                                                      |
|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|
| 8:00  |                                                                                                                                                                | <i>An Overview of the GeoVision Report</i> (Hamm, S. et al.)                                                                                                                                                                                                  | <i>Status of Japanese Supercritical Geothermal Project in FY2018</i> (Hiroshi Asanuma et al.)                                             |                                                                                                                                        |
| 8:20  | <i>Supercritical Fluid Extraction of Lithium from Synthetic Geothermal Brines</i> (Arna Palsdottir et al.)                                                     | <i>GeoVision Analysis Supporting Task Force Report: Exploration</i> (Doughty, C. et al.)                                                                                                                                                                      | <i>Greenfire Energy DBHX Retrofit at Coso KGRA</i> (John R Muir et al.)                                                                   | <i>Testing Flexible Couplings for Geothermal Wells</i> (Ingolfur Thorbjornsson)                                                        |
| 8:40  | <i>Competitiveness of Direct Mineral Extraction from Geothermal Brines</i> (Anna M Wall)                                                                       | <i>GeoVision Analysis Supporting Task Force Report: Reservoir Maintenance and Development</i> (Lowry, T. et al.)                                                                                                                                              | <i>Combining Geothermal Potential and Direct Air Capture for Negative Emission Power Generation in California</i> (Helene Pilorge et al.) | <i>Hydrodynamic Analysis on Flow Accelerated Corrosion of Carbon Steel Piping with Orifice Structure*</i> (Masaki Iwata et al.)        |
| 9:00  | <i>Removing Silica from Geothermal Water - Year 2 of Pilot Plant Operation - Re-Design and Ramping up the Pressure</i> (Thomas Borrmann et al.)                | <i>GeoVision Analysis Supporting Task Force Report: Barriers—An Analysis of Non-Technical Barriers to Geothermal Deployment and Potential Improvement Scenarios*</i> (Young, K. et al.)                                                                       | <i>Supercritical Geothermal Cogeneration to Provide Long Run Solutions to Problems Facing the Salton Sea Area*</i> (Jim Shnell)           | <i>High-Temperature Corrosion Testing Facility for Coating Materials in Simulated Geothermal Environment</i> (Danyil Kovalov et al.)   |
| 9:20  | <i>Developments in the Nanostructured Calcium Silicate Technology for Preventing Silica Deposition and Opening New Business Opportunities</i> (James Johnston) | <i>GeoVision Analysis Supporting Task Force Report: Electric Sector Potential to Penetration</i> (Augustine, C. et al.)                                                                                                                                       | <i>Design and Laboratory Study of a Five-layer Thermoelectric Power Generator</i> (Kewen Li et al.)                                       | <i>Wellhead-based Casing Integrity Assessment and Monitoring</i> (Yuxin Wu et al.)                                                     |
| 9:40  | <b>9:40 - 10:10 Break</b>                                                                                                                                      |                                                                                                                                                                                                                                                               |                                                                                                                                           |                                                                                                                                        |
|       | ENCOURAGING GROWTH IN THE GEOTHERMAL INDUSTRY<br>Chair:                                                                                                        | GEOVISION 2<br>Chair:                                                                                                                                                                                                                                         | DRILLING<br>Chair:                                                                                                                        | GEOCHEMISTRY<br>Chair:                                                                                                                 |
| 10:10 | <i>Panel Discussion</i>                                                                                                                                        | <i>GeoVision Analysis Supporting Task Force Report: Thermal Applications—Quantifying Technical, Economic, and Market Potential of Geothermal District Heating Systems in the United States</i> (McCabe, K. et al.)                                            | <i>An Unconventional Directional Sidetrack of a Geothermal Well in Kenya: Menengai Well MW-15A</i> (Martin Kibiwott Rotich)               | <i>Geochemical Characteristics of the Menengai Geothermal Reservoir, Kenya: An Overview*</i> (Jeremiah Kipngok)                        |
| 10:30 | <i>Panel Discussion</i>                                                                                                                                        | <i>GeoVision Analysis Supporting Task Force Report: Thermal Applications—Geothermal Heat Pumps</i> (Liu, X. et al.)                                                                                                                                           | <i>Successful Well Design and Remedial Cementing By Top Squeeze Method at Steamboat, NV, USA</i> (Matthew J Sophy)                        | <i>Importance of Metadata Assessment to Incentivize Geothermal Exploration; Case Study of Puracé Volcano, Colombia</i> (Esteban Gomez) |
| 10:50 | <i>Panel Discussion</i>                                                                                                                                        | <i>GeoVision Analysis Supporting Task Force Report: Geothermal Hybrid Systems</i> (Wendt, D. et al.)                                                                                                                                                          | <i>Well Drilling in Sol de Mañana Geothermal Field - Laguna Colorado Geothermal Project*</i> (Paola Adriana Coca Suaznabar)               | <i>Chemistry of Stibnite, Orpiment and Other Sulfide Minerals Deposited from Geothermal Brines</i> (Oleh Weres)                        |
| 11:10 | <i>Panel Discussion</i>                                                                                                                                        | <i>GeoVision Analysis Supporting Task Force Report: Impacts—The Employment Opportunities, Water Impacts, Emission Reductions, and Air Quality Improvements of Achieving High Penetrations of Geothermal Power in the United States</i> (Millstein, D. et al.) | <i>Integrated Drilling Services For Geothermal Project Laguna Colorado*</i> (Bruno Pereyra)                                               | <i>Investigation of the Effects of Metal Cations on Polycarboxylate Calcite Inhibitors</i> (Michael Bluemle)                           |
| 11:30 | <i>Panel Discussion</i>                                                                                                                                        | <i>The GeoVision Roadmap</i> (Hamm, S. et al.)                                                                                                                                                                                                                |                                                                                                                                           |                                                                                                                                        |
|       | <b>Lunch 11:50 - 2:00pm</b>                                                                                                                                    |                                                                                                                                                                                                                                                               |                                                                                                                                           |                                                                                                                                        |

\*Paper is also a poster presentation.



# TECHNICAL PROGRAM

## Tuesday Afternoon

|      | MOJAVE<br>DEVELOPMENT IN CANADA<br>Chair:                                                                                                                     | CATALINA<br>FORGE UPDATE 1<br>Chair:                                                                                                   | MADERA<br>GEOLOGY<br>Chair:                                                                                                                                                                                                   | PASADENA<br>WELL INTEGRITY TECHNOLOGY 2<br>Chair:                                                                                                                   |
|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2:00 | <i>Geothermal Energy in Canada: Heating Up</i> (Alison Thompson)                                                                                              | <i>FORGE in 2019</i> (John McLennan et al.)                                                                                            | <i>Characterizing the Subsurface Structures and Determination of In-Situ Stress Orientations Using Acoustic Borehole Images: A Case Study from Theistareykir Geothermal Field, Northeastern Iceland</i> (Tito Perdana et al.) | <i>Formed-in-place Ceramic Systems for Sealing and Flow Control in Geothermal Applications</i> (William E Lowry)                                                    |
| 2:20 | <i>Alberta's Western Canada Sedimentary Basin's First Electrical Geothermal Project</i> (Catherine J. Hickson et al.)                                         | <i>New Geoscientific Developments at the Utah Frontier Observatory for Research in Geothermal Energy (FORGE) Site</i> (Stuart Simmons) | <i>Refinements of Stratigraphic Markers in Mak-Ban Geothermal Field Using Recent Gamma Ray Logs and Implications to Well Targeting</i> (Corinne Mae M Estrella)                                                               | <i>Self-healing and Crack-sealing Ability of 30-day-long 300oC Cured Thermal Shock Resistant Cement Composites</i> (Tatiana Pyatina et al.)                         |
| 2:40 | <i>A Combined Application of Drone-Based Thermal Infrared and Magnetic Surveys for Geothermal and Element Exploration in Western Canada</i> (Alison Thompson) | <i>FORGE Earth Model Update</i> (Rob Podgorney et al.)                                                                                 | <i>Geothermal Hydrological Sustained Flow Paths in Extensional Terrain</i> (Al Waibel et al.)                                                                                                                                 | <i>Development of an Improved Cement for Geothermal Wells</i> (George Trabits)                                                                                      |
| 3:00 | <i>Borealis Geopower and Canadian Communities Engagement</i> (Alison Thompson et al.)                                                                         | <i>Modeling Support for Drilling and Stimulation Planning for Utah FORGE Phase 3</i> (Aleta Finnila)                                   | <i>Review of Groundwater Flow Velocity Measurement Method</i> (Haiyan Lei et al.)                                                                                                                                             | <i>Use of Fly Ash and Metakaolin in Wellbore Cementing to Prevent Alkali-Silica Reactivity of Amorphous Si-rich Components*</i> (Mileva Radonjic et al.)            |
| 3:20 | <b>3:20 – 3:50 Break</b>                                                                                                                                      |                                                                                                                                        |                                                                                                                                                                                                                               |                                                                                                                                                                     |
|      | GEOPHYSICS<br>Chair:                                                                                                                                          | FORGE UPDATE 2<br>Chair:                                                                                                               | EXPLORATION/RESOURCE ASSESSMENT<br>Chair:                                                                                                                                                                                     | DIRECT USE/HEAT PUMP<br>Chair:                                                                                                                                      |
| 3:50 | <i>Magnetotellurics - Measurements and 3D Modeling of Topography and Galvanic Distortion</i> (Stephen Hallinan)                                               | <i>Geophysics at the Milford, Utah, FORGE Site: Update on Gravity Surveys and 3D Modeling*</i> (Christian Hardwick et al.)             | <i>Resource Reporting and Project Assessment Case Studies using the Geothermal Research Optimization and Reporting Technique (GeoRePORT)*</i> (Amanda Kolker et al.)                                                          | <i>Open Field Heated Agriculture for Enhanced Crop Production Using Waste Geothermal, Municipal, and Co-Gen Hot Water and Steam Condensate</i> (Michael T Petralia) |
| 4:10 | <i>Deep Resistivity Imaging of Geothermal System Using Magnetotelluric Surveys, A Case Study</i> (Mehran Gharibi et al.)                                      | <i>Seismic Monitoring at the Utah Frontier Observatory for Research in Geothermal Energy</i> (Kristine L Pankow et al.)                | <i>Hawai'i Play Fairway, Phase 3 Update</i> (Nicole Lautze)                                                                                                                                                                   | <i>Plaine de Garonne Energies (PGE): A New Geothermal District Heating in Bordeaux, France</i> (Delphine Patriarche et al.)                                         |
| 4:30 | <i>Surface Deformation and Seismicity at the North Brawley Geothermal Field in Southern California</i> (Mariana Eneva)                                        |                                                                                                                                        | <i>Heat Flow Accumulation and Water Enrichment Genesis of Sandstone Geothermal Reservoir in China: a Case Study in North Shandong Plain</i> (Fengxin Kang)                                                                    | <i>Geothermal Energy Direct uses in México: Preliminary Results and Advances on Projects Developed by CeMIEGeo</i> (Alfonso García-Gutiérrez et al.)                |

**Adjournment 4:50pm  
Poster Session 5:00 - 7:00pm**

**Thank you to our Neck Wallet sponsor:**



\*Paper is also a poster presentation.

# POSTER SESSION

Tuesday September 17, 5pm - 7pm

## CONVENTION CENTER FOYER

Chair: Trenton Cladouhos

### BEYOND BATTERIES

*A Preliminary Study of a Novel Heat Pump Integrated Underground Thermal Energy Storage for Shaping Electric Demand of Buildings\** (Xiaobing Liu et al.)

*Geothermal-enabled Zero Energy Community\** (Dane Christensen et al.)

### GEOCHEMISTRY

*Geochemical Characteristics of the Menengai Geothermal Reservoir, Kenya: An Overview\** (Jeremiah Kipngok)

### GEOTHERMAL POLICY

*GCG Compliance in Geothermal SOE of Indonesia* (M. Reza Iqbal)

### CASE STUDIES

*Recent Activities Regarding Performance Improvement of the Geothermal Power Plant* (Naoki Yabuki)

*The Potential for Binary Geothermal Power in the Williston Basin\** (Will D Gosnold)

### DEVELOPMENT IN EAST AFRICA

*1D Inversion Of Magnetotelluric Data From Ashute, Butajira Geothermal Prospect, South-East Ethiopia And Its Geothermal Implications\** (Tsegaye W Tadesse)

### DRILLING

*Impact of Foaming Agent on the Performance of Colloidal Gas Aphron Drilling Fluid for Geothermal Drilling* (Wenxi Zhu Zhu)

*Integrated Drilling Services For Geothermal Project Laguna Colorado\** (Bruno Pereyra)

*Well Drilling in Sol de Mañana Geothermal Field - Laguna Colorado Geothermal Project\** (Paola Adriana Coca Suaznabar)

### EGS

*The Use of Advanced Percussion Drilling to Improve Subsurface Permeability for Enhanced Geothermal Systems\** (Kang Lao et al.)

*Urban Close-Loop Enhanced Geothermal Systems with Deep Multi-Lateral Wells\** (Aleksandr Vetsak)

### EGS COLLAB

*EGS Collab Earth Modeling: Geostructural Status of the Testbed\** (Ghanashyam Neupane et al.)

*EGS Collab Numerical Experiments: Simulations of the 3D Geothermal Heat Flow and Tracer in 3D Fractured Media* (Elchin Jafarov)

*Fracture Imaging Using CASSM Data for EGS Collab Experiments\** (Wenyong Pan et al.)

*Geochemical Impacts to Fracture Flow at the Core Scale\** (Megan Smith et al.)

### EMERGING TECHNOLOGIES

*Supercritical Geothermal Cogeneration to Provide Long Run Solutions to Problems Facing the Salton Sea Area\** (Jim Shnell)

### EXPLORATION & RESOURCE ASSESSMENT

*Hawai'i Statewide Geothermal Play Fairway Analysis: Final Phase Aqueous Geochemistry Results and Work in Progress* (Colin M Ferguson)

*Resource Reporting and Project Assessment Case Studies Using the Geothermal Research Optimization and Reporting Technique (GeoRePORT)\** (Amanda Kolker et al.)

*Thermal Conductivity Characterization of Larderello and Mt. Amiata Geothermal Fields, Italy.* (Stefano Bellani et al.)

### FORGE UPDATE

*Geophysics at the Milford, Utah, FORGE site: Update on Gravity Surveys and 3D Modeling\** (Christian Hardwick et al.)

### GEOPHYSICS

*Interpolations from Vertical Electric Soundings for the Characterization of the Geothermal System of the Municipality of Paipa, Colombia* (Gilbert F Rodriguez)

### MODELING TECHNOLOGY

*Heterogeneous Permeability within Productive Geothermal Fractures\** (Steven Fercho)

### RESERVOIR ENGINEERING & MANAGEMENT

*Simulation of Advection-Diffusion Problems with a Unified Lattice Boltzmann Equation* (Haiyan Lei)

### TECHNOLOGY TRANSFER BETWEEN OIL & GAS AND GEOTHERMAL APPLICATIONS

*Geothermal Energy Utilization of Multi-well Oil Pads via the Application of Organic Rankine Cycle Systems* (Will D Gosnold et al.)

### WELL INTEGRITY TECHNOLOGY

*Hydrodynamic Analysis on Flow Accelerated Corrosion of Carbon Steel Piping with Orifice Structure\** (Masaki Iwata et al.)

*Use of Fly Ash and Metakaolin in Wellbore Cementing to Prevent Alkali-Silica Reactivity of Amorphous Si-rich Components\** (Mileva Radonjic et al.)

\*Paper is also an oral presentation.

# TECHNICAL PROGRAM

## Wednesday Morning

|       | MOJAVE                                                                                                                                                          | CATALINA                                                                                                                                                                                            | MADERA                                                                                                                                                                  |
|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|       | BEYOND BATTERIES<br>Chair:                                                                                                                                      | EGS COLLAB 1<br>Chair:                                                                                                                                                                              | FIELD OPERATIONS<br>Chair:                                                                                                                                              |
| 8:00  | <i>Geothermal-enabled Zero Energy Community*</i> (Dane Christensen et al.)                                                                                      | <i>Observations from the First EGS Collab Testbed: Part 1 – Responses of Fractured, Crystalline Rock to Hydraulic Stimulation and Initial Fluid Circulation Experiments</i> (Paul Schwering et al.) | <i>Advanced On-Line Steam Purity Analyzer for Geothermal Power Plants</i> (Paul N von Hirtz et al.)                                                                     |
| 8:20  | <i>Geologic Thermal Energy Storage of Solar Heat to Provide a Source of Dispatchable Renewable Power and Seasonal Energy Storage Capacity</i> (Dan Wendt)       | <i>Observations from the First EGS Collab Testbed: Part 2 – Responses of Fractured, Crystalline Rock to Long-Term Flow Experiments</i> (Hunter A Knox et al.)                                       | <i>Working with 600F Rated Geothermal Logging Cables</i> (Randy A Normann)                                                                                              |
| 8:40  | <i>Thermal-Shock Resistant Cement for Heat Storage</i> (Tatiana Pyatina)                                                                                        | <i>EGS Collab Earth Modeling: Geostructural Status of the Testbed*</i> (Ghanashyam Neupane et al.)                                                                                                  | <i>Welding: Properties, Characteristics and Applications in the Geothermal Industry</i> (Patrick Hanson et al.)                                                         |
| 9:00  | <i>Experimental Investigation of a Novel High Energy Density Mobile Sorption-based Thermal Battery</i> (Lingshi Wang et al.)                                    | <i>Direct Downhole Measurement of a Stimulated Fracture Displacement First Results from the SIMFIP Tool Tests performed during the EGS Collab Project</i> (Yves Guglielmi et al.)                   |                                                                                                                                                                         |
| 9:20  | <i>A Preliminary Study of a Novel Heat Pump Integrated Underground Thermal Energy Storage for Shaping Electric Demand of Buildings*</i> (Xiaobing Liu et al.)   | <i>Shear Slip Analysis of Fracture Networks to Determine Suitability of Candidate Testbeds for the EGS Collab Hydroshear Experiment</i> (Ankush Singh et al.)                                       |                                                                                                                                                                         |
| 9:40  | <b>9:40 – 10:10 Break</b>                                                                                                                                       |                                                                                                                                                                                                     |                                                                                                                                                                         |
|       | DEVELOPMENT IN EAST AFRICA<br>Chair:                                                                                                                            | EGS COLLAB 2<br>Chair:                                                                                                                                                                              | RESERVOIR ENGINEERING<br>Chair:                                                                                                                                         |
| 10:10 | <i>Opportunities and Challenges in Geothermal Development in Ethiopia</i> (Solomon Kebede K Haile)                                                              | <i>Fracture Tracer Injection Response to Pressure Perturbations at an Injection Well</i> (Earl Mattson et al.)                                                                                      | <i>The Development of a Fully Coupled Wellbore-Reservoir Simulator for Geothermal Application</i> (Maziar Gholami Korzani et al.)                                       |
| 10:30 | <i>1D Inversion Of Magnetotelluric Data From Ashute, Butajira Geothermal Prospect, South-East Ethiopia And Its Geothermal Implications*</i> (Tsegaye W Tadesse) | <i>Geochemical Impacts to Fracture Flow at the Core Scale *</i> (Megan Smith et al.)                                                                                                                | <i>Development of Geothermal Reservoir Simulator Dealing with Mineral Reactions</i> (Daichi Tanabu et al.)                                                              |
| 10:50 | <i>A Comparison of Alteration Mineralogy and Measured Temperatures from Three Exploration Wells in Fiale Caldera, Djibouti</i> (Jesse Turk et al.)              | <i>Microearthquake Moment Tensor Inversion for EGS Collab Experiments: Preliminary Results</i> (Yu Chen et al.)                                                                                     | <i>Comparison of Fracture Permeability Estimated from Well Tests and Radon Tracer</i> (T. Kuo)                                                                          |
| 11:10 | <i>Reservoir Characterization from Exploration Well Completion Tests in the Fiale Caldera, Djibouti</i> (Colin Carver)                                          | <i>Anisotropic Traveltime Tomography of Campaign Cross-Borehole Seismic Data from the First EGS Collab Testbed</i> (Kai Gao et al.)                                                                 | <i>Three-Dimensional Structural Model Building Constrained By Induced Seismicity Alignments at The Geysers Geothermal Field, Northern California</i> (Craig S Hartline) |
| 11:30 | <i>Abaya Geothermal Project, A High Enthalpy Geothermal System in the Main Ethiopian Rift</i> (Snorri Gudbrandsson)                                             | <i>Fracture Imaging Using CASSM Data for EGS Collab Experiments*</i> (Wenyong Pan et al.)                                                                                                           |                                                                                                                                                                         |
| 11:50 | <i>Structural Controls and Slip Tendency in the Chiweta Geothermal Zone: Northern Part of the Malawi Rift, Africa.</i> (Estefanny Davalos-Elizondo et al.)      | <i>EGS Collab Project: Accomplishments and Plans</i> (Tim Kneafsey et al.)                                                                                                                          |                                                                                                                                                                         |

**Adjournment 12:10pm  
Award Lunch 12:10 - 2:00pm**

**Thank you to our  
Bronze sponsors:**



\*Paper is also an oral presentation.



# PHOTO CONTEST



**1st Place:** *Ray of Steam* - **Piyush Bakane**, Reno, Nevada, USA

**2nd Place:** *Cooling Tower, Theistareykir Power Station* - **Hreinn Hjartarson**, Reykjavik, Iceland

**3rd Place:** *Zunil Geothermal Plant* - **Steven Fercho**, Reno, Nevada, USA

**2018  
Winners!**

Geothermal Resources Council's

## 2019 AMATEUR PHOTO CONTEST

All are invited to submit photos that illustrate the benefits of geothermal energy, including exploration, research and development, energy production, drilling, community development, and always-on green energy integration.



### CASH PRIZES

- 1st.....\$150
- 2nd....\$100
- 3rd.....\$75

Honorable Mention will be awarded in two specific categories:

#### DIVERSITY

Celebrating inclusivity in the geothermal industry

#### COMMUNITY

Providing positive interaction and impact on communities

Awards will be presented at the **GRC Annual Meeting** September. 14-18, 2019, in Palm Springs, California.

More Info and Entry Form:

[https://geothermal.org/Annual\\_Meeting/photo.html](https://geothermal.org/Annual_Meeting/photo.html)

### SUBMISSION DEADLINE

August 2, 2019

# HOTEL ACCOMMODATIONS

All the events at the GRC Annual Meeting & Expo will be held in the Palm Springs Convention Center. The GRC has contracted for a discounted block of rooms at two host hotels. The **Renaissance Palm Springs Hotel** is attached to the convention center and the **Hilton Palm Springs Hotel** is just one block away.

~~~~~

Please Note: The Renaissance Palm Springs Hotel room block is only available from 14-22 September. Those attending pre-meeting workshops and fieldtrips and needing a room 12 & 13 September at the GRC rate will have to make a reservation at the Hilton Palm Springs Hotel where the room block is available 12-19 September. We apologize for the inconvenience.

~~~~~

**Make your hotel reservation thru the GRC website:  
[www.geothermal.org](http://www.geothermal.org)**

**The discount ends August 21.**

- **We strongly recommend making your hotel reservations on-line** through a dedicated webpage. The preferred rate is automatically applied.
- OR
- If you make your reservations over the phone make sure you mention you are part of the **Geothermal Resources Council** group to get the special rate.

## RENAISSANCE PALM SPRINGS

The pool complex is the largest in Palm Springs, including a kids' pool and play area, and is open late for anyone who craves an after-hours moonlit dip. Enjoy fine dining in the DATE restaurant, exquisite cocktails at ROCKS bar or take in a drink under the stars at our luxurious outdoor patio bar. And to discover the outstanding natural beauty of the surrounding area, just ask resident Navigator Will for all the best local tips. *Connected to the convention center.*

**Rates start at \$150 a night. Rate available 14-22 September ~ Book by 21 August.**



*NB: Room Block discount not available for GRC pre-meeting workshops & fieldtrips.*

## HILTON PALM SPRINGS

This stunning desert retreat is situated at the foot of the spectacular San Jacinto Mountains. Work out in the modern fitness center, rejuvenate at Elements Spa or simply relax with a cocktail from the Al Fresco bar by the outdoor pool.

The hotel is only 1 mile from Palm Springs International Airport and walking distance to many popular attractions including shops, galleries, museums and nightlife. Close to championship golf tournaments and more. One block from the convention center.

**Rates start at \$150 a night. Rate available 12-19 September ~ Book by 21 August.**

*NB: Room Block discount is available for GRC pre-meeting workshops & fieldtrips.*



*The Pool Bar at the Hilton Palm Springs*

## Why Stay at the Conference Hotels?

GRC strongly encourages you to stay at the two hotels listed above to gain the benefits of networking with colleagues, being close to the event venues, and relaxing in a nice hotel property.

We make every effort to negotiate the best possible rates. When you stay at the conference hotels, you help GRC meet our contractual obligations, avoid paying financial damages for this meeting, secure suitable venues and preferred dates-and-rates for future conferences.

**BOOK YOUR ROOM!**



# FLOOR PLANS

## Palm Springs Convention Center and Renaissance Hotel



andreas parking = 400 spaces

TO DOWNTOWN PALM SPRINGS →

EAST ANDREAS ROAD



NORTH CALLE ALVARADO



**I** = Information Desk Services

- Local Dining Suggestions
- Local Dining Reservations
- Area Attractions/Tours
- Maps/Directions
- Transportation:
  - Taxi
  - Hotel Shuttle & Limousine
- Airline Boarding Pass Printing
- Lost and Found

**\$** = ATM

amado parking = 480 spaces

east lot parking



# EXPO

Every year, the Expo hosts one of the world's largest gathering of vendors providing support for geothermal resource exploration, characterization, development, production and management.

The trade show provides a unique opportunity for exhibitors to showcase their projects, equipment, services and state of the art technology to the geothermal community. More than 100 exhibitors are expected. For more information about exhibiting please visit the Exhibitor Portal...

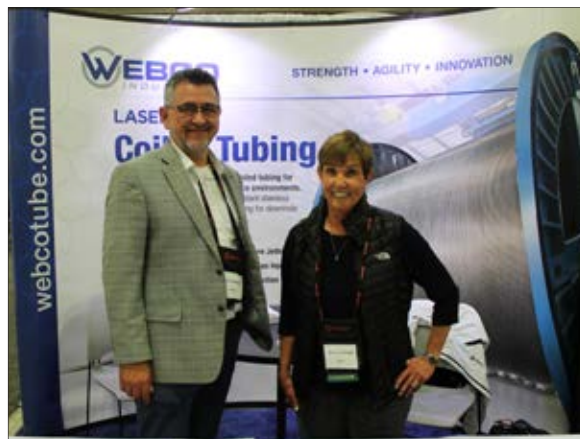
List of Exhibitors (as of June 12). Please check on the GRC website for current information:

| <b>EXHIBITORS</b>                                 | <b>BOOTH #</b> | <b>EXHIBITORS</b>                 | <b>BOOTH #</b> |
|---------------------------------------------------|----------------|-----------------------------------|----------------|
| A.W. Chesterton                                   | 307            | PCC Metals Group                  | 429            |
| AMSA                                              | 413            | PM International Suppliers LLC    | 141            |
| Boart Longyear Company                            | 431            | POWER Engineers                   | 220            |
| BS&B Safety Systems                               | 406            | PowerChem Technology              | 311 & 410      |
| Case RMC                                          | 117            | Probe (formerly Kuster)           | 520            |
| C-FER Technologies (1999) Inc.                    | 403 & 502      | Quantec Geoscience Limited        | 409            |
| CFM San Diego                                     | 526            | Quantum Spatial, Inc              | 36             |
| CGG Geoscience                                    | 210            | Rexa                              | 528            |
| Department Of Oil Gas and<br>Geothermal Resources | 411            | Scientific Drilling International | 440            |
| EGESIM                                            | 301            | Seequent                          | 222            |
| Emerson/Caltrol, Inc.                             | 414 & 416      | Sinclair Well Products            | 427            |
| EvapTech                                          | 407            | Solenis LLC                       | 214            |
| Exergy Spa                                        | 212            | Southern California Valve         | 530            |
| Fuji                                              | 430 & 432      | Suez                              | 224            |
| Gardner Denver Nash                               | 309            | Thermochem                        | 401 & 500      |
| GeoMechanics Technologies                         | 341            | TNG Energy Services               | 226 & 228      |
| GeothermEx                                        | 107 & 206      | Torishima Pump Mfg.               | 506            |
| Horizon Well Logging                              | 216            | Tsurumi Manufacturing Co., Ltd.   | 415            |
| Karlsruhe Institute of Technology                 | 208            | Turboden                          | 230, 232, 234  |
| Maxwell Oil Tools                                 | 240            | U.S. Bureau of Land Management    | 514            |
| Mitsubishi Hitachi Power Systems                  | 230, 232, 234  | Utah FORGE                        | 417            |
| Nalco                                             | 433 & 532      | Veizades & Associates, Inc.       | 408            |
| Nevada Division of Minerals                       | 516            | Webco                             | 434            |
| Ormat                                             | 201            | Well Analysis Corporation         | 333 & 335      |
| Paul Graham Drilling & Service Co                 | 315 & 317      | Wieland Thermal Solutions         | 331            |

**DON'T MISS OUT! Booths still available!! Reserve your space at the Exhibitor Portal...**



The GRC Expo is one of the world's largest gathering of geothermal energy vendors.



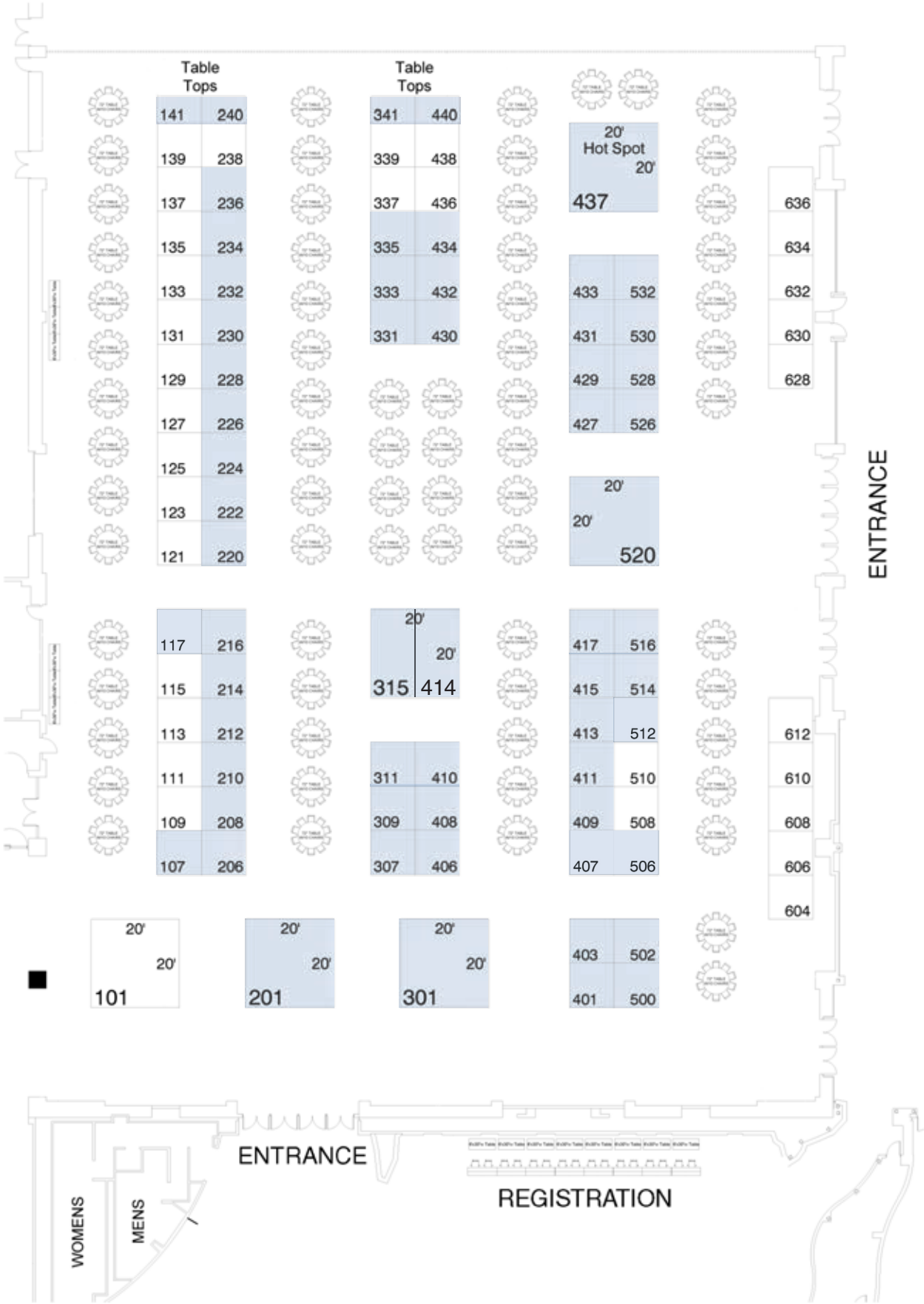
The folks from Webco will be ready to answer your questions.

# Geothermal Resources Council & Expo

SEPTEMBER 15-18, 2019

PALM SPRINGS CONVENTION CENTER | OASIS BALLROOM 1 & 2

REV. 6/19



# GRC 2019 ANNUAL MEETING & EXPO REGISTRATION FORM

SEPTEMBER 15-18 | PALM SPRINGS, CALIFORNIA | PALM SPRINGS CONVENTION CENTER

SEPT  
15-18



## REGISTRATION INFORMATION

FIRST & LAST NAME \_\_\_\_\_

NAME ON BADGE \_\_\_\_\_

NAME OF COMPANY OR INSTITUTION \_\_\_\_\_

ADDRESS \_\_\_\_\_

CITY \_\_\_\_\_ STATE/PROVINCE \_\_\_\_\_ POSTAL CODE \_\_\_\_\_

COUNTRY \_\_\_\_\_

PHONE \_\_\_\_\_

FAX \_\_\_\_\_

E-MAIL \_\_\_\_\_

### Full Conference Registration Options:

(Includes access to the Technical Sessions, Expo Hall, Sunday Night Receptions and lunches for the days selected. Only 3-day passes will include a Transactions, Vol. 43 Flash Drive)

- |                                                                                                                                           |                          |          |
|-------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|----------|
| <input type="checkbox"/> 3-Day: GRC Member Registration (Does NOT include 2020 Membership)                                                | (early bird) \$980       | \$ _____ |
| <i>Don't Forget to Renew Your Membership on the Next Page!</i>                                                                            | (after July 31st) \$1130 | \$ _____ |
| <input type="checkbox"/> 3-Day: Non-GRC Member Registration (Includes 2020 Membership dues)                                               | (early bird) \$1180      | \$ _____ |
| <input type="checkbox"/> Do not want a GRC Membership                                                                                     | (after July 31st) \$1330 | \$ _____ |
| <input type="checkbox"/> 3-Day: Student Registration (must fax or email a copy of current academic ID or class registration)              | (early bird) \$150       | \$ _____ |
| (Includes Trivia Contest & 2020 Membership dues)                                                                                          | (after July 31st) \$175  | \$ _____ |
| 1-Day: (early bird) <input type="checkbox"/> \$525 Monday <input type="checkbox"/> \$525 Tuesday <input type="checkbox"/> \$375 Wednesday |                          |          |
| (after July 31st) <input type="checkbox"/> \$625 Monday <input type="checkbox"/> \$625 Tuesday <input type="checkbox"/> \$475 Wednesday   |                          | \$ _____ |
| 1 Day pass does NOT include 2020 Membership dues)                                                                                         |                          |          |

**Guest Option:** A Full Conference Pass includes up to 2 complimentary guest pass(es) to the Expo only (does not include lunch). Please include the names of the accompanying guest(s) if any:

### Expo Only Registration Options:

- |                                                                                  |                           |          |
|----------------------------------------------------------------------------------|---------------------------|----------|
| <input type="checkbox"/> 3-Day Registration (includes Sunday Night receptions)   | \$375                     | \$ _____ |
| <input type="checkbox"/> 1-Day: <input type="checkbox"/> Sunday Night Receptions | \$175                     | \$ _____ |
| <input type="checkbox"/> Monday                                                  | \$225                     | \$ _____ |
| <input type="checkbox"/> Tuesday                                                 | \$225                     | \$ _____ |
| <input type="checkbox"/> Wednesday                                               | (open to the public) FREE | \$ _____ |

### Additional Lunch Tickets & Transactions Flash Drive Options:

Additional Lunch Tickets at \$55 per ticket (include number of tickets for each day):

- |                                                                                                                       |                    |          |
|-----------------------------------------------------------------------------------------------------------------------|--------------------|----------|
| <input type="checkbox"/> _____ Monday <input type="checkbox"/> _____ Tuesday <input type="checkbox"/> _____ Wednesday | \$55 <sub>ea</sub> | \$ _____ |
|-----------------------------------------------------------------------------------------------------------------------|--------------------|----------|

Additional copies of Transactions, Vol. 43 on Flash Drive: (picked up only at registration counter)

(Post-meeting price is \$50) Quantity: \_\_\_\_\_ \$35<sub>ea</sub> \$ \_\_\_\_\_

**Page 1 SUBTOTAL:**

\_\_\_\_\_

## REGISTER EARLY!

As of August 1st, registration will require an additional fee of up to \$150 per person. On-site registration will be charged an additional \$50 late fee.

**Early Bird Registration Expires: July 31, 2019.**

(must be postmarked or faxed by 7/31/19)

## 5 EASY WAY TO REGISTER:

1. my.geothermal.org
2. Fax: 530.758.2839
3. Phone: 530.758.2360 ext. 100
4. Email: alay@geothermal.org
5. Mail: GRC, PO Box 1350, Davis, CA 95817

CONTINUED ON NEXT PAGE...



# REGISTRATION FORM

SEPTEMBER 15-18 | PALM SPRINGS, CALIFORNIA | PALM SPRINGS CONVENTION CENTER

## 2020 MEMBERSHIP RENEWAL

(Tier pricing is based on the current World Bank classification. Please visit the GRC Membership page: <http://my.geothermal.org> to find out what Tier your country is in.

- Regular Tier 1: \$130 Tier 2: \$78 Tier 3: \$39 \$ \_\_\_\_\_
- Retired Tier 1: \$65 Tier 2: \$39 Tier 3: \$20 \$ \_\_\_\_\_
- Benefactor \$230 \$ \_\_\_\_\_
- Company/Institutional \$650 \$ \_\_\_\_\_
- Supporting \$1,300 \$ \_\_\_\_\_
- Sustaining \$2,275 \$ \_\_\_\_\_
- Patron \$3,250 \$ \_\_\_\_\_

## 2020 POLICY COMMITTEE MEMBERSHIP

(fees are in addition to GRC membership fees)

- Individual/Student/Faculty \$100 \$ \_\_\_\_\_  
(available only to GRC members)
- Corporate Level \$1,000 \$ \_\_\_\_\_  
(available only to GRC Corporate Level members)
- Board Level \$10,000 \$ \_\_\_\_\_  
(available only to GRC Supporting/Sustaining/Patron members)

## FOUNDATION DONATION

- Education  Publication  Pioneer \$ \_\_\_\_\_

## OPTIONAL EVENTS:

(Provide total based on number of persons)

### Monday, September 16, 2019, 6:30pm-10:00pm

- GRC Mixer at Air Museum Ticket (early bird) \$75 \$ \_\_\_\_\_  
(onsite price will be \$95) (after July 31st) \$85 \$ \_\_\_\_\_

### Tuesday, September 17, 2019, 12:30pm-1:30pm

- Trivia Contest Individual Registration \$30 \$ \_\_\_\_\_  
(FREE for Students)

## FIELD TRIPS:

### Saturday, September 14, 2019 (Half Day)

- San Andreas Fault Jeep Tour \$250 \$ \_\_\_\_\_

### Sunday, September 15, 2019 (Half Day)

- Palm Canyon Hiking Tour \$150 \$ \_\_\_\_\_

### Wed. & Thur., September 18-19, 2019 (Two Days)

- Imperial Valley \$250 \$ \_\_\_\_\_

(Overnight accomodation is **double occupancy** - some meals included)

### Wed. & Thur., September 18-19, 2019 (Two Days)

- Coso Geothermal \$375 \$ \_\_\_\_\_

(Overnight accomodation is **single occupancy** - some meals included)

Additional ID verification is required for this trip. See website for more details.

**CANCELLATIONS:** If you must cancel your registration please notify the GRC by August 16th in order to receive a refund (minus a \$100.00 handling fee). Cancellations received after August 16th cannot be refunded. Substitution(s) can be made at any time, with prior approval.

## WORKSHOPS:

### Friday & Saturday, September 13-14, 2019

New Frontiers in EGS Technology

**By July 31: Starting Aug. 1**

- Member \$650 \$750 \$ \_\_\_\_\_
- Non-Member \$750 \$850 \$ \_\_\_\_\_
- Student \$225 \$275 \$ \_\_\_\_\_

### Saturday, September 14, 2019

Supercritical & Superhot Geothermal Resources

**By July 31: Starting Aug. 1**

- Member \$375 \$475 \$ \_\_\_\_\_
- Non-Member \$475 \$575 \$ \_\_\_\_\_
- Student \$175 \$225 \$ \_\_\_\_\_

## DIETARY RESTRICTIONS:

- Check here if you would like vegetarian meals.

Other dietary restrictions: \_\_\_\_\_

|                            |          |
|----------------------------|----------|
| <b>Total This Page</b>     | \$ _____ |
| <b>Total Previous Page</b> | \$ _____ |
| <b>TOTAL ENCLOSED</b>      | \$ _____ |

## PAYMENT INFORMATION:

Pre-payment by one of the following methods must accompany this form. The GRC cannot bill participants.

- Check payable to Geothermal Resources Council in U.S. currency through a U.S. bank.
- Government Purchase Order (please enclose)

Please charge my:

- VISA  MasterCard  American Express

|                             |                 |
|-----------------------------|-----------------|
| NAME ON CARD (please print) |                 |
| BILLING ADDRESS             |                 |
| CREDIT CARD NO.             | EXPIRATION DATE |
| SIGNATURE                   |                 |

By registering for the GRC Annual Meeting & Expo and/or adding your personal data to the GRC database for the use of the GRC websites, and/or to receive communications of our newsletters, emails announcements, etc., you are agreeing to the terms and conditions outlined in the GRC Privacy Policy which includes using your contact information for an attendees list. The GRC Privacy Policy can be viewed on the GRC Website: [https://geothermal.org/Privacy\\_Policy.html](https://geothermal.org/Privacy_Policy.html). For a copy of the Privacy Policy to be emailed or mailed to you or if you would like to opt out of including your information on an attendees list, please contact the GRC office.