GRC and GEA Unify - A New Start
New Members of the GRC Board of Directors
Bulletin Goes Digital
GRC Annual Meeting & GEA GeoExpo+ 2017
- The Awards
Smarter Subterranean Strategies

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PART OF THE CLEAN STEAM REVOLUTION
President’s Message
by Maria Richards

Communication from the GRC
by Ian Crawford

Inside Geothermal: North America, Central & South America, Australasia, Asia, Africa, Europe, Education, Technology, Climate Change
by Ian Crawford

Geothermal 2.0: Superior Value + Operational Flexibility = New Contracts
by Paul Thomsen

The 41st GRC Annual Meeting & GEA GeoExpo+ - Part Two
- The GRC Awards
- The Poster and Technical Session Awards
- The GEA GeoExpo+

This Just In! Late breaking news from the global geothermal community
by Ian Crawford

Uncovering the Caribbean Treasure - Geothermal Energy
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Publications, Websites, Video & Maps
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New GRC Members

Calendar of Events

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COVER: Power in the Dark, by Robert Zierenberg, Davis, California, USA. Early afternoon sunset on a calm late December day over the Reykjanes geothermal field. Honorable Mention in the 2017 GRC Photo Contest.
The New GRC Membership Website  
www.my.geothermal.org

Highlights Include:
• Events: Allows you to register for GRC Events such as the GRC Annual Meeting.
• Directory: Allows you to search and view other GRC members’ public profile. Only available to current members.
• My Account: Allows you view your profile, update your information, renew your membership and pay invoices.
• Shopping Cart: You can now pay all your dues and invoices together.

My Account:
• Photo: You can now upload a headshot of yourself
• Bio: Allows you to upload your bio or resume that can be viewed and downloaded by other GRC members.
• Social Media Links: You can now link your personal social media sites to your profile for other members to view.

Update Your Profile Today!

Public Profile:
• Exclusive Access: Restricted to current GRC Members only.
• Advertise Your Services: Members can find your information and download your bio/resume.
• Stay Connected: Allow members to follow you on your social media links.
President’s Message
by Maria Richards

Welcome

It’s a new year and with it comes the enthusiasm of a fresh start. This year there are certainly many reasons to have enthusiasm for the Geothermal Resources Council (GRC)!

Welcome to our new members who are joining GRC as a result of the unification with the Geothermal Energy Association. Your ideas and skills are going to be an important contribution to the long-term success of this organization. It was exciting to see that 93% of the vote was for unification.

Welcome to our new members on the GRC Board of Directors: Ann Robertson-Tait, Josh Nordquist, Jennifer Livermore, and Roland Horne. As a working Board you are going to gain a new understanding of the value and strength of the GRC and help us continue to grow because of your diverse experience. As you step-up so will Stuart Johnson, Karl Urbank, Dennis Kaspereit, and Patrick Hanson leave the Board. A special Thank You to each of them for years of dedication to the Board and the GRC membership!

Welcome to those in the broader renewable energy industry: solar, wind, biomass, and waste-heat. The GRC Vision is for “An open exchange of geothermal information to meet the world’s energy demand in a manner that is environmentally responsible.” Through working side-by-side with your industries we will succeed in developing the projects that provide for an environmentally responsible and economically strong world.

Welcome to the new age of a digital GRC Bulletin. As the first digital only edition (no printed issues showing up in our mailboxes anymore), I’m aware that we have not yet gone fully digital. Our staff is exploring new ways to enhance our Bulletin as we now have room to grow content, incorporate interactive applications and even change the timing of the Bulletin. All the fences are being taken down and the sky’s the limit for where we can go in delivering the most educational and enjoyable magazine.

Therefore, read on and think big as you do so! Pass along the GRC Bulletin articles that you find insightful to friends and colleagues and send feedback to the Editor Ian Crawford on what you liked and disliked about this digital version.

From the constant GRC Twitter, Facebook and LinkedIn news feeds, to the regularly updated Global Geothermal News website to the weekly Global Geothermal News - Weekly Update, to this bi-monthly Bulletin, there is enough material from the GRC to keep you busy just keeping up with other people’s news. Therefore, I welcome you in 2018 to join me in learning mindfulness meditation. Give yourself the opportunity to start with even 10 seconds as a starting point and explore what you can achieve. The goal is for improved health and more clear ideas for geothermal success in 2018 and beyond. To get you started, here is some space to allow your mind to let go.

We welcome new ideas ... in fact, we want your ideas and votes. Yes, the GRC is a democratic organization where you as a member can vote for or against suggested changes to our association. For years only 1/3 of the GRC members cast their vote and this past November and December counts were the same. I’m bringing this up now because you get to have another chance to be active and vote on an important matter, the name of the newly unified organization. Do we keep “Geothermal Resources Council” or do we change it? Watch for the email announcement and then cast your vote. As President, it’s more enjoyable when everyone is involved.... 100%. It’s your turn to help us decide the future course of the GRC for years to come!

Welcome to OUR success!
The GRC Bulletin - A New Era

After 45 years of printed publication the voice of the Geothermal Resources Council - the GRC Bulletin - is transitioning to the newest technology. As of this issue, the magazine only available as a PDF file online.

In addition to a reduction in the cost of printing and mailing this innovation will give our members and subscribers better access to the essential news and information from the global geothermal community.

The online GRC Bulletin is now available - for members only* - on the GRC Library website at www.geothermal-library.org.

* Please Note: The GRC Bulletin is a member benefit. To retain this value we can only offer the online version from the members only area of the GRC Library. To access the magazine online you will need to have a Member ID and password. Contact the GRC Librarian, Brian Schmidt at bschmidt@geothermal.org If you need help in this process or have any questions.

Geothermal Resources Council and Geothermal Energy Association Members Overwhelmingly Vote for Unification

The Geothermal Resources Council (GRC) and the Geothermal Energy Association (GEA) are excited to announce their unification. Combining the GRC and GEA strengthens the voice of our industry with a single organization devoted to advancing the science, education, and development of renewable geothermal energy resources.

Members of both organizations voted on the decision to unify and the results were overwhelmingly in favor. They will benefit from an increased value for their dues and improved networking relationships as the geothermal community moves forward together.

The activities of the GEA will be transitioned into the GRC in early 2018. One of the key activities is already underway through the establishment of a special committee, the GRC Policy Committee. This committee will focus on educating and lobbying leaders at state and federal levels to expand their knowledge about the geothermal industry. The committee will also assist the geothermal community in its awareness of opportunities to expand renewable energy projects, building a stronger platform for the entire U.S. energy grid. All members are encouraged to join in this new effort.

"Together, the now unified GRC and GEA can advance the geothermal community in more ways to connect with the larger energy industry and create a clean environment for future generations to enjoy," stated Maria Richards, President of the GRC Board of Directors.

Doug Glaspey, President of the Board of Directors for the GEA said, "The members of GEA look forward to working within a single organization to advocate for and advance sound geothermal law and policy that will expand our industry. The unification of our two organizations will allow us to pursue this mission in the most efficient manner possible."

The GRC will continue as a non-profit, 501(c)3 corporation serving as the professional educational association for the international geothermal community, as a focal point for continuing professional development through outreach, information transfer and education services.

The GRC’s Policy Committee will file an annual 501 (h) election, which allows them to conduct legislative and regulatory advocacy. An additional membership fee to join the Policy Committee will
raise the funds for their activities. This provides
the GRC with a mechanism to keep their primary
members’ dues and funding completely separate.

The headquarters for the unified organization
will be in Davis, California and operate under
the name “Geothermal Resources Council” until
further discussion of a possible name change is
completed.

For information on the GRC and the new Policy
committee, please contact Estela Smith at 530-758-
2360 or grc@geothermal.org.

Search Begins for Executive Director
of GRC

The process of recruiting to fill the vacant GRC
Executive Director role has begun. A resume and
a cover letter should be submitted no later than
February 9, 2018.

The successful applicant must be an
experienced, confident, team-oriented leader. This
position is an exempt, professional management
job with a flexible, 40-hr work week. The successful
applicant will receive a 1-3 year contract with
annual performance reviews. Employment is on an
"at-will" basis.

More information can be found on the GRC
website at: https://geothermal.org/employment.

Four New Members of the GRC Board
of Directors

The Geothermal Resources Council (GRC) is
governed by a Board of Directors, elected by the
general membership to 2-year terms. To provide
continuity, half of the Board is elected every year.

All GRC members are eligible for election to the
Board of Directors.

The global GRC membership took part in the
ballot in November, and the result was that four
new members of the Board were elected: Roland
Horne, Jennifer Livermore, Josh Nordquist and
Ann Robertson-Tait.

They join nine other members who have been
re-elected to the Board of Directors: Dave Boden,
Marcelo DeCamargo, Kevin Kitz, Danielle
Matthews-Seperas, Bill Rickard, Elaine Sison-
Lebrilla, Gene Suemnicht, Kevin Wallace and
Patrick Walsh.

Photos of the new Board of Directors can be
seen on the GRC Website at www.geothermal.org/
BOD.html

Reservations can now be made for hotel rooms for
next year’s GRC Annual Meeting & Expo in Reno,
Nevada, USA, October 14-17, 2018.

Reserve your room now...... https://aws.
passkey.com/event/49537648/owner/7268/home

All the events and accommodation are in one
location, the luxurious Peppermill Resort Spa
Casino, the only resort in the United States whose
heating source is totally provided from geothermal
energy produced on the immediate property.

There is a choice of three room styles at
discounted rates. In the Peppermill North and
West Wings the room rates start at an affordable
$89 a night. The award winning luxurious Tower
Rooms offer panoramic views of the majestic
Sierra Nevada mountains and are available
from $109 a night. Top of the line are the lavish
accommodations in the Tuscan Tower at $149
a night. The discount ends September 19, 2018.

Attendees can make their reservations on a
secure website prepared specially
for the GRC. The links are available
from the GRC Annual Meeting
website at: www.geothermal.org/
meet-new.html.

The new members of the Board of Directors (From left to right) Roland Horne, Jennifer Livermore,
Josh Nordquist and Ann Robertson-Tait.
Exhibitors can now reserve their booth

Exhibitors who desire a booth at the Expo should contact the GRC. Contact Anh Lay at alay@geothermal.org or (530) 758-2360 for more information. All the essential information will also be available on the GRC Annual Meeting website at: www.geothermal.org/meet-new.html.

Call for Sessions

New this year to the GRC Annual Meeting is a “Call for Sessions” – we are inviting the proposals for sessions at this year’s meeting. Sessions can be organized and led by up to three people, a session chair and two co-chairs. Successful session chairs will be expected to assist the technical chair recruit papers and organize reviews.

The Session Proposal process is simple, please email a Session Title and Description to Anh Lay at alay@geothermal.org by February 18, 2018.

Details on the requirements of the proposal are detailed below:

Session Title: Session proposals must include an informative title (20-300 characters, not including spaces) and entered in initial capitalization.

Description: The session description is limited to 250 words. The description will be used during the review process. Session descriptions will be reviewed by the GRC Annual Meeting committee for inclusion in the meeting. Successful session proposals will be listed on the GRC website during the abstract submission phase to assist submitters in identifying an appropriate session to submit their abstract.

Descriptions must adhere to the following criteria:

• Concise definition of the scientific topic.
• Proposals must focus on scientific results and/or their applications.
• Explain why the session is topical and relevant.

• Sessions in tribute of a specific person will be considered, but appropriate justification must be provided.
• Session proposals that are deemed to be primarily advertisements of commercial products and services will not be considered.
• Session proposals focused a specific experiment or development are encouraged.

Optional: Please include the names of any specific people that you would recruit to write a paper for this session.

A separate “Call for Papers” will be released once sessions are reviewed and selected.

GRC Scholarships 2018

The Geothermal Resources Council (GRC) is pleased to announce the availability of the 2018 GRC Scholarship Awards.

To qualify for one of these awards a student must be a GRC member (student memberships are only $5 per year) as well as a student in an accredited academic institution. Selection of recipients will be based upon a variety of factors, including the individual’s academic record, student activities, geothermal industry experience, and career goals.

The following awards are available:

• Two (2) GRC Undergraduate Scholarship Awards of $1,500 – to be eligible for one of these awards, the candidate must be a third or fourth year undergraduate at an accredited institution. For applicants in fields other than engineering or the geosciences, a clear connection to geothermal production must be demonstrated by the applicant. (Fall 2018)

• Three (3) GRC Graduate Scholarship Awards of $2,500 – to be eligible for one of these awards, the candidate must be enrolled in a graduate-level program at an accredited institution. For applicants in fields other than engineering or the geosciences, a clear connection to geothermal production must be demonstrated by the applicant. (Fall 2018)

• One (1) Student Geothermal Project Award of $4,500 – selection of recipient will be based primarily upon the creation and description of a geothermal-focused project, though other
factors such as the individual’s academic record, student activities, geothermal industry experience, and career goals will factor into the determination as well. The project can represent a variety of academic subjects, including, but not limited to, geosciences, engineering, and economics. The primary requirement is that the project be focused on some aspect of geothermal power production, geothermal direct use applications or geothermal heat pumps.

Applications must be received by May 25, 2018 to be considered.

For application instructions and other details see the announcement on the GRC website at: www.geothermal.org/students.html. Please direct questions regarding the scholarship awards to: Brian Schmidt, bschmidt@geothermal.org or 530-758-2360, ext. 107.
Inside Geothermal

We are taking advantage of this, the first all digital issue of the GRC Bulletin, to provide a better source for your geothermal energy news. We will still provide the global coverage you have come to expect but we will present it here in a more condensed form.

For more information on the news item and a link to the original source, click on the Global Geothermal News link at the end of each story. You will then link to the award-winning news website of the GRC, a source for all your geothermal energy news, updated at least twice a day.

The Global Geothermal News can also be received as a daily newsletter summary - sign up at http://feeds.feedburner.com/GlobalGeothermalNews.

A weekly update of Global Geothermal News is also sent to all members of the GRC as an email newsletter.

Billionaires’ Renewable Energy Fund Details Interest in Geothermal Energy Technologies

Two years after it was first unveiled, Breakthrough Energy Ventures (BEV) - a billion dollar fund to finance breakthroughs in energy technology - is finally pulling back the curtain a little bit.

Founder Bill Gates of Microsoft explained online why BEV has chosen geothermal energy as one of the five technologies: "There is a phenomenal amount of energy stored up as heat under the Earth's surface—many times more than we could get from all the known coal and oil reserves in the world. Tapping this source involves pumping steam or hot water from underground to drive turbines."

According to their website, BEV believes recent advances in drilling technology present interesting new opportunities for geothermal. "Techniques like horizontal drilling, multilateral drilling, extended reach drilling, complex path drilling, and hydraulic fracturing, or fracking, all developed to extract fossil resources, offer interesting possibilities for geothermal energy."

Dear Mr. Gates,

We wanted to thank you for your blog post of December 12 on the “4 Signs of Progress on Climate Change” and your commitment on finding solutions to climate change. We read this piece with great interest, specifically on your commitment towards “especially promising but also underfunded” areas in clean energy investments, including geothermal power.

We are extremely pleased to see this commitment towards geothermal energy and agree with your statement that it is “a phenomenal amount of energy stored up as heat under the Earth’s surface”. We are the International Geothermal Association, and the undersigned 31 people are together forming its Board of Directors. We represent countries, companies, research institutes, and universities. All with a passion for geothermal energy and a dedication to see the geothermal industry thrive.

We love the efforts and the goal of Breakthrough Energy Ventures and the initial investment areas of focus. We share your view that heat stored near-surface in volcanic islands are the quick wins. We also take note that mature techniques, notably from the petroleum industry, help to unlock geothermal resources deeper in the subsurface.

This is exactly why we are engaged and committed to bring geothermal further: the quick wins are done. We need to push harder, collaborate together, and work effectively towards connecting those unexploited geographic areas to their phenomenal energy source beneath their feet. We are keen to work with you and your Breakthrough Energy Ventures to make this happen. [Click on the following link to read the rest of the letter].

Global Geothermal News......
USD 50 Million in Loans Available for Renewable Energy Projects

The International Renewable Energy Agency (IRENA), in partnership with the Abu Dhabi Fund for Development (ADFD), is inviting applications for funding for renewable energy projects in developing countries. Within the framework of the ADFD-funded USD 350 million (AED1.285 billion) IRENA/ADFD Project Facility, the current funding round of USD 50 million in concessional loans marks the sixth of seven annual cycles.

The projects selected for the fifth funding cycle will be announced in January 2018.

Applications for the sixth cycle will be accepted until 17:00 GST on February 15, 2018. Global Geothermal News........

Report Shows Continued Decline in Cost of Generating Electricity from Alternative Energy Technologies

Lazard’s latest annual Levelized Cost of Energy Analysis (LCOE 11.0) shows a continued decline in the cost of generating electricity from alternative energy technologies. Global Geothermal News......

NORTH AMERICA

ARPA-E Issues OPEN Funding Opportunity Announcement to Support Early-Stage Energy R&D

The U.S. Department of Energy (DOE) has announced up to USD 100 million in funding for new projects as part of the Advanced Research Projects Agency-Energy’s (ARPA E) latest OPEN funding opportunity. OPEN will support America’s top innovators through dozens of early-stage research and development projects as they build technologies to transform the nation’s energy system.

The deadline to submit a concept paper is February 12, 2018 at 5:00 p.m. E.T. Global Geothermal News........

More than One Million Dollars Available for Geothermal Energy Research

As part of the U.S. Department of Energy - Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) Program a recent update has further information on the topics to be funded - included are two geothermal energy technologies:
Inside Geothermal

- Low Enthalpy Geothermal Forward Osmosis
- Dispatchable Geothermal Operations

The Maximum Phase I Award Amount is USD 150,000 increasing to a Maximum Phase II Award Amount of USD 1,000,000.

Applications for SBIR Phase I and STTR Phase I are being accepted. Letter of Intent Due Date is Monday, January 8, 2018 and the Application Due Date is Monday, February 26, 2018.

Global Geothermal News..........

Latest Figures Highlight Golden State’s Prominence in Geothermal Energy

California on its own is #1 in the world for geothermal energy production, with 2,694 MW of capacity, about 19.5% of the global total.

California recently set a new goal to increase the renewable content of its electricity from one third to 50 percent by 2030. The state also has a goal to install 12,000 MW of renewable distributed generation. The California Energy Commission (CEC) is tracking progress toward achieving its renewable goals and the status of permitting and constructing new renewable energy facilities in California.

Highlights for geothermal energy in California:
- Geothermal produces 13,000 GWh a year of Renewables Portfolio Standard Eligible Generation or 17% of the total for renewable energy.
- Geothermal provides 2,694 MW of capacity from 43 power plants, 10% of the total for renewables.
- There are 7 outstanding Environmental Permits issued by the CEC for possible near-term geothermal power projects for a total of 381 MW capacity.

Global Geothermal News..........

Geothermal Energy Exploration Bill Passes Out of Committee

The U.S. House Natural Resources Committee has approved legislation from Idaho 1st District GOP Rep. Raul Labrador to ease regulation on development of new geothermal energy resources. The bill, H.R. 4568, passed on a bipartisan voice vote; an earlier version of the bill passed the House in 2012. Global Geothermal News..........

Takeover of Calpine to be Completed First Quarter of 2018

Calpine Corporation has announced that its stockholders approved the acquisition of Calpine by Energy Capital Partners, along with a consortium of investors led by Access Industries and Canada Pension Plan Investment Board, for USD 15.25 per share in cash.

The acquisition is expected to be completed during the first quarter of calendar year 2018, subject to satisfaction of the remaining customary closing conditions, including receipt of certain regulatory approvals.

Calpine operates 13 geothermal power plants at The Geysers, north of San Francisco, California, generating 634.1 net megawatts.

Global Geothermal News..........

Swedish Company to Supply Geothermal Power Plant in Northern California

Swedish company Climeon has received an order for a geothermal power plant in Lassen County in Northern California.

The customer, Wendel Energy Operations I in Susanville, has ordered four Climeon Heat Power systems with delivery in 2018. The power plant has a fifteen years offtake agreement with a local utility and provides vital baseload power to the community. Climeon has been instrumental in structuring the financing of the project.

Global Geothermal News..........

24 MW Tungsten Mountain Geothermal Power Plant Begins Commercial Operation

Ormat Technologies Inc. has announced that the 24 MW Tungsten Mountain geothermal power plant located in Churchill County, Nevada, began commercial operation on December 1, 2017.

Tungsten Mountain will sell its power under a 26-year Power Purchase Agreement (PPA) with the Southern California Public Power Authority (SCPPA), announced in June 2017.

SCPPA resells the entire output of the plant to the Los Angeles Department of Water and Power (LADWP). The power plant is expected to generate
approximately USD 15 million in average annual revenue. *Global Geothermal News*........

**More Wastewater to be Supplied to The Geysers Geothermal Field**

Lake County Special Districts Administrator Jan Coppinger was the guest speaker at the fall Geysers Geothermal Association dinner on November 16.

She reported on the Anderson Springs wastewater project. The Lake County Board of Supervisors has signed a contract for construction of the collection system directing more recycled water to The Geysers Geothermal Field to replenish the geothermal reservoir. *Global Geothermal News*....

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**Deal Reached to Fund Salton Sea Restoration - Permits for Geothermal Power Projects Could be Issued Soon**

Geothermal Energy has an opportunity to provide the revenue for restoring the blighted inland sea.

California regulators have approved a plan to spend nearly USD 400 million over 10 years to slow the shrinking of the state’s largest lake.

The state’s plan contemplates the development of more geothermal power plants near the south shore. There are now 11 geothermal plants in the area, and the state’s plan requires that canals and ponds be built to ensure access to areas where new plants could be built.

Negotiating easements that preserve rights for geothermal development along the south shore has taken longer than anticipated, said Bruce Wilcox, the state’s Assistant Secretary of Salton Sea policy. "That has slowed things down, some permitting has slowed things down a little bit,” Wilcox said. “But I think we are very close to getting those done.” *Global Geothermal News*....

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**GreenFire Energy Gets Shell Support for Demo Closed Loop Geothermal Power Project**

GreenFire Energy Inc. has announced that the Shell GameChanger™ program has agreed to provide financial support for GreenFire’s world’s first demonstration of closed-loop geothermal power generation at a currently inactive well in the Coso California geothermal field.

GreenFire Energy Inc.’s innovative ECO2G™ geothermal well retrofit technology will enable geothermal project owners to generate power from idle or marginal wells at low risk and attractive cost per MWh. Success in geothermal well retrofits will eventually enable GreenFire to develop large-scale ECO2G projects in other locations. *Global Geothermal News*....

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Company Plans to Develop Geothermal Projects in Klamath Basin Using Kalina Cycle Technology

Kalina Power Limited has announced plans to develop geothermal projects in southern Oregon, USA, with Klamath Hills Geothermal LLC (KHG). KHG has projects at various stages of development. The initial project being developed is a 10 MWe project in Klamath County.

Kalina and KHG recently entered into an agreement that all project interests held or developed by KHG will be developed exclusively in conjunction with Kalina using Kalina Cycle technology. The agreement provides terms under which Kalina can earn a majority interest in KHG through its participation and support in project development. Global Geothermal News........

Nevada Utility Seeking Additional 330 MW Renewable Energy

NV Energy is seeking up to 330 MW of additional long-term renewable energy to advance its commitment to clean energy for Nevada.

This 2018 Renewable Energy Request for Proposals provides bidders the opportunity to propose projects ranging in size from 35 MW up to 330 MW. The deadline for bids is February 2, 2018. Global Geothermal News........

New Production Well to be Drilled at San Emidio Geothermal Facility

The Bureau of Land Management (BLM), Winnemucca District, Black Rock Field Office has approved a proposal submitted by US Geothermal Nevada LLC to drill a new geothermal production well at the San Emidio Geothermal Facility located 12 miles south of the town of Gerlach, Washoe County, in the San Emidio Desert basin. The operation is currently a 14.7 MW binary cycle geothermal plant sitting on 40 acres of joint private land and BLM administered lands. Global Geothermal News........

Environmental Assessment for the 45 MW Phase III McGinness Hills Geothermal Expansion Project Available for Public Comment

The BLM Mount Lewis Field Office has prepared and made available for public comment an Environmental Assessment (EA) for the Ormat Phase III McGinness Hills Geothermal 45 MW Expansion Project. Global Geothermal News........

U.S. Geothermal Now Sole Owner of Raft River Power Plant

U.S. Geothermal Inc. has announced it has reached an agreement to acquire its partner’s remaining ownership interest in Raft River Energy I LLC from Goldman Sachs. The purchase was scheduled to close on January 2, 2018 and the price consists of a one-time USD 350,000 cash payment from U.S. Geothermal to Goldman Sachs. The company will then own 100 percent of the project. Global Geothermal News........
California Will Value Geothermal Energy Again as a Baseload Renewable - U.S. Geothermal


According to U.S. Geothermal’s CEO Douglas Glaspey “As we’ve progressed our engineering and operating cost estimates, we’ve endeavored to sharpen our pencil on PPA price and remained confident that we will be successful. The California market is ever-changing and in general we see it moving back toward valuing baseload renewable energy as they increase our overall renewable energy procurement moving toward their 50% RPS requirement. Global Geothermal News........

Arizona Utility to Seek 100 MW of New Renewable Energy in 2018

Salt River Project (SRP) of Arizona is preparing to issue a Request for Proposals (RFP) in early 2018 for 100 MW of new renewable energy. The renewable energy projects selected in the process are intended to help SRP expand its customer-dedicated green energy programs for large commercial and industrial customers.

The RFPs will be issued in January and will consider a number of technologies, including solar, wind, geothermal and biomass. Global Geothermal News........

Geothermal Energy Research in an Abandoned Gold Mine

The Homestake Gold Mine in Lead, South Dakota, was once the largest and deepest gold mine in all of North America. It produced approximately 41 million ounces of gold during 126 years of operation. In 2002, the mine was shuttered when the gold veins vanished. Then, after pumping and maintenance costs increased, the Barrick Gold Corporation let the mine slowly fill with water.

Beginning this year, Lawrence Berkeley National Laboratory (LBNL) is leading a new geothermal research project at the mine, dubbed “COLLAB.”

LBNL is partnering with seven other DOE national labs and six universities to develop field experiments focused on understanding and modeling rock fractures, an essential element of “enhanced geothermal systems.” With this research, they could help unlock 100-plus gigawatts of EGS potential. Global Geothermal News........

Geotheralist Nicole Lautze Wins Clean Energy Education & Empowerment Award

In November, the U.S. Department of Energy co-hosted the sixth annual Clean Energy Education & Empowerment (C3E) Women in Clean Energy Symposium in partnership with the MIT Energy Initiative and Stanford University’s Precourt Institute for Energy.

Among the women recognized and receiving awards was Nicole Lautze in the Education category, an associate faculty member at the University of Hawaii Manoa, where she founded the Hawaii Groundwater and Geothermal Resources Center. She leads a team of senior scientists in the development of an updated geothermal resource assessment for the state of Hawaii. Global Geothermal News........

Legislation to Boost Geothermal Energy Development in Canada Signed Into Law

Bill C-63, a second Act to implement certain provisions of the budget and other measures, has received royal assent and is now law.

The highlights include a boost for geothermal energy in Canada. Accelerated capital cost allowance has been extended to a broader range of geothermal projects and expenses (including eligibility for transmission equipment expenses). The range of geothermal energy project expenses that are eligible as Canadian renewable and conservation expenses, which can be fully deducted in the year incurred, are enlarged.

Also, geothermal projects can claim exploration wells and flow-through shares for all project types as well as other heat transfer equipment. Global Geothermal News........
Valemount Geothermal Power Project Moves Ahead
On December 6th, the BC Ministry of Energy granted a permit extension to Borealis GeoPower for a drill program for a geothermal energy plant along Canoe Reach south of Valemount. The next step for the Calgary-based company is to seek authorizations from the Oil and Gas Commission to start drilling. Global Geothermal News..........

Completion of Alterra Takeover Expected in First Quarter of 2018
Alterra Power Corp. has announced that its shareholders have voted overwhelmingly to approve the previously announced plan of arrangement whereby Innergex Renewable Energy Inc. will acquire all of the issued and outstanding common shares of Alterra.

Alterra has applied for a final order of the Supreme Court of British Columbia approving the arrangement and is in the process of obtaining various regulatory approvals and key third party consents. Completion of the arrangement is expected to occur in the first quarter of 2018. Global Geothermal News..........

Exploratory Drilling Underway at Yukon Geothermal Energy Project
The Ta’an Kwäch’än Council, Da Daghay Development Corporation, in partnership with the Yukon Geological Survey, is undertaking a study of geothermal heat flow in the Whitehorse area.

Drilling of a well is underway at a site about three kilometers west of Takhini Hot Springs on Settlement Land of the Ta’an Kwäch’än Council. Downhole temperatures will be monitored for up to a year in partnership with the Da Daghay Development Corporation to determine the geothermal gradient at this location.

Funding for the project is through the Government of Yukon and the Government of Canada. Global Geothermal News..........

Project Showcases Potential for Geothermal Energy at British Columbia Site
A new Geoscience BC project to share historical data about geothermal heat and power potential at Mount Meager, in southwestern British Columbia, has been released.

The information, which is available on the Geoscience BC website can be used to better understand the characteristics of the rock types and subsurface geological structures that might contain geothermal resources. This is essential for assessing the viability of geothermal energy and heat in the area north of Whistler. Global Geothermal News..........

25 MW Los Humeros III Phase A Geothermal Power Plant Inaugurated
General Director of the Federal Electricity Commission (FCE), Jaime Hernández Martínez, helped inaugurate the 25 MW extension of the Humeros complex making the total capacity 94 MW. Global Geothermal News..........

More Grants Provided to Support Sustainable Geothermal Development in Eastern Caribbean
The formalization of an EU grant contribution to the Geothermal Risk Mitigation Programme for the Eastern Caribbean has been announced, facilitating the development of up to 60 MW of geothermal energy capacity in up to five countries – Dominica, Grenada, St. Kitts and Nevis, Saint Lucia, and St. Vincent and the Grenadines.

The EUR 12 million in grant funding will be used to provide investment grants at the exploration phase, as well as technical assistance to support capacity-building initiatives and studies that explore opportunities for, and the feasibility of, interconnection between islands to facilitate the export of electricity by geothermal energy producers. Global Geothermal News..........

European Commissioner for International Cooperation and Development Neven Mimica meets with Dr. William Warren Smith, President of the Caribbean Development Bank. (Courtesy European Union)
European Union Provides Funds for Geothermal Energy Development on Dominica

The European Union has provided Dominica with EUR 3.52 million as part of continued assistance towards rehabilitation of the country. The funds will assist the government in establishing a legal framework for the development of geothermal energy and technology. A unit will also be set up to promote geothermal investments, ensure the efficient use of the geothermal resources, and to monitor all safety issues relating to the operation of geothermal plants. Global Geothermal News..........

Drilling Begins at Nevis Geothermal Project

Drilling of exploration test wells for the geothermal energy project on Nevis is expected to be completed by the end of January, according to Deputy Premier, Hon. Mark Brantley.

This well is to confirm geothermal reservoir properties including flow rate, temperature and sustainability. Global Geothermal News..........

CENTRAL & SOUTH AMERICA

Second Call for EOI in Funding for Geothermal Projects in Latin America

The Geothermal Development Facility for Latin America (GDF) has announced that the second call for Expressions of Interest (EOI) in grant funding for geothermal projects began on December 1, 2017 and will close January 31, 2018.

The Pre-EOI sign-up phase is continuous and interested developers can complete the mandatory sign-up phase prior to completing the EOI.

As a point of reference, 100% of the developers that expressed an interest in the first call for EOI and then later submitted proposals were funded, totaling EUR 22 million for four surface study grants and four confirmation drilling grants, in six countries. Global Geothermal News..........

Third Well at San Jacinto Geothermal Project Drilled

Polaris Infrastructure Inc. reports that with the availability of the rig and favorable economies of scale associated with drilling multiple wells, Polaris Energy Nicaragua S.A (PENSA) is moving forward with plans to drill a third new production well as part of the 2017 San Jacinto drilling program.

This well, SJ 12-5, will be drilled off the same well-pad as SJ 12-4, likely targeting further expansion of the production zone at San Jacinto to the north or northwest. Drilling was expected to commence in November 2017. Global Geothermal News..........

Enel Wins 33 MW of New Geothermal Capacity in Chile Tender

Enel S.p.A., acting through its subsidiary Enel Generación Chile, has been awarded the supply of 33 MW of geothermal energy from resources in the Antofagasta region to a number of Chilean distribution companies through a tender launched by the country’s National Energy Commission (Comisión Nacional de Energía), and aimed at meeting the energy demand of regulated market customers over the 2024-2043 period. Global Geothermal News..........

Exploration About to Begin at Socompa Volcanic Geothermal Project in Argentina

Exploration was due to begin in the second half of January at the Socompa Volcanic Geothermal Project on the border of Argentina and Chile, within the agreement made with the provincial state company Salta Energy and Mining Resources (REMSA). Global Geothermal News..........

AUSTRALASIA

Twenty Possible Sites Identified for Geothermal Energy Power Plants in Australia

Australia’s first grid-connected geothermal power plant should be up and running soon. The commissioning of the Winton geothermal power plant and its connection to the grid was planned for January or early February.

The Queensland Local Government Association’s corporate entity Peak Services is partnering with local councils to make other geothermal power plants a reality.

Jari Ihalainen, CEO of Technical and Advisory Services at Peak Services, said the Winton project is a small pilot plant but the aim is to eventually provide 100 per cent of power to the community.

Mr. Ihalainen said other geothermal plants are being explored for Quilpie, Longreach and Normanton, and there are around 20 potential sites. Global Geothermal News..........
Kiwi Geothermal Test Rig Can Help Solve Scaling Issues

A Materials Test Rig was installed at Ohaaki Thermal Kilns near Taupo, North Island, earlier this year as an outcome of the Above Ground Geothermal and Allied Technologies (AGGAT) program. The equipment confirmed significant scaling potential from the geothermal resource. The test rig will give researchers an opportunity to seek an answer to the scaling problem.

Dr. Sadiq J. Zarrouk, geothermal engineering expert from the University of Auckland said magnetite scales are formed due to a combination of corrosion and scaling effects, which are a common occurrence and unfortunately unavoidable.

“The best thing to do is to clean the pipes thoroughly every time the rig is shut down or isolate them from oxygen and silica by mothballing. However, the extent of damage to pipe thickness is within the designed corrosion allowance.”

“In any case, I believe the AGGAT Geothermal Test Rig will remain an asset for the geothermal community for many years to come,’ he said. Global Geothermal News..........

Work Begins on 28 MW Ngawha Geothermal Power Station Expansion

Top Energy gained consent late last year for a two-stage expansion at the Ngawha Geothermal Power Station in the Far North of New Zealand, which could eventually boost capacity to just over 80 MW. Drilling is due to start early this year.

Stage 1 of the project, building a 28 MW power plant, is due to be completed in June 2021. A team from Iceland Drilling will be based in Northland for one year from April 2018. Ormat Technologies Inc. signed an approximately $50 million Engineering, Procurement and Construction, (EPC) contract to provide its air-cooled Ormat Energy Converters. Global Geothermal News..........

Successful Maintenance at Nga Awa Purua Geothermal Power Station

Mercury reports that the regular maintenance at the Nga Awa Purua Geothermal Power Station in New Zealand has been carried out in record time.

The power station was shut down on October 27 and all the working parts checked and replaced, if worn. It was back up and running again on November 10. While a shutdown of the power station usually takes 20 days, this time it only took 15 days, although no short cuts were taken. Global Geothermal News..........

ASIA

Short-Term Flow Tests at Akita Geothermal Energy Project Carried Out

INPEX Corporation has announced it conducted short-term flow tests to gauge the capacity of an exploratory well it has drilled in the Oyasu region of Akita Prefecture,
Sinopec Star Petroleum Ltd, Sinopec’s geothermal energy development arm, said it would increase the geothermal and other new-energy heating area in Xiongan by 10 million square meters to 16 million sq m in 2017.

In 2016, by replacing coal with geothermal energy, the geothermal heating area in Xiongxian county, part of Xiongan New Area, reached 4.5 million sq m, making it the first region to achieve its smokeless city plan.

Global Geothermal News

Feed-in Tariff Increased for Geothermal Energy in Taiwan

The Taiwan government has cut feed-in tariffs for renewable energy installations by less than initially planned to speed up the nation’s “green” energy goals.

To accelerate geothermal energy system installations, the ministry has increased the feed-in tariff to NT$ 6.1710 from the proposed NT$ 5.6447 for the first 10 years of the installations’ subsidiary period, it said, adding that the new tariff aims to help operators reduce their initial risk.

The tariff would drop to NT$ 3.5685 per unit for the remaining 10 years of the 20 year subsidiary period, lower than the NT$ 4.4465 per unit previously proposed, it said.

Meanwhile, the NT$ 8.3 billion “green” bonds issued by state-run Taiwan Power Co were listed on the nation’s over-the-counter bourse, marking the largest “green” debt issue by a local firm this year.

Global Geothermal News

Development Bank Funds Chinese Geothermal-Based District Heating Showcase

The Asian Development Bank (ADB) has approved a loan for USD 499 million to set up a regional emission-reduction and pollution-control facility as part of a support program to improve the air quality in the Beijing-Tianjin-Hebei region.

The facility will showcase how advanced technologies, including hydrogen-based low-emission transport and geothermal-based district heating, can be adopted on a large scale by major emitting industries and enterprises, according to the ADB.

Global Geothermal News

Sinopec to Boost Geothermal District Heating Around Beijing

State-owned China Petroleum & Chemical Corp., also known as Sinopec, said it will further develop geothermal energy in Xiongan New Area, Hebei province, as it seeks to make the smog-ridden region smokeless.

Global Geothermal News

China: Geothermal District Heating is Part of New Five-Year Plan

China has announced a five-year plan to convert northern Chinese cities to clean heating during the winter through to 2021.

The National Development and Reform Commission (NDRC) asked regions with rich geothermal resources to replace coal heating "as soon as possible."

China will boost shallow geothermal energy heating in smog-prone Beijing-Tianjin-Hebei and nearby regions, the state planner said in a statement, in a bid to curb coal use during winter as part of Beijing’s fight against air pollution.

Geothermal energy contained in terrain and waters less than 200 meters underground, with temperatures below 25°C (77°F), is encouraged to power heating systems in buildings.

Global Geothermal News

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Global Geothermal News
Drilling of Geothermal Exploration Well Begins on Taiwanese Island

Drilling of a geothermal exploration well has begun on Green Island, located off the south-east coast of Taiwan, with a plan to install a 200-kilowatt geothermal generator by the end of 2019 that will generate over 1 million kilowatt hours of energy annually.

CPC Chairman Tai Chein said that following the development of relevant technologies by other individuals or institutes, Taiwan may be able to extract heat energy from underground more efficiently. *Global Geothermal News*........

Thai Export–Import Bank to Support Geothermal Power Plant Projects in Japan

EXIM Thailand has signed a financial facility agreement worth 2,205 million yen, or approximately 661.50 million baht, with Thai Luxe Enterprises Plc. to support the company’s investment in eight geothermal power plant projects with a total capacity of 1,000 kW in Beppu, Oita Prefecture, Japan’s largest source of hot springs.

The company has planned power sales to Kyushu Electric Power Company at a tariff rate of 40 yen/unit over a 15-year term. *Global Geothermal News*........

Philippines Update

Testing and Commissioning of 12 MW Maibarara-2 Geothermal Power Project to Begin Shortly

Maibarara Geothermal Inc. (MGI) has secured approval to participate in the wholesale electricity spot market (WESM), paving the way for its commercial operation of the 12 MW expansion of its geothermal facility in Sto. Tomas, Batangas.

The testing and commissioning of Maibarara-2 was planned to start by middle of December, 2017. Export of power to the grid is expected soon after. *Global Geothermal News*........

First 5 MW from Biliran Geothermal Power Plant Projected for September 2018

Biliran Geothermal, Inc. (BGI) is building a 50 MW geothermal power plant on Biliran island in the Eastern Visayas region at a project cost of USD 208.021 million.

A source at the company said BGI is speeding up the forging of Power Supply Agreements (PSA) to give it a ready market for its output, especially the first 10 MW. The PSAs will be the go-signal for the start of the power plant construction.

The first two units, each at 5 MW, are targeted to be completed by September 2018 and March 2019, respectively. The rest are scheduled to be finished between July 2021 and July 2023. *Global Geothermal News*........

Survey of Geothermal Energy Resources Near Taipei Will Begin Next Year - Reports

State-run oil refiner CPC Co., Taiwan plans to explore for geothermal resources on Mt. Datun, in suburban Taipei, next year, the company’s new head has said.
An initial assessment showed that most of the damage was not to the power plants but to pipelines and the marshaling station. Global Geothermal News

Agreement Reached on 40 MW Unified Leyte Geothermal Power Administration

Phinma Energy Corp. and Power Sector Assets and Liabilities Management Corp. (PSALM) have agreed to mutually terminate the administration agreement for the 40 MW strip of energy of the Unified Leyte Geothermal Power Plant.

The company said it would withdraw the case it filed earlier and drop further claims.

The case sought to restrain PSALM from terminating the administration agreement for the selection and appointment of independent power producer administrators for the strips of energy of the Unified Leyte Geothermal Power Plants located in Tongonan, Leyte on grounds of administrator’s default. Global Geothermal News

EDC Brings Leyte Geothermal Power Plants Back Online After Earthquake

Energy Development Corp. (EDC) reported in mid November it had been impacted by the magnitude 6.5 earthquake that hit Leyte island in July 6, 2017. All major units were brought back to service soon afterwards, except for two 60 MW units in its Mahanagdong geothermal plant. Global Geothermal News

Leyte Geothermal Power Plants Hit by Typhoon Urduja

In December 2017, Energy Development Corp. issued an advisory stating that operations of its Leyte Geothermal Power Plants had been affected by landslides and flooding brought by Typhoon Urduja.

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Indonesia Update

30 MW Geothermal Power Plant in West Java Starts Operation

The 30 MW Karaha Bodas geothermal power plant in West Java, Indonesia, around 80 km southeast of the West Java provincial capital, Bandung, has started generating electricity for the national grid. Global Geothermal News.......

330 MW Sarulla Geothermal Power Plant to be Completed This Year

POWER magazine announced winners of its annual 2017 Top Plants awards. Among the five winners in the renewable power generation category is the Sarulla Geothermal Power Project.

Backed by a multinational financing effort along with support from the Indonesian government, the USD 1.6 billion project may be on track to achieve payback within nine years.

Construction kicked off in earnest in May 2014, and this March, SIL, the first 110-MW unit of the power plant, commenced commercial operation. It is “performing well,” Ormat said. Successful testing was soon completed at the second unit, NIL 1, and the unit began supplying power on October 2, 2017. The third unit, NIL 2, is under construction, and Sarulla expects that the unit will commence operation in 2018. Global Geothermal News.......

Indonesia: PLN Signs PPA for 86 MW from Rantau Dedap Geothermal Power Plant

State-owned electricity firm PLN and PT Supreme Energy Rantau Dedap (SERD) have signed an amendment to the Power Purchase Agreement (PPA) for the 86 MW Rantau Dedap geothermal project to be built in Muara Enim, South Sumatra.

The PPA Amendment is an important step for the Rantau Dedap PLTP project, following the completion of the drilling of six exploration wells in 2015 and feasibility studies in 2016. The exploration activities confirm that the capacity to be generated is sufficient to build a power plant with a capacity of up to 86 MW (net) for phase I. The company reports that drilling will start in the middle of this year. Global Geothermal News.......

Construction Starts on 5 MW Geothermal Power Plant on Bacan Island

Work has begun on the 5 MW first phase of a 20 MW geothermal power plant in Songa, on Bacan island in the regency of South Halmahera, North Maluku, tapping into a geothermal reserve with a possible capacity of 140 MW. Global Geothermal News.......

Sri Lanka Geothermal Power Plant Project is On Track

Planning and mapping has been undertaken for the construction of the first ever geothermal power plant in Sri Lanka, says dean of the geology faculty at the University of Peradeniya, Prof. Athula Senaratne.

The mapping between Trincomalee and Pussangoda has been completed and a final report is due in April, he said, adding the construction could begin thereafter with the support of the private sector.

Prof. Senaratne said this could be an ideal solution to the energy problems in the country. Global Geothermal News......
11 Expressions of Interest Received for Geothermal Risk Mitigation Facility 5th Application Round

The African Union Commission (AUC) reports that 11 Expressions of Interest (EoI) for the Geothermal Risk Mitigation Facility (GRMF) 5th Application Round (AR) were received and accepted. The eleven EoIs consists of 6 Surface Studies and 5 Drilling Programs. The EoI came from 6 countries (Djibouti, Ethiopia, Kenya, Rwanda, Uganda, Tanzania) and were submitted by private, as well as public, entities.

All applicants should receive feedback regarding their EoI by the end of February 2018.

Implementation and Power Purchase Agreements Signed for More than 1,000 MW of Ethiopian Geothermal Power Projects

Corbetti Geothermal plc (Corbetti), the Government of the Federal Democratic Republic of Ethiopia and Ethiopian Electric Power have signed an Implementation Agreement (IA) and a Power Purchase Agreement (PPA) for the 520 MW Corbetti geothermal power project.

Once ratified by parliament, the agreements will enable Corbetti to commence drilling the first production wells in 2018. It also lays the foundations for subsequent geothermal projects.

Leveraging work undertaken by Corbetti, the PPA and IA for the 500 MW Tulu Moye geothermal project in Oromia regional state, were also signed.

Tender to Supply Drilling Rigs for Ethiopian Geothermal Power Project to Open Soon

Ethiopian Electric Power is to publish a tender between January-February 2018 seeking qualified firms with the capability to supply 2 drilling rigs and relevant accessories, execute drilling operation and maintenance for the 75 MW Aluto Langano Geothermal Project in central Ethiopia, in accordance with technical and schedule of requirements.

The awarded firm, depending on the results of the first 8 wells, shall be prepared to continue the drilling and program for up to an additional 12 wells; a determination to continue the drilling campaign will of course depend on the results of the drilling. It is anticipated that both production and injection wells would be drilled during project implementation.

KenGen to Launch Subsidiary to Oversee Non-Electricity Generating Business

Power producer KenGen says it is awaiting regulatory approvals to launch a subsidiary that will oversee its non-electricity generating business. The subsidiary, named KenGen Energy Services (KES), will handle diversified business segments that will be hived off from KenGen, leaving the mother company to handle power production and sales.

Kenya Update

Exploration to Start Soon at Suswa Geothermal Power Project

Chinese company Zhejiang Kaishan Compressor Co. will begin exploration and drilling for geothermal power in Narok County shortly. The company has gotten the green light to drill steam wells in the Suswa South-Magadi-Shompole steam fields.

Ground Breaking at 35 MW Menengai Geothermal Energy Project in March

Sosian Menengai Geothermal Power has announced that groundbreaking for its 35 MW Geothermal Power Project at Menengai is slated for mid-March. Construction of the plant is expected to take about 18 months.

Sosian Menengai Geothermal Power, Ormat Technologies and Quantum Power East Africa Limited are the three firms selected to build a 35 MW steam power plant each on a public-private partnership basis at Menengai.

Quantum Power East Africa Limited has also announced that the construction of a 35 MW geothermal power plant will commence on March 1st 2018.

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AUC Grant to Help Fund 140 MW Turkana Geothermal Project

Olsuswa Energy has received a grant totaling USD 980,000 (about Sh101.5 million) from the African Union Commission (AUC) towards the development of its 140 MW Turkana geothermal power plant.

The funds will be used to conduct a surface study and infrastructure upgrade program at the Barrier volcanic complex located in Turkana County. Global Geothermal News.

Five Promising Geothermal Regions Identified in South Africa

South African geologist Taufeeq Dhansay and a group of five fellow scientists from the Council of Geoscience and Nelson Mandela University in Port Elizabeth believe that their government is overlooking significant volumes of geothermal energy.

Writing in the *South African Journal of Science*, Dhansay notes that South Africa does not have active volcanoes or evidence of recent volcanic activity. Yet he believes a recent heat-mapping study suggests there is still enough heat and warmth beneath the land that could be used to generate steam and electricity, making use of recent technological advances in the field of low-enthalpy geothermal energy harvesting. Global Geothermal News.

EUROPE

USD 246 Million Funding Available for Renewable Energy Projects

Funding is available in eight energy topics under the 2018-2020 Horizon 2020 Work Programme. The total available funding is EUR 212.5 million.

The application period is open – candidates can submit their proposals until January 31 2018 (two-stage call) or February 13 2018 (single-stage call). Global Geothermal News.

45 MW Phase I Theistareykir Geothermal Power Plant Begins Operations

Landsvirkjun has announced that the 1st 45 MW phase of the Theistareykir Geothermal Power Plant was commissioned in mid-November, 2017. The 2nd phase of another 45 MW will be on-line.
The power plant will improve the electricity supply for the northeastern part of Iceland and provide electricity to a silicon metal plant. 

Scottish and Danish Companies Team Up to Develop Geothermal Heat Projects in Great Britain

Danish company Geoop has signed a Memorandum of Understanding with Townrock Energy of Aberdeen, Scotland to jointly promote green energy, develop projects and support initiatives in Britain regarding geothermal energy. A special focus will be on geothermal heat projects for district heating or similar larger consumer bases.

Work Begins on Scotland’s first Deep Geothermal Heating System

A ceremonial groundbreaking has kickstarted work on the GBP 65 million HALO urban regeneration project in Kilmarnock in East Ayrshire, south of Glasgow. It will incorporate Scotland’s first deep geothermal heating system with a 2km deep well drilled this year to enable water to be heated by the surrounding rocks, pumped back up again and then into properties at the project.

264 MW of Geothermal Projects Apply for Dutch Renewable Subsidy

The Netherlands Enterprise Agency (Rijksdienst voor Ondernemend Nederland – RVO) has announced that it has received a total of 5,783 applications for a combined capacity of 5.3 GW in the second round of the 2017 SDE+ (Stimulering Duurzame Energieproductie) program for large-scale solar and renewable energy power projects.

Of these projects 264 MW was allocated to geothermal projects. The SDE+ compensates for the difference between the price of renewable energy and the market value of the energy supplied. Subsidies are allocated for periods of 8, 12 or 15 years depending on the maximum number of full load hours for each technology.

Scottish Company Wins Contract to Drill Four Additional Geothermal Wells in the Netherlands

Scottish based international drilling and engineering contractor KCA Deutag has announced that its land drilling operation has been awarded a new contracts to drill for a geothermal resource in the Netherlands.

The T-700 drilling rig was recently used to complete two geothermal wells in the Netherlands. The new 5-month contract is for an additional four wells with the same client.

New Geothermal Energy Alliance in South Holland

The Province of South Holland, DAGO (Dutch Association Geothermal Operators), EBN BV, Eneco, HVC, Hydreco GeoMEC BV and the Municipality of Westland have created the Geothermie Alliantie Zuid-Holland, to promote the use of geothermal heat in South-Holland.

Drilling Starts for 4,000 Meter Deep Geothermal Well for Dutch Greenhouse Warming Project

Drilling has begun for the Westland Trias geothermal project, initiated by a consortium of 49 greenhouse companies aiming to heat their greenhouses in a renewable manner and with stable costs.

The final section of the well will be drilled to the Trias layer at a depth of 4,560 meters. This last
hole will not be cemented in connection with the recovery of heat. **The well-test is expected to take place in January 2018.** 

**Global Geothermal News**

**Drilling for Bordeaux Geothermal District Heating Network to Begin in 2019**

Bordeaux municipality has announced a project to develop a geothermal district heating network. Engie Cofely and energy storage firm Storengy have won a 30-year contract to develop the **Plaine Rive Droite heat network** on the right bank of the Garonne river.

The city aims to meet 82 per cent of its heat demand with geothermal energy, with the remainder provided by natural gas. Work is planned to begin as soon as all necessary permits are obtained, with drilling expected in early 2019. 

**Global Geothermal News**

**Geothermal District Heating Network Starts Up in Paris Suburb**

Géodalys has announced that final tests on the **Dammarie-lès-Lys geothermal district heating network** were successful and was due to start running in early December. The location is a commune in the south-eastern suburbs of Paris, France. 

**Global Geothermal News**

**Swedish Company to Deliver Heat Power Modules to Geothermal Project in Bavaria**

Germany based Geoenergie Kirchweidach (GEK) and the Swedish clean tech company Climeon have signed a non-binding **Letter of Intent** (LOI) covering a supply of Climeon Heat Power modules to a geothermal power plant project in the Municipality of Kirchweidach in Bavaria, Germany. The potential order value is estimated to be about EUR 5 million.

The technology will utilize the excess heat of the existing geothermal plant that supplies heat to a 20 hectare greenhouse and to the city of Kirchweidach. 

**Global Geothermal News**

**Geothermal District Heating Project Starts in Geneva Suburb**

A large borehole is being drilled in Satigny, a municipality in the Canton of Geneva, Switzerland. It will reach a **depth of 650 meters**. Geologists believe the water temperature at that depth will be around **25 to 30°C**.

There will be a further six bores drilled in the next three years. The canton hopes the new power source will cut the use of heating oil by 53 percent. 

**Global Geothermal News**

**Funds made Available for Geothermal Energy Feasibility Study in Serbia**

The Municipality of Bogatic, in the far north of Serbia, will receive around EUR 30,000 to prepare detailed geothermal research and assessment of the possibility of producing heat and electricity from geothermal resources. 

**Global Geothermal News**

**Greenhouse Heated by 80°C Geothermal Resource Begins Operations in Central Turkey**

Timfog Engineering Company has completed the heating system of **Aldosan Greenhouse** in Afyon province using 80°C geothermal water sources. Alfa Laval exchangers from Sweden and Grundfos pumps from Germany are being used. 

**Global Geothermal News**

**New Wing Opens at Larderello Geothermal Museum**

The **Geothermal Museum** in Larderello (Tuscany, Italy) is growing. This exhibition space, dedicated to energy from the earth, already attracts...
18 MW Turcas Kuyucak Geothermal Power Plant in Full Commercial Operation

The Turcas Kuyucak Geothermal Power Plant in the village of Yöre, Kuyucak district, Aydın province, in western Turkey has started commercial power production at full capacity.

The first 10 MW of the 18 MW Kuyucak Geothermal Power Plant were in operation already. The remaining 8 MW was temporarily accepted into operation as of 7 December 2017. Global Geothermal News........

EDUCATION

50 Hour Course on Surface Geothermal Exploration

22-28 March, Tenerife (Canary Islands, Spain)

GeoTenerife is delighted to co-organize this week-long surface geothermal exploration training course with the Canary Island Volcanology Institute (INVOLCAN) and the University of La Laguna.

There are a maximum of 40 places available, which will be granted on a first come, first served basis.

The course is aimed primarily at earth science under-graduate students, but PhD students and Postdocs are also welcome to apply. The week will include 50 teaching hours and participants will earn 2 ECTS from La Laguna University. All teaching and materials will be in English.

The aim of this course is to introduce graduate students to geophysical and geochemical methods used on surface geothermal exploration by alternating lectures with practical laboratory and field activities. Lessons will be given by researchers having an international scientific background and first-hand experience on geothermal exploration.

The prerequisites for attending this course are skills in Earth Sciences, as well as knowledge of Mathematics, Physics and Chemistry. Global Geothermal News........

thousands of visitors from around the world every year. It’s now been enhanced with new materials, documents and halls in order to increase its cultural offering and to display the great history of geothermal energy, which was born in Larderello.

It’s located on the first floor of the historic palace that belonged to Conte Francesco De Larderel – one of the fathers of geothermal energy – and joins the spaces already open to the public on the ground floor. Global Geothermal News........

4 MW ORC Geothermal Plant Begins Operating in Azores

The 4 MWe Pico Alto binary geothermal power plant has begun operations on the island of Terceira in the Azores.

For this challenging project located in a remote site 1,500 Km off the coast of Portugal, the Exergy - CME Consortium supplied a turnkey solution, including the engineering and construction of the gathering systems, the air cooled ORC unit equipped with an Exergy Radial Outflow Turbine and all balance of plant equipment. Global Geothermal News........

(Courtesy Exergy)
SCIENCE & TECHNOLOGY

New Explanation for the Source of Newberry and Yellowstone Geothermal Heat

Newly published research contradicts what has been a long-held — although fervently debated — theory about the hotspot underlying the Yellowstone supervolcano.

Geologists at the University of Illinois used seismic waves that travel through the earth after earthquakes and explosions to produce an almost X-ray-like view of what’s going on underground. The information was then fed through a supercomputer to mimic different geologic scenarios that are known to have occurred over the past 20 million years in an attempt to come up with an explanation for the Yellowstone hotspot.

Their conclusion? Yellowstone’s heat is being funneled east from the geologically active Pacific Coast. Global Geothermal News........

New Method to Extract Lithium and Gold from Brine at Geothermal Power Plants

MGX Minerals Inc. of Vancouver, Canada has announced that its partner PurLucid, also based in Canada, has developed a high temperature filtration method to purify geothermal brines.

Purlucid and MGX have developed a proprietary, low energy design process that removes scale-forming ions and dissolved salts while not requiring a reduction in brine temperatures for filtration to occur. Notably, the process uses PurLucid’s existing patented and exclusively licensed replaceable membrane skin layers (RSL) filtration system.

MGX and PurLucid are now undertaking studies to build treatment systems capable of being integrated into existing geothermal infrastructure or incorporated as standalone systems for mineral and metals extraction. Global Geothermal News........

Making ORC Geothermal Power Systems More Efficient

Sponsored by the DOE’s Geothermal Technologies Office, Pacific Northwest National Laboratory (PNNL) in Washington State, USA “rewrote the book” on the operation of Organic Rankine Cycle (ORC) systems in an effort to make a transformational advance in the technology and its use within the geothermal industry. The PNNL-developed system—the Harmonic Adsorption Recuperative Power System (HARP)—uses a novel approach that eliminates the need for the evaporator, high pressure pump, and condenser in ORC systems. Global Geothermal News........

Increasing Interest in Using Geothermal Energy for Desalination

There is increasing interest in using geothermal energy for desalination, providing a constant source of stable ‘base-load’ power for continuous, long-term periods. It could be used directly for membrane distillation, while thermal distillation like Multi-Effect Distillation (MED) and Multi-Stage Flash (MSF) could be powered using the electricity it generates. Global Geothermal News........
Patent Awarded for Reducing H2S at Geothermal Power Plants

Ecolab USA Inc. has been assigned a patent for a method of reducing hydrogen sulfide content in a medium. The method may include the steps of contacting a medium containing hydrogen sulfide with an effective amount of hydrogen peroxide, contacting the medium with an oxidizing agent, converting the hydrogen sulfide to sulfate, and reducing the hydrogen sulfide content in the medium. The medium may be a gas or a liquid. Global Geothermal News........

Study Reveals Sources of Geothermal Energy in Greenland

The main features of the predicted geothermal heat flux (GHF) map include a large region with high GHF in central-north Greenland surrounding the NorthGRIP ice core site, and hotspots in the Jakobshavn Isbrae catchment, upstream of Petermann Gletscher, and near the terminus of Nioghalvfjerdsfjorden glacier. Global Geothermal News........

Abandoned Coal Mines - a Potential Source of Geothermal Heat

There is a delightful irony that the legacy of the dirtiest of fuels, coal, now has the potential to deliver a low carbon energy future.

Abandoned coal mines seem incredibly promising due to their networks of flooded galleries and shafts lying at depths of up to several hundred meters below the surface. One can be almost certain that the water flow necessary for deep geothermal wells will be found in these flooded underground voids. The risk of not finding flowing water underground can inhibit deep geothermal developments elsewhere. Global Geothermal News........

Research on Using Flooded Abandoned Mine Workings as a Geothermal Heat Source

Quintessa is supporting a new PhD research project at the University of Edinburgh. Fiona Todd will be investigating the practicality of using flooded, abandoned mine workings as a geothermal heat source – potentially a key supply of low-carbon energy for those cities with a long-standing mining heritage.

The large area of typical mine workings and the elevated temperature at depth, make such underground voids a potentially very efficient means of accessing the heat being generated at depth in the Earth. Global Geothermal News........

DOE Lab Wins Awards for Geothermal Energy Innovation

Eight Los Alamos National Laboratory (LANL) technologies won R&D 100 Awards at R&D Magazine’s annual ceremony in Orlando, Florida. These “Oscars of Invention” honor the latest and best innovations of the past year.

LANL is a United States Department of Energy national laboratory based in New Mexico. Two of the awards are for geothermal energy applications:

- Discrete Fracture Network Modeling Suite (dfnWorks) is a computational suite that simulates and predicts the flow and transport of fluids through underground fractured rock.

- High-Temperature Electric Submersible Pump Motor (HT-ESP) is rugged and reliable, offering improved thermal performance compared to conventional submersible pumps used in deep underground and extremely hot environments. Global Geothermal News........
New Map Shows Geothermal Heat Below Antarctica

This is the best map yet produced of the warmth coming up from the rocks underneath the Antarctic ice sheet.

This geothermal heat flux is key data required by scientists in order to model how the White Continent is going to react to climate change. Global Geothermal News........

Great Potential for Direct Use of Geothermal Energy From Deep Aquifers

A paper presents results of a global resource assessment of geothermal energy within deep aquifers for direct heat utilization. Greenhouse heating, spatial heating, and spatial cooling are considered in this assessment.

Even with a conservative recovery factor of 1% and an assumed lifetime of 30 years, the annual recoverable geothermal energy is in the same order as the world final energy consumption of 363.5 EJ yr\(^{-1}\).

Although the amount of geothermal energy stored in aquifers is vast, geothermal direct heat applications are currently underdeveloped with less than one thousandth of their technical potential used. Global Geothermal News........

Corrosion Resistant Coatings for High Temperature Geothermal Applications

TWI, an U.K.-based independent research and technology organization, is coordinating a recently won European Horizon 2020 project for the development of novel and cost-effective corrosion resistant coatings for high temperature geothermal applications. This project, dubbed Geo-Coat, comes from the low carbon energy call to develop next generation technologies for renewable electricity and heating/cooling. Global Geothermal News........

More Efficient Method for Extraction of Lithium from Geothermal Brine

A three-stage bench-scale column extraction process to selectively extract lithium chloride from geothermal brine is described in a recent issue of Environmental Science & Technology. The goal of this research is to develop materials and processing technologies to improve the economics of lithium extraction and production from naturally occurring geothermal and other brines for energy storage applications. Global Geothermal News........

Locating Supercritical Geothermal Fluids by Teleseismic Converted Waves

Exploiting supercritical geothermal resources represents a frontier for the next generation of geothermal electrical power plant, as the heat capacity of supercritical fluids (SCF), which directly impacts on energy production, is much higher than that of fluids at subcritical conditions. Reconnaissance and location of intensively permeable and productive horizons at depth is the present limit for the development of SCF geothermal plants.
The authors use, for the first time, telesismic converted waves (i.e. receiver function) for discovering those horizons in the crust. Thanks to the capability of receiver function to map buried anisotropic materials, the SCF-bearing horizon is seen as the 4km-depth abrupt termination of a shallow, thick, ultra-high (>30%) anisotropic rock volume, in the center of the Larderello geothermal field. Global Geothermal News........

**CLIMATE CHANGE**

**Climate Change: USA Only Country Not to Have Signed Paris Agreement**

The USA is set to become isolated in its stance on the Paris climate agreement, after Syria said it was preparing to join the deal.

Syria and Nicaragua were the only nations outside the deal when it was agreed in 2015. Nicaragua signed in October.

In June the US said it would withdraw, but the rules of the agreement state that this cannot be done until 2020. Global Geothermal News........

**Last Year Was One of the Hottest Three Ever Recorded**

2017 was the hottest year since global records began that was not given an additional boost by the natural climate cycle El Niño, according to new data. Even without an El Niño, the year was still exceptionally hot, being one of the top three ever recorded.

The three global temperature records are compiled by the UK’s Met Office and Nasa and Noaa in the United States. The Met Office said the average temperature in 2017 was 0.99°C above that seen from 1850-1900, despite the Pacific Ocean moving into its cooler La Niña phase. Global Geothermal News........

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**Coiled & Straight Length Tubing for Geothermal Applications**

**BELOW GROUND:** Webco manufactures high quality laser seam-welded duplex, nickel alloy, and stainless steel coiled tubing for demanding downhole conditions. Customers rely on LaserLine® products for scale and corrosion inhibition in oil & gas and geothermal well applications.

**Commonly Stocked Sizes**
- .250" O.D. x .035" or .049" wall
- .375" O.D. x .035" or .049" wall
- Other sizes stocked or available by request.

**Commonly Stocked Grades**
- Nickel Alloy 625
- Nickel Alloy 825
- 2205 Duplex
- 316L Stainless
- Other alloys available upon request

**ABOVE GROUND:** Webco manufactures and stocks a full range of straight length carbon steel and corrosion resistant alloy tubing for heat exchanger and pressure tube applications. Value-added services, including u-bending and finning, are available.

Webco maintains an extensive inventory of coiled and straight length tubing. International shipping is available. Email Laserline@webcotube.com or call 918-245-2211.

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Image: Land & Ocean Temperature Percentiles Jan-Dec 2017 NOAA’s National Centers for Environmental Information Data Source: GHCN-M version 3.3.0 & ERGIST version 4.0.3

National Oceanic and Atmospheric Administration (NOAA)
In 2017, for the first time, the combined energy and capacity values of geothermal energy significantly exceeded the value of solar photovoltaic (PV) resources in California. In the first quarter of 2017, geothermal’s wholesale energy value in southern California was $13.50/MWh greater than solar PV. At the same time, utility estimates of marginal solar PV capacity ratings for the 2018 Resource Adequacy (RA) compliance period were between nearly 0 percent and 20 percent, resulting in a capacity value difference of up to $18.50/MWh between geothermal and solar PV. Today in California, geothermal has a combined energy and capacity value of $32/MWh higher than solar PV using very conservative assumptions. When you account for geothermal’s ancillary services and operational flexibility, combined values climb to more than $40/MWh higher than solar PV. These calculations demonstrate that geothermal can compete with solar PV on a net cost basis, even as PV costs continue to decline.¹

Wait…what? How can that be?

The California electric power system is undergoing many operational, reliability and market changes due to the rapid penetration of solar PV. Solar penetration in California has increased from 500 MW in 2010 to over 14 GW today.² At low penetration levels, (e.g., under 5 percent of annual energy) solar in California had high energy and capacity values because it generated during what were then the peak load hours. As a result of increased solar penetration, and because now solar provides energy and capacity during times of low or even negative pricing, energy and capacity values for solar have plummeted. Geothermal can obtain higher energy and capacity values because it can produce outside the solar PV production hours during the new peak load hours illustrated by the famous CAISO “duck curve.”

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ORMAT offers geothermal clients more of everything that matters when it comes to developing geothermal resources.

We’ve built more than 2,500 MW of capacity in more than 160 power plants worldwide. We’re experts at using more technologies, including conventional steam, binary, combined cycle and integrated two-level unit technologies. We’ve developed more facilities, in more sizes, from a few kilowatts to hundreds of megawatts. We’re involved in more of the essential steps needed to take a facility from concept to reality; whether it is exploring, developing, designing, engineering, manufacturing, constructing or operating geothermal power plants.

Doing more also means we offer clients more of our in-depth experience as an operator. We’ve learned more about geothermal by operating a global network of geothermal facilities efficiently and profitably; and it is that deeper knowledge we share with our clients. We do more to add value to existing facilities, year after year, by expanding and integrating new technologies to boost efficiency and power output.

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Experts have long predicted that, as solar energy production increased in California and elsewhere, the energy and capacity value of additional solar resources would decrease and eventually be significantly lower than the value of other renewable resources including geothermal.\textsuperscript{3,4} Data now shows that not only did a reversal in the comparative values of geothermal and solar PV take place in California in 2017 but that geothermal’s comparative value will continue to grow with increasing solar penetration over the next decade.

Its operational flexibility further enhances geothermal’s value. For over 50 years, geothermal facilities have performed diligently to provide power 24 hours a day, seven days a week. So effective was the industry in marketing this attribute that many believe geothermal is solely a baseload resource. That is no longer the case.

Since 2010, 96 percent of all installed geothermal facilities in the U.S. utilize a binary geothermal technology that can ramp up and down faster than new “flexible” gas turbines such as the LM2500 or GELMS100.\textsuperscript{5}

A binary geothermal facility cycles geothermal fluid through a set of heat exchangers, where the heat is transferred to a motive fluid that vaporizes and spins the turbo-generator, while the geothermal fluid is returned to the underground reservoir. Decoupling the geothermal reservoir and well field from the power generating equipment through the use of a working fluid allows binary geothermal facilities to operate in both a baseload or an operationally flexible mode that provides 100% dispatchability, at unparalleled ramp rates – up to 30% of generator nameplate per minute - and can even be controlled by the system operator using Automatic Generation Control (AGC). Geothermal power plants offer additional benefits to grid stability like voltage support and inertia. Ormat’s Puna geothermal facility in Hawaii has provided these services since 2011.\textsuperscript{6}

After years of solar dominating new renewable energy contracts in California, utilities, the CAISO and CCA’s are starting to appropriately value renewable resources that provide energy and capacity value while also being operationally flexible.

On June 1, 2017, The Los Angeles Department of Water and Power (LADWP) announced it had entered into a new, 26-year power sales agreement for approximately 150 MW of power to be generated by a portfolio of new and existing binary geothermal power plants. LADWP explained in its press release: “In addition to producing fossil-free power, geothermal energy offers many desirable benefits. Because it can provide continuous...
energy generation, a geothermal plant is expected to produce power at 95 percent or more of its capacity year-round – a higher capacity than the wind or solar renewable energy resources. With its baseload predictability, geothermal energy also saves on transmission and other integration costs, as compared to variable renewables like wind and solar power.”

With the CAISO now looking for flexible resources that can perform the following functions: 8

- sustain upward or downward ramp;
- respond for a defined period of time;
- change ramp directions quickly;
- store energy or modify use;
- react quickly and meet expected operating levels;
- start with short notice from a zero or low-electricity operating level;
- start and stop multiple times per day; and
- accurately forecast operating capability.

Geothermal stands alone in providing all of those operating capabilities while assisting in absorbing more solar and other variable energy resources and reducing greenhouse gas emissions to 1990 levels. Higher renewable penetration and greenhouse gas reductions are absolutely possible when California utilities, regulators, and system operators appropriately evaluate, procure and develop cost-effective, flexible renewable resources such as geothermal 2.0 to meet California’s goals.

Paul A. Thomsen is the Executive Director, Government & Regulatory Affairs for Ormat. Previously, Thomsen served as Chairman and Commissioner of the Public Utilities Commission of Nevada and as Nevada Gov. Brian Sandoval’s Director of the Governor’s Office of Energy.


The 41st edition of the GRC Annual Meeting, together with the GEA GeoExpo+, was held from October 1-4 in Salt Lake City, Utah, USA.

We are documenting the meeting in two parts. In the last issue we reported on the Opening Session, the results of the Photo Contest and a report on the Charity Golf Tournament. In this issue we write about the GRC Awards, the Poster and Technical Session awards and the GEA GeoExpo+.

**GRC Awards 2017**

The CRC Awards recognize distinguished colleagues in the geothermal community from around the world and have been a highlight of the geothermal calendar since the late 1970’s.

*The Joseph W. Aidlin, Geothermal Pioneer, Henry J. Ramey, Jr. Geothermal Reservoir Engineering and Ben Holt Geothermal Power Plant Awards* were presented at the Opening Session of the GRC Annual Meeting. The Geothermal Special Achievement Awards were presented at a special ceremony at Tuesday lunchtime in the Expo hall.

**Geothermal Pioneer Award**

*James B. Koenig*

For outstanding accomplishments in geothermal resources exploration, evaluation and development worldwide.

"I entered the geothermal world in 1965... and I’ve never left. Among my favorite memories are: siting the discovery wells at Miravalles, Costa Rica and Dixie Valley, Nevada fields; founding GeothermEx in 1973; being GRC President (1989-
1991); and my continuing work in development of Olkaria, Kenya (now over 600 MW). But no one does it alone. I thank my GeothermEx colleagues Subir Sanyal, Jim McNitt, Chris Klein and Eduardo Granados; and 3 old friends, Giancarlo Facca, Wesley Breuer and Donald Finn, for their wise counsel. And I thank the GRC for this award.”

**Sabodh K. Garg**

In recognition for outstanding contributions to reservoir and well data interpretation, and to modeling geothermal system behavior.

"Thanks to the GRC Honors and Awards Committee for this award. Professor Ramey was always very generous in sharing his knowledge with younger members of the geothermal community. Finally, I wish to acknowledge my past and present collaborators for their contributions to advancing our understanding of geothermal systems."

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**Ben Holt Geothermal Power Plant Award**

**Kevin Kitz, P.E.**

For outstanding achievements in designing geothermal power plants, including innovative geothermal ORC power plants.

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**Geothermal Special Achievement Award**

**Mack Kennedy**

In recognition of remarkable contributions to the understanding of geothermal systems and selfless leadership in the geothermal research community.

"It is common to question one’s worthiness of an award, and although I am no exception, I am deeply honored to join the past recipients. To the GRC and the many who have helped me, worked with me, argued with me and put up with me -- thank you very much!!"

**Joseph "Skip" Matlick**

In recognition for his 40 years of outstanding contributions to geothermal drilling and geology, and for being a mentor to many.

"Developing geothermal reservoirs has been my entire career focus. I am proud to be part of this industry and its accomplishments. My work has been gratifying, and it’s been a pleasure to work with many GRC members. I am greatly honored to be chosen for this award."

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**Elizabeth Johnson**

In appreciation of her efforts to advance California geothermal energy development by...
working with local communities, government agencies, and developers for more than three decades as the Geothermal Officer for the Division of Oil, Gas, and Geothermal Resources.

“Thank you GRC for this award! I was honored to have a career regulating geothermal wells in California for 30 years. Geothermal energy has proved to be sustainable, clean, and a benefit for everyone who uses electricity and cares about the environment. I’m proud I had a part in geothermal’s development in California.”

**Geothermal Special Achievement Award**

**Dennis J. Gilles**

Dennis Gilles currently serves as Executive Advisor for US Geothermal Inc. He previously held the position of Chief Executive Officer for US Geothermal from April 2013 until July 2017. He also served on the Board of Directors for US Geothermal from September 2011 until July 2017.

**GRC Special Citation Award**

**Alfredo Mainieri Protti**

For his lifelong pioneering work and enduring achievements in Costa Rica’s geothermal power development.

For more information on this award see the article: Alfredo Mainieri Protti Geothermal Field - Formerly Miravalles by Susan Fox Hodgson from the November/December 2017 Bulletin.

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More information on the GRC Awards on the GRC Website at [https://geothermal.org/awards.html](https://geothermal.org/awards.html)

More photos from the Opening Session on the GRC Flicker website - [https://flic.kr/s/aHsm51rHXB](https://flic.kr/s/aHsm51rHXB)

More photos from the Awards Lunch on the GRC Flicker website - [https://flic.kr/s/aHsm5xVxZD](https://flic.kr/s/aHsm5xVxZD)

**Poster Session Awards**

**Best Student Poster Award - Sponsored by Calpine**

**Shashank Tiwari**, University of Utah - A 2D Hydroterm Model Of The Utah Forge Site.

**Best Professional Poster Award**


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Shashank Tiwari and his winning poster. PHOTO BY IAN CRAWFORD

Shashank Tiwari of NREL, Golden, Colorado, is an author of the Best Professional Poster Award at the GRC Annual Meeting. PHOTO BY IAN CRAWFORD
More photos from the Poster Reception on the GRC Flicker website - https://flic.kr/s/aHsm6sRki8

Technical Session Awards

The judging criteria included the technical content, the quality of the visual aids and the presenter’s ability to communicate the subject matter. Over 220 presentations were made totaling over 75 hours over three days.

The winning presentations in each session are:


**Geology 1** - *A Refined Conceptual Model For Subsidence at Wairakei, New Zealand*, by Fabian Sepulveda et al.


**Power Operations / Flexible Generation / Maintenance 1** - *Design of Wairakei B Station GRS Upgrade*, by Tracy Mills.


**Heatflow and Climate Change** - *Borehole Temperatures, Meteorologic Data, and Baseline Temperatures for Recent Climate Change: from Local to Global Scales*, by David Chapman et al.


**Geochemistry 1** - *Comparison and Controls of Thermal Spring Chemistry in Cascade Range and Olympic Mountains Geothermal Provinces, Washington*, by Jon Golla et al.


**Education and Community Engagement 1** - *New Role of Geothermal Exploration*, by Professor Masami Nakagawa.


**Drilling 1** - *Durability of Bond between High-Temperature Cement Composites and Carbon Steel*, by Tatiana Pyatina.

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Kevin Kitz (left) and Andy Sabin (right) enjoy a poster discussion. PHOTO BY IAN CRAWFORD

The posters enjoyed high visibility in the busy Expo. PHOTO BY IAN CRAWFORD
**Field Operations / Production Technologies**
- Analytical and Experimental Study of Measuring Enthalpy in Geothermal Reservoirs with a Downhole Tool, by Xuhua Gao et al.


**Country Updates** - Turkish Geothermal – Perspectives on Development, Construction, and Operations, by William Harvey.

**Drilling 2** - A New Approach to Mitigate Casing failures in High-Temperature Geothermal Wells, by Ingolfur Thorbjornsson.

**Emerging Technologies 2** - Retrofitting a Geothermal Plant With Solar and Storage to Increase Power Generation, by Joshua McTigue.

**FORGE 1: Fallon** - An Update on the Geologic Model of the Fallon FORGE site, by Drew Siler et al.


**Drilling 3** - Numerical Analysis of the Two-material Downhole Flow Field in Hydrothermal Jet Drilling, by Zehao Lyu et al.

**Power Operations / Flexible Generation / Maintenance 2** - Case Study: Shell Side Geothermal Power Plant Condenser Cleaning Utilizing Hydrogen Peroxide (H2O2) at The Geysers, by Brian Benn et al.

**FORGE 2: Milford** - Revised Geologic Mapping and Fracture Analysis of Bedrock Adjoining the Utah FORGE Site, by Stefan Kirby et al.

**Exploration: Miscellaneous** - Post-depositional Alteration Of Siliceous Sinter Near Old Faithful Geyser, Yellowstone National Park, USA, by Bridget Lynne.


**Drilling 4** - Concept of Thermal-Shock Enhanced Drill Bit for Supercritical Geothermal Drilling, by Shigemi Naganawa.


**Modeling and Simulation: ORCs and Misc** - Modeling of the Effect of Module Size and Material Property on Thermoelectric Generator Power, by Kewen Li et al.

**Field Ops/Direct Use** - Transforming Silica into Silicate – Pilot Scale Removal of Problematic Silica from Geothermal Brine, by Thomas Borrmann.


**Exploration: Mineral Extraction and Regional Updates** - Do Geothermal Systems Play a Role in Lithium Brine Enrichment in Nevada Playas?, by Mark Coolbaugh.

**Geology and Play Fairways 2** - Applying Play Fairway Analysis for Human Impacts in Geothermal Exploration Site Selection – A Preliminary Study in Yi-Lan Plain, Taiwan, by Chyi Wang et al.

**Geophysics 3** - Multi-Physics Imaging of the Darajat Field, by Wolfgang Soyer et al.


The GRC has added all the papers associated with the technical session presentations to the GRC Geothermal Library at www.geothermal-library.org. Papers from the 2017 Annual Meeting are now available for members only. Papers from previous years are available for all.

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**Email Updates from Global Geothermal News**
GRC Fieldtrips

More photos from the GRC Fieldtrips on the GRC Flicker website - https://flic.kr/s/aHsm6Xn2dc

The GRC Fieldtrip at the Giant Geyser in Yellowstone National Park.

The Cyrq Thermo geothermal power plant in southern Utah.

All 600 plus photos from the GRC Annual Meeting & GEA GeoExpo+ on the GRC Flicker website - https://www.flickr.com/photos/geothermalresourcescouncil/collections/72157688299345345/
GEA GeoExpo+

More photos from the GEA GeoExpo+ on the GRC Flicker website - https://flic.kr/s/aHskKeCuwI

Ormat Technologies was a big presence, as always, in the exhibition hall PHOTO BY IAN CRAWFORD

Tito Perdana (left) and Marcelo DeCamargo (right) both of GeoThermex, a Schlumberger company, enjoy meeting attendees at their booth. PHOTO BY IAN CRAWFORD

The Expo is a window on the geothermal energy industry. PHOTO BY IAN CRAWFORD

Jene Harmon (left) and Jerri Lauderdale (right) both of Webco are friendly faces at the Expo. PHOTO BY IAN CRAWFORD
Ormat Acquires U.S. Geothermal

U.S. Geothermal Inc. has announced that it has entered into a definitive merger agreement under which a wholly owned subsidiary of Ormat Technologies, Inc. will acquire the company for USD 5.45 per share in an all cash transaction.

The agreement, which has been unanimously approved by both companies’ Boards of Directors, represents a premium of approximately 28.5% to the prior day closing stock price on January 23rd, 2018. Global Geothermal News..........

BLM Approves 48 MW Ormat Phase III Expansion of McGinness Hills Geothermal Plant

The Bureau of Land Management (BLM), Mount Lewis Field Office, has completed its analysis of Ormat Inc.’s proposal for an expansion to their McGinness Hills Geothermal Facility in Nevada, USA. The Decision Record (DR) allows operations to begin at the Phase III project site.

This newest expansion will consist of access roads, a pipeline, a power plant, wells and transmission line. Global Geothermal News..........

Flow Tests to Begin at Guatemala Geothermal Project

Bluestone Resources Inc. of Vancouver, British Columbia, has provided an update regarding the permitted Mita Geothermal project located adjacent to Bluestone’s Cerro Blanco Gold project in Guatemala.

Bluestone’s Board of Directors has approved a flow test program to further test select geothermal wells with the goal of upgrading the confidence level of the known geothermal reservoir. The data collected will provide the basis for the development strategy going forward. Flow testing is expected to commence in February and be completed by the end of March.

According to their website, Bluestone expects Phase 1 to include the installation of a 2 to 3 MW geothermal turbine for power generation. This initial power would be used by the Cerro Blanco gold project for potential mine development, including dewatering and ventilation. A Phase Two would include the development of a 12 MW geothermal power plant which could generate the balance of the power required for operations. Global Geothermal News..........

Swimming Pool Warmed by Geothermal Heat Opens in Western Australia

A $26-million geothermal pool has opened alongside the beach in the Perth suburb of Scarborough, tapping into the Yarragadee geothermal aquifer, maintaining a balmy 26-28°C. Global Geothermal News..........

Study Concludes Geothermal Electricity is Among Cheapest Renewable Forms of Electricity


The study makes comparisons of fixed and variable costs for converting different forms of primary resources into electric energy performed by national and international agencies as well as by a major German electrical utility. The conclusion: geothermal electricity produced from natural steam or permeable hot water reservoirs is among the cheapest renewable forms of electricity. Global Geothermal News..........

Workers put the final touches to the Scarborough Pool. Courtesy The West Australian
To add to the pristine beaches and lush green forests that the Caribbean is well known for, many islands within the Caribbean are on its way to the recovery of a buried treasure - **Geothermal energy**.

Some islands within the Caribbean have been utilising low temperature geothermal applications since the 1700s. Hot spring baths in islands such as St. Lucia, Dominica and Nevis, therapeutic purposes are amongst some of its uses. This thermal energy within the Earth’s Crust, is one of the few renewable, low-carbon emission energy sources. It can be used to consistently generate power 24-hours a day, regardless of the season. Its use in this way can impact positively on the economies of many Caribbean nations who do not produce oil and gas and are heavily dependent on imported oil for electricity generation.

Many of these islands, located within the Lesser Antilles island arc, have been identified as “ideal” locations for geothermal exploitation because of the active magmatic heat sources beneath most of the islands and intersecting fault systems. The islands of the arc have been largely built by volcanism caused by the subduction of the Atlantic oceanic crust beneath the Caribbean plate. Spread across 11 islands within the

Did you know that the electricity prices within most non-producing oil and gas Caribbean nations can be as high as US$ 0.50 per kWh depending on the oil price?
Islands located on the Lesser Antilles island arc. There are 21 volcanoes spread across 11 of these islands and they are highlighted in yellow. Source: UWI Seismic Research Centre.

The Bouillante geothermal plant on the French island of Guadeloupe is the only geothermal power plant currently operating in the Caribbean. It is a 15.7MWe plant and supplies about 6% of the electricity in the island. Plans for this power plant involves expanding the total capacity by 30MW by 2021 (Ormat Technologies, 2016). Looking into the future, the Bouillante power plant may not be the only geothermal plant in the Caribbean. Recent geothermal developments show that many islands are at various stages of geothermal developments, ranging from geothermal exploration to geothermal exploitation. These islands include: Dominica, Montserrat, St. Kitts and Nevis, Grenada, St. Lucia, St. Vincent and the Grenadines and Martinique.

Possible Treasure Maps from Geothermal Exploration

Locating favourable locations for geothermal wells is a well thought process that requires defining the geothermal prospect. Like a treasure map, geothermal exploration methods have helped define geothermal prospects within the islands mentioned above. These islands’ search for geothermal energy began with the work of geothermal exploration methods which ranged from geological, geochemical and geophysical surveys. Surface mapping of numerous thermal springs, solfataras, fumaroles and steam vents, cold discharges, fossil alteration areas and phreatic craters were some of the initial steps to mapping the geothermal prospects. Adding to this, geochemical surveys were also used to define geothermal prospects, for example in St. Lucia (Damore et al, 1990), Dominica (Traineau et al, 2015), Nevis (La Fleur and Hoag, 2010), St. Vincent (Huttner, 1996), Martinique (Gadalia et al, 2015) and Montserrat (EGS, 2010).

To add to these rich data, these islands have also conducted geophysical surveys to help further identify the geothermal reservoir and possible drilling locations. Methods such as gravity,
resistivity, magnetic and seismic techniques have helped map geothermal resources. For example, a Magnetotellurics survey conducted in Montserrat (Ryan et al., 2009) helped to map the conductive clay cap in the South-western area of Montserrat (St. Georges Hill). This conductive clay cap is typical of a geothermal system. Below are the possible geothermal locations identified from geothermal exploration on these islands.

The findings from the geothermal exploration surveys have also helped to locate drilling locations. In Dominica’s geothermal area, Wotten Waven, three slim hole wells were drilled from 2011-2012 and a field potential of 65MW was confirmed. In Montserrat two exploratory wells were drilled in the St. Georges area to 2298m and 2800m in 2013 and encountered temperatures of 230°C and 265°C respectively. Evaluations concluded that the maximum yields were about 1.5MW per well. A third well is currently being drilled also in the St. Georges area, Montserrat. In 2008, three small diameter exploratory wells were drilled in Nevis about 3.7 km apart in the Spring Hill, Jessups and Hamilton estates areas. All encountered temperatures greater than 225°C. Results obtained lead to confirm that the site, Nevis 1, had the potential of supplying the country with a base load of at least 30MWe. St. Lucia and Martinique have also drilled exploratory wells.

<table>
<thead>
<tr>
<th>Dominica</th>
<th>Wotten Waven</th>
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<tbody>
<tr>
<td>Montserrat</td>
<td>St. Georges Hill</td>
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<tr>
<td>St. Lucia</td>
<td>Sulphur springs</td>
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<tr>
<td>St. Kitts/Nevis</td>
<td>NW area/Spring Hill, Jessups and Hamilton</td>
</tr>
<tr>
<td>St. Vincent</td>
<td>Soufriere area</td>
</tr>
<tr>
<td>Grenada</td>
<td>North of Mount St. Catherine</td>
</tr>
<tr>
<td>Martinique</td>
<td>Montagne Pelée, Petite Anse, Lamentin</td>
</tr>
</tbody>
</table>

Geothermal areas for islands in the Eastern Caribbean identified from geothermal exploration.

Many of these islands have future plans for geothermal power plant installations. There are however some challenges that have been delaying this. Amongst these challenges include recent natural disasters, funding and lack of education within these islands. In addition to this, in drilling for geothermal energy there still exists the potential risk associated with drilling an unproductive well.

**Overcoming challenges and putting that treasure to use!**

To overcome some of these challenges recent activities were highlighted. The Caribbean Development bank (2017) reported that funding was received from European Union Caribbean Investment Facility to support the development of the geothermal exploration in the Eastern Caribbean. The geothermal energy can be used for the creation of a regional grid that can potentially be supplied to neighbouring islands. For example, work has already started with this concept of an interconnection grid for Guadeloupe-Dominica-Martinique and Nevis-St. Kitts. Lastly to reduce the uncertainties with drilling unproductive wells, new integrated geophysical techniques are being incorporated to model geothermal systems in the Caribbean. The applications are expected to significantly improve our ability to image and qualitatively conceptually model high temperature geothermal systems.

**Conclusion**

It is an exciting time for many islands in the Caribbean as they continue the journey to uncover this hidden treasure. Dominica, Montserrat, St. Kitts and Nevis, Grenada, St. Lucia, St. Vincent and the Grenadines and Martinique continue to aspire to recover Geothermal Energy: some with plans for geothermal power plant installations and some with ongoing geothermal exploration for unexplored geothermal prospects within the Caribbean. Though faced with some challenges, harnessing this sustainable and renewable energy can improve growth in the region by simultaneously reducing the region’s heavy dependence on expensive imported fossil fuels.
References:


Damore, F. et al., 1990, Preliminary geochemical and thermodynamic assessment of the geothermal resources, Sulphur Springs area, St Lucia, W.I. Applied Geochemistry 5, no. 5-6 587-604. doi:10.1016/0883-2927(90)90058-d.

EGS Inc. Final report Geothermal Exploration in Montserrat, Caribbean; EGS Inc.: Santa Rosa, USA, 2010; p189.


Ryan, G.A et al., 2009 Imaging the Montserrat Geothermal Prospect Using Magnetotelluric (MT) and Time Domain Electromagnetic Induction (TDEM) Measurements; 16366.00-2009.01; Institute of Earth Science and Engineering: Auckland, New Zealand; p. 77.


Publications, Websites, Videos & Maps
by Ian Crawford

New Report Highlights Rapid Deployment and Falling Costs of Clean Energy

World Energy Outlook 2017 (International Energy Agency)
Four large-scale shifts in the global energy system set the scene for the World Energy Outlook 2017: the rapid deployment and falling costs of clean energy technologies, the growing electrification of energy, the shift to a more services-oriented economy and a cleaner energy mix in China, and the resilience of shale gas and tight oil in the United States. More Information........

Electrification of Industrial Processes Based on Renewable Technologies May Offer Greater Potential for CO2 Emissions Reduction - Report

Renewable Energy for Industry (International Energy Agency)
Electrification of industrial processes, if based on renewable technologies, may offer greater potential for CO2 emissions reductions. This would entail continued electrification of energy for motion and force, still far from being completed, and electrification of heat and steam production via a series of technologies.

This report reveals the promises, but also the limits, of direct industrial uses of renewable heat (solar, geothermal) or biomass. Renewable electricity has much greater potential, directly or through the formation of synthetic fuels or hydrogen-carriers – hydrogen being used in industry as feedstock, process agent or energy. Download the Report (PDF)........

OPEC Recognizes that Renewable Energy is Fastest Growing Energy Type

2017 World Oil Outlook (OPEC)
The Organization of the Petroleum Exporting Countries (OPEC) has released the latest version of its World Oil Outlook.

Driven by expansion in developing countries, global energy demand is set to increase by 35% over the period 2015–2040. Other renewables - consisting mainly of wind, photovoltaic, solar and geothermal energy - are projected to be by far the fastest growing energy type. It is estimated to have an average annual growth rate of 6.8% over the forecast period. Oil and coal are projected to grow at much lower rates of 0.6% and 0.4% p.a., respectively. Download the Report (PDF)........

Japanese Low Temperature Geothermal Power Market to Expand - Report

Low Temperature Geothermal Power in Japan (Frost & Sullivan)
Despite stagnation in development of geothermal energy technology at medium and high temperatures, increased investment and technological innovation targeting low temperature geothermal power (<120°C), historically used primarily for heating purposes, are expected to significantly increase the addressable market potential for geothermal power and represent a new growth market in the country. Download the Report (PDF)........

New Report Surveys Supply Chain for Geothermal Energy

Supply chain of renewable energy technologies in Europe: An analysis for wind, geothermal and ocean energy (European Union)
The global market in geothermal power is dominated by four major manufacturers (Toshiba, Mitsubishi, Ormat, Fuji) accounting for about 80% of the installed capacity (Annex et al., 2016).
The European market is still dominated by conventional dry steam/flash technology (65% of installed capacity). However, the majority of recent installations are binary power plants. The main turbine suppliers after 2012 are Ormat (34% market share, followed by Exergy and Atlas Copco with 22% and 19% of market share, respectively. Download the Report (PDF). .

How United Nations Framework Classification for Resources Applies to Geothermal Energy

Application of UNFC to Geothermal Energy Resources - Selected Case Studies (ECE Energy Series No. 51)

This publication includes a set of 14 case studies on the applications of United Nations Framework Classification for Resources (UNFC) to geothermal energy from Australia, Germany, Hungary, Iceland, Italy, Netherlands, New Zealand, Philippines and the Russian Federation. Download the document (PDF). .

Geothermics

Through affiliation with the International Geothermal Association (IGA) the GRC offers a discount to the professional journal Geothermics, which publishes articles on the theory, exploration techniques and all aspects of utilizing geothermal resources.

Current, past as well as upcoming articles in Geothermics can be found by going to: http://www.elsevier.com/locate/geothermics

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The 2017 edition of the GRC Membership Roster and Registry of Geothermal Services and Equipment has been sent to all GRC members.

The “Phone Book” for the world geothermal industry, the GRC Membership Roster provides contact information for more than 1,000 corporate and individual members of the GRC in cross-referenced lists for speedy access. In addition, this publication offers contact information for additional geothermal associations and a number of federal and state geothermal offices. To make sure you are included in the 2018 Roster renew your GRC membership-deadline is February 28.

As of December 31, 2017 the membership of the GRC stood at 1,176 including 217 student members. Membership is drawn from 44 countries around the world.

Contact information for these and all other GRC Members can be found in the online GRC Member Database at https://eseries.geothermal.org (access for Members only).

More information on Membership of the GRC can be found online at: www.geothermal.org/membership.html

The GRC has a wide-ranging global membership.
Calendar of Events

Regional Workshop on Geothermal Financing and Risk Mitigation in Africa (IRENA)
31 January-2 February, Nairobi, Kenya

World Sustainable Development Forum (WSDF)
Implementing The Paris Agreement and The SDGs
1-2 February, Hotel Intercontinental Presidente, Mexico City
http://worldsdf.org

2018 NASEO Energy Policy Outlook Conference
6-9 February, The Fairmont, Washington, DC, USA
http://energyoutlook.naseo.org/

Stanford Geothermal Workshop
12-14 February, Stanford, California, USA
https://pangea.stanford.edu/researchgroups/geothermal/stanford-geothermal-workshop

Second Annual Danish Geothermal Energy Conference
19 February, Christiansborg, Denmark
http://geoop.dk/geotermikonference/

IV. Geothermal and Natural Mineral Waters Symposium and Exhibition
21-24 February, Afyonkarahisar City, Turkey
https://jeotermalsempozyumu.org/

GeoTHERM – Expo & Congress
1-2 March, Offenburg, Germany
www.geotherm-germany.com/

CAS Deep Geothermal Systems - Certificate of Advanced Studies
Module 4: Reservoir Evaluation and Production
12-16 March, Neuchâtel, Switzerland
www.unine.ch/cas-deegeosys

ACORE National Renewable Energy Policy Forum
14 March, Washington Marriott at Metro Center, Washington, DC, USA
www.acorepolicyforum.org/

3rd IGC Turkey Geothermal Conference & Exhibition
14-15 March, Ankara, Turkey
www.igc-turkey.com/

9th European Geothermal PhD Days (EGPD)
14-16 March, Zurich, Switzerland
https://geothz.ch/conferences/egpd/

7th ITB International Geothermal Workshop
21-22 March, Institut Teknologi Bandung (ITB), Indonesia
http://geothermal.itb.ac.id/workshop2018/

GeoTenerife Field School - Surface Geothermal Monitoring
22-28 March, Tenerife, Canary Islands, Spain
http://geotenerife.com/geothermal-exploration-field-school/

25th Annual Congress of the Mexican Geothermal Association
19-20 April, Morelia, Michoacán, México
www.geotermia.org.mx/geotermia/?page_id=1131

5th Expo Geothermal
19-21 April, İzmir, Turkey
http://demosfuar.com.tr/fair/2

Iceland Geothermal Conference 2018
24-26 April, Reykjavik, Iceland
www.igc.is

Resources for Future Generations Premier Conference On Energy • Minerals • Water • The Earth
16-21 June, Vancouver Convention Center, Vancouver, BC, Canada
http://rfg2018.org/

ICEM18 - Eighteenth International Conference of Experimental Mechanics (EuraSEM)
Session on "Experimental Methods in Geothermal Engineering"
1-5 July, 2018, Brussels, Belgium
www.icem18.org

GEOHEAT International Geothermal Conference
4-7 September, Petropavlovsk-Kamchatsky, Russian Federation
https://pbs.twimg.com/media/DLsAdQDW0AAxWj9.jpg

GRC Annual Meeting & Expo
14-17 October, Reno, Nevada, USA
www.geothermal.org/meet-new.html

Seventh African Rift Geothermal Conference (ARGeo-C7)
29 October–4 November, Kigali, Rwanda
www.theargeo.org ■
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