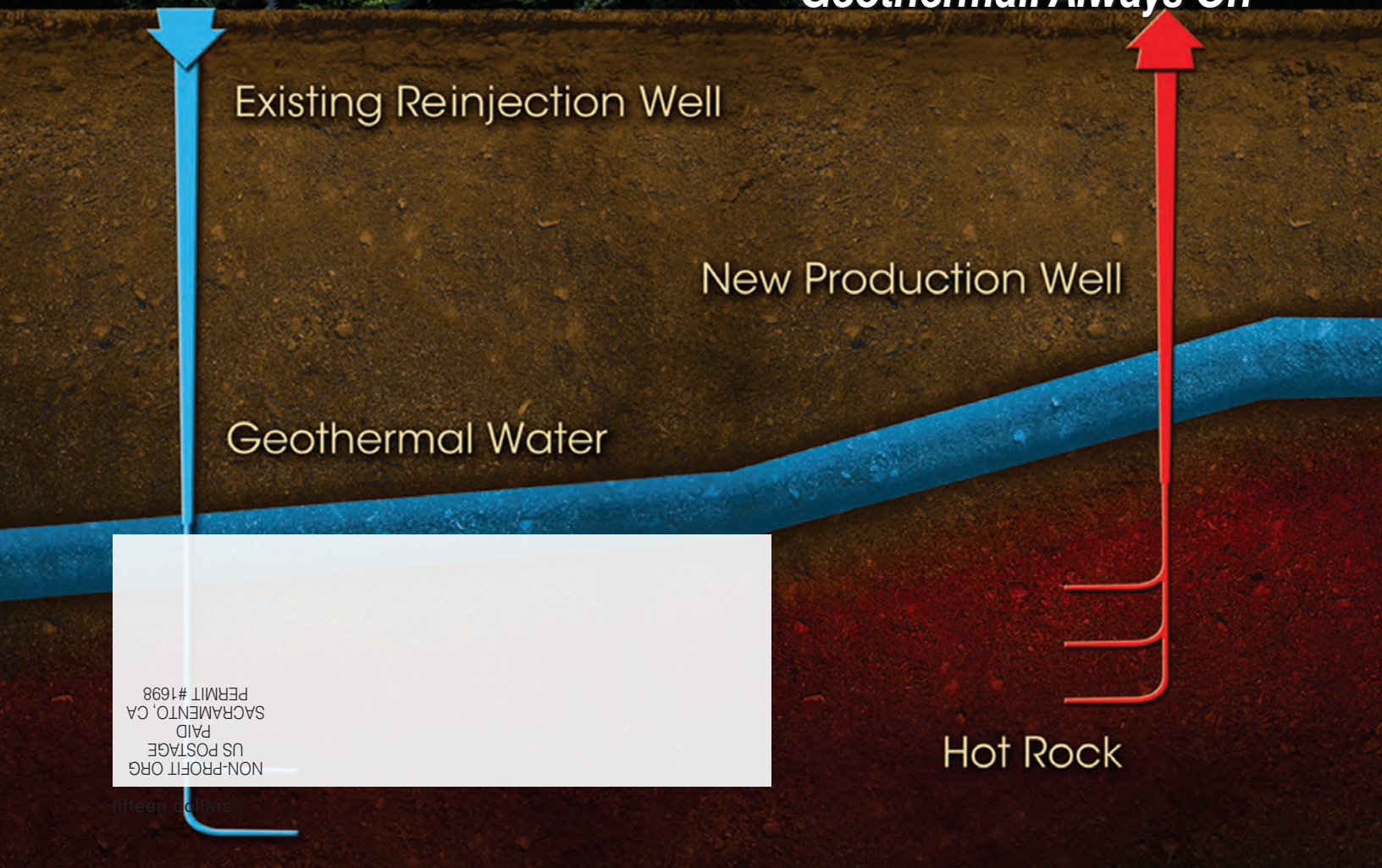
GEOTHERMAL RESOURCES COUNCIL

Bulletin

Vol. 44, No. 5
September/October 2015

GRC Annual Meeting & GEA Expo
"Geothermal: Always On"



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Bulletin

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The Geothermal Resources Council (GRC) *Bulletin* (ISSN No. 01607782) is published as a service to its members and the public, with six issues per annual volume. The GRC is an international, non-profit educational association whose purpose is to encourage research and environmentally sound exploration, development, and utilization of geothermal-energy resources worldwide through cooperation with governmental agencies, academic institutions, and the private sector. The GRC *Bulletin* provides a forum for information transfer to the public and among professionals in many fields related to geothermal resources, including geology, exploration, development, electric-power production, and direct-use technologies. The views and opinions expressed by authors in this publication do not necessarily reflect those of the GRC or its members. For changes of address or membership information, please contact us.

Geothermal Resources Council

P.O. Box 1350
Davis, CA 95617-1350

Phone: 530-758-2360
Fax: 530-758-2839

www.geothermal.org

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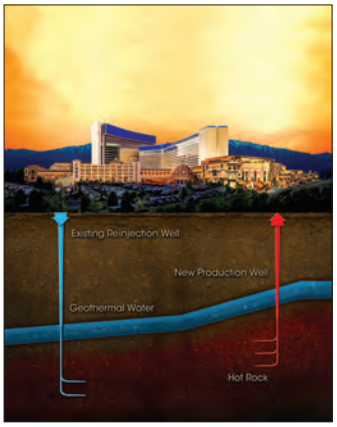

COVER: The Peppermill Resort Spa Casino, the only resort in the United States whose heating source is total provided from geothermal energy produced on the immediate property. COURTESY PEPPERMILL


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President's Message

by Paul Brophy, President of the GRC

Welcome to the 39th GRC Annual Meeting

By the time you read this the 2015 GRC Annual Meeting and GEA Expo (Annual Meeting) at the Peppermill Hotel in Reno will be almost upon us. Historically the first GRC Meeting was in El Centro, California in 1972, the year the GRC was formed. The first of our regular Annual Meetings did not begin until 1977 in San Diego. We have had an Annual Meeting continuously (this year is the 39th) since then which is no mean achievement.

I would like to offer a few words regarding how we select our Annual Meeting locations. Some years ago we were following a general pattern of choosing between three primary locations - San Diego, Reno and San Francisco. However, San Francisco got far too expensive for us and we dropped that location following the 2000 Annual Meeting in Burlingame. Other multiple locations include Hawaii and Portland, Oregon (each 3 times) and Palm Springs, California and Salt Lake City, Utah (each twice). At various times we have also been to Houston, Texas, Santa Rosa and Sacramento, California and Las Vegas, Nevada. Our 2016 Meeting (the 40th) will be returning to Sacramento.

For each year a number of sites are selected by the Annual Meeting Advisory Committee with assistance from our outside conference consultant Paul Miller. Because of booking requirements the decision on the location is normally made two to two and a half years before the actual date so now we are in the process of deciding the location for 2017. The Advisory Committee makes a recommendation which is put before the Board of Directors for a vote.

The Greater Reno area (Reno and Sparks) has always been a good location for the GRC, due in part to i) the proximity to a large number of geothermal developments, ii) having numerous geothermal-aware residents and iii) having relatively inexpensive hotel rooms and conference facilities. We almost always come to Reno in years that the World Geothermal Congress is held because we recognize that in those years (WGC occurs once every five years) the focus will always be on the international activities.

This year, in addition to our regular GRC Workshops, Technical Sessions, social events and the GEA trade show, the GRC will be running field trips that will incude visits to the McGinness Hills, Steamboat and Long Valley geothermal projects. We also have Lisa Shevenell as our General Chair, so are assured of a well-organized and well-run meeting. We have a few new social events and this year we will be debuting a brand new conference App that will allow attendees to follow the schedule on their mobile devices, even allowing you to personalize your day-to day activities (see page 12 for more information). The Annual Meeting guide can be downloaded together with the App so the information is available at all times, even at times when there is no internet connection! We are very excited to launch this new service. Please give us feedback and let us know how well it works for you.

And of course we thank all the GRC staff for the work the hard work they put in to organizing the Annual Meeting throughout the year. It is not an easy job to do but the Meeting always seems to run smoothly and efficiently - so again thanks and I hope to see you all in Reno

Please feel free to contact me at any time by phone at (707) 544-0955 or by email at pbrophy@envgeo.com if you have any suggestions or ideas on how we can improve the GRC experience for you. ■

Executive Director's Message

by Steve Ponder

GRC Mission Statement and a Super Bowl Victory

Over the last few months the GRC Board of Directors has been drafting a new Mission Statement for the GRC, part of an overall new strategic planning effort. The GRC staff has been following this process with keen interest. My view is that once the Mission Statement is finalized, it will be of great help in managing, prioritizing and leading the GRC in new directions.

A good example of the value of mission statements is from an American football team, the Seattle Seahawks. The team had been floundering for years until Paul Allen of Microsoft fame became the owner and Pete Carroll, a legendary coach took over the helm. They developed a very simple Mission Statement that outlined the type of team they wanted to build. This simple agreement included a buy-in by the coaches, players, management, and ultimately even the fans. Their mission statement and goals helped the Seahawks to a Super Bowl victory in 2013.

In developing a Mission Statement for the GRC, the Board has stolen a play from the Seahawks play book. Pete Carroll was recently at a dinner with four business men and in conversation he asked each person to describe what their company did. Each man spoke for several minutes and then Pete went back around the table and asked each person to condense what they had just said to just 7 or 8 words. That focus became the breakthrough for the GRC Board of Director's in developing their own Mission Statement. Short and sweet is the key.

The Board should approve the new GRC Mission Statement by the Annual Meeting and President Paul Brophy intends to unveil it during his remarks at the Opening Session. He also plans to share the process that led to the development of the Mission Statement in his column in the next *GRC Bulletin*. ■

Communication from the GRC

by Ian Crawford, Director of Communications

GRC Awards Announced

The GRC has announced awards honoring the best and brightest of the global geothermal energy community. These prestigious awards have been a highlight of the geothermal calendar since the late 1970's.

This year's award winners are:

Joseph W. Aidlin Award
Gene Suemnicht
For lifetime contributions to geothermal exploration and development worldwide and exceptional commitment to GRC.

Geothermal Pioneer Award
Alfredo Lahsen
For lifetime achievements in geothermal studies in the Andes and for educating generations of geothermal scientists in Latin America.

Henry J. Ramey Jr. Award
Thomas Kohl
For seminal contributions to the modeling of hydraulic stimulation of EGS reservoirs and fluid flow in fractured media, and for mentoring the next generation of geothermal reservoir engineers.

Ben Holt Award
Robert Tucker
For lifetime achievement and innovation in geothermal power plant and process design.

Geothermal Special Achievement Award
Roland Horne
For unparalleled contributions to geothermal education and development worldwide, through the Stanford Workshops, World Geothermal Congress, and his leadership and commitment to the International geothermal Association (IGA) and GRC.

Geothermal Special Achievement Award
Ryuichi Itoi
For lifetime commitments to education and research, efforts that influenced much of Asia Pacific's geothermal development.

Geothermal Special Achievement Award
Al Waibel
For significant global contributions to geothermal mapping and field work for over 40 years.

The GRC will present the prestigious Aidlin, Pioneer, Henry J Ramey Jr., Ben Holt, and Special Achievement awards at the **Annual Membership Meeting & Awards Luncheon**, the climax to the **GRC Annual Meeting**, at the Peppermill Resort Spa Casino, Nevada, USA, on **Wednesday, September 23**.

Geothermal Resources Council Announces Scholarship Winners

$15,000 in Scholarship Awards will be presented at the 2015 GRC Annual Meeting

The GRC is pleased to announce the recipients of six GRC Scholarship Awards.

GRC Student Project Award ($4,500):

- **Marisa Earll** – Master's student in the Department of Hydrology and Water Resources at the University of Arizona

GRC Graduate Scholarship Awards ($2,500):

- **Owen Callahan** -- PhD candidate at University of Texas at Austin
- **Cari Covell** – Master's student at the Iceland School of Energy of Reykjavik University
- **Cary Lindsey** – PhD student at University of Idaho

GRC Undergraduate Scholarship Awards ($1,500):

- **Thomas Lund** – Mechanical Engineering student at University of Colorado, Boulder
- **Jeffrey Olson** – Petroleum Engineering student at Colorado School of Mines

The selection of recipients was based upon a variety of factors, including the individual's academic record, student activities, geothermal industry experience, and career goals.

The scholarships will be presented at the GRC Awards Luncheon at the **GRC Annual Meeting**, at the Peppermill Resort Spa Casino, Reno, Nevada, USA, on **Wednesday, September 23**.

GRC Annual Meeting & GEA Geothermal Energy Expo

By the time you receive this issue of the *GRC Bulletin* **the biggest GRC Annual Meeting & GEA Expo** will be just a few short weeks away. It is not too late to join the global geothermal community in Reno, Nevada, USA. Time to start packing!

All the necessary information, including the *Final Program*, is available online at www.geothermal.org

"Geothermal: Always On"

Register Now!

Registration can be made online at: eseries.geothermal.org – look for the link from the front page of the GRC website at: www.geothermal.org – or by completing and returning the *Registration Form*, also found on the front page of the GRC website. **Early bird registration expires August 30**.

From August 31 the rates are the following:

- Current **GRC members pay $895** to attend all three days. **Non-members pay $995** *which includes complimentary GRC partial 2015 and full year membership for 2016*.
- **Students**, with current academic identification or class schedule, **pay just $5**! *This also includes the complimentary GRC partial 2015 and full year membership for 2016*.
- **One day registration is $475 each day**.

A *Final Program* is available to view, download and print-out if you wish.

Scan the QR code on the right to view the PDF on your mobile device.

Register now using the GRC Annual Meeting *Registration Form* available on the GRC website at: www.geothermal.org/meet-new.html

OR

Register Online at: https://eseries.geothermal.org/

Book your Room! - Discount ends August 28

The room blocks at the **Peppermill Resort Casino Spa** are almost full. Book your room now to avoid disappointment!

There is a link to the dedicated booking website on the front page of the GRC Annual Meeting web page at: www.geothermal.org/meet-new.html.

Make sure you book through the special website created by the hotels for GRC and GEA – using another method might result in a more expensive rate and exposure to possible scams!

Flying to Reno

Reno-Tahoe International Airport offers **nine airlines** providing over 100 daily flights serving the following **Non-Stop Destinations**:

Chicago/Midway (MDW)
Chicago/O'Hare (ORD)
Dallas
Denver
Guadalajara, Mexico
Houston (IAH)
Las Vegas
Los Angeles
Minneapolis/St. Paul
New York/JFK
Phoenix
Portland
San Francisco
Salt Lake City
San Diego
San Jose
Seattle

Airport Shuttle

The airport is a short **13 minute (3.5 mile) drive from the Peppermill Resort Spa Casino**.

The airport shuttle departs from the airport going to the Peppermill **every half-hour** beginning at 4:15 am, and continuing to 11:45 pm. This shuttle picks-up **outside the D Doors** located **at North exit** of the **Baggage Claim** area.

The shuttle back to the airport departs from the valet area outside the Hotel Lobby, and runs **every half-hour** beginning at 4 am. The last shuttle departs from the Peppermill going to the airport at 11:30 pm.

NOTE: The Peppermill is a **4 hour drive from San Francisco International Airport, 2.5 hours from Sacramento Metropolitan Airport**. Las Vegas is a 7 hour drive.

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More information on the GRC Annual Meeting & GEA Expo can be found at: www.geothermal.org/meet-new.html. Check back online for the most up-to-date information.

Register now!

Register now using the GRC Annual Meeting Registration Form available on the GRC website at: www.geothermal.org/meet-new.html **OR**

Register Online at: https://eseries.geothermal.org/ ■

The GRC Annual Meeting & GEA Expo Has Gone Mobile!

We strongly encourage you to download our mobile guide to enhance your experience at the GRC Annual Meeting & GEA Geothermal Energy Expo. You'll be able to plan your day with a personalized schedule and browse exhibitors, maps and general show info. *You can browse all the essential information* **even without internet access**.

The app is compatible with iPhones, iPads, iPod Touches and Android devices. Windows Phone 7 and Blackberry users can access the same information via our mobile site at https://guidebook.com/guide/34171/

To get the guide, choose one of the methods below:

- Download 'Guidebook' from the Apple or Amazon App stores or from the Android Marketplace
- Visit http://guidebook.com/g/GRC2015 from your phone's browser
- Scan the following image with your mobile phone (QR-Code reader required, e.g. 'Red Laser', 'Barcode Scanner')

From the Guidebook application, tap "Download Guides" then "Redeem Code". Enter the code **grc2015** and the guide will download to your device!
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2015-2016 GRC Board of Directors

President (2015-16)
Paul Brophy
Phone: (707) 544-0955
Email: pbrophy@envgeo.com

President-Elect (2017-18)
Maria C. Richards
Phone: (214)-768-1975
Email: mrichard@mail.smu.edu

Past President (2013-14)
Louis E. Capuano, Jr.
Phone: (707) 595-8742
Email: lcapuano@capuanoengineering.com

Tonya (Toni) Boyd
Phone: (541) 891-2571
Email: toniboydgeo@gmail.com

Anna K. Carter
Phone: (530) 736-2299
Email: geothermalservices@gmail.com

Patrick Hanson
Phone: (707) 536-3300
Email: phanson610@gmail.com

Stuart Johnson
Phone: (775) 848-6922
Email: Stuartdjohnson1@gmail.com

Dennis Kaspereit
Phone: (760) 485-1855
Email: dkaspereit@geothermalresourcegroup.com

William (Bill) Rickard
Phone: (760) 341-0186
Email: billrickard@geothermalresourcegroup.com

Andrew Sabin
Phone: (760) 939-4061
Email: andrew.sabin@navy.mil

Elaine Sison-Lebrilla
Phone: (916) 732-7017
Email: Elaine.Sison-Lebrilla@smud.org

Gene A. Suemnicht
Phone: (707) 799-8097
Email: gsuemnicht@envgeo.com

Karl F. Urbank
Phone: (707) 431-6034
Email: karl@calpine.com

Louis Capuano III
Phone: (707) 595-8740
Email: leciii@capuanoengineering.com

Richard Campbell
Phone: (303) 805-5773
Email: rcampbell@tetratech.com

Dennis J. Gilles
Phone: (208) 424-1027
Email: dgilles@usgeothermal.com

James W. Lovekin
Phone: (510) 898-3112
Email: jlovekin@slb.com

Roy L. Mink
Cell: (208) 699-4396
Email: h2oguy@copper.net

Joseph Moore
Phone: (801) 585-6931
Email: jmoore@egi.utah.edu

Masami Nakagawa
Phone: (303)384-2132
Email: mnakagaw@mines.edu

Shigeto Yamada
Phone: 81-44-329-2123
Email: yamada-shigeto@fujielectric.com

Katherine R. Young
Phone: (303) 384-7402
Email: Katherine.Young@nrel.gov

James "Josh" Crowell
Ex officio Student Member
Phone: (701) 740-3050
Email: james.crowell@my.und.edu

Photos of the Board of Directors can be seen on the GRC website at: www.geothermal.org/bod.html

Inside Geothermal

NORTH AMERICA

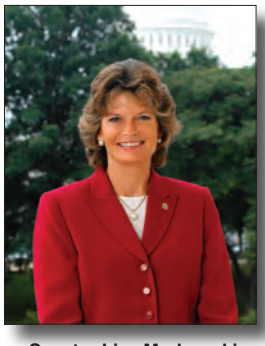
President Obama Orders U.S. Power Plants to Cut Carbon Pollution

President Barack Obama has released final details of the **Clean Power Plan**, part of the administration's fight against climate change.

According to a news release from **The White House**, "The Clean Power Plan establishes the first-ever national standards to **limit carbon pollution from power plants**. We already set limits that protect public health by reducing soot and other toxic emissions, but until now, existing power plants, the largest source of carbon emissions in the United States, could release as much carbon pollution as they wanted."

"The final Clean Power Plan sets flexible and achievable standards to **reduce carbon dioxide emissions by 32 percent from 2005 levels by 2030**, 9 percent more ambitious than the proposal."

New Legislation Would Set a 50 GW Goal for Geothermal Energy in U.S.


Senator Lisa Murkowski

The **Energy Policy Modernization Act of 2015**, introduced in July, is sponsored by **Senator Lisa Murkowski**, a Republican from Alaska, and **Senator Maria Cantwell**, a Democrat from Washington State. The bipartisan legislation features five titles reflecting common ground on energy efficiency, infrastructure, supply, accountability, and land conservation.

According to the U.S. **Geothermal Energy Association (GEA)**, the act includes several provisions supporting geothermal energy:

- **Sets a 50,000 MW National Geothermal Goal**;
- Directs federal agencies to identify priority areas for development;
- Allows federal oil and gas lease holders to **obtain a non-competitive geothermal lease to facilitate coproduction of geothermal power** - today 25 billion barrels of hot water are produced annually from oil and gas wells within the United States;
- Facilitates new discoveries by allowing **the limited non-competitive leasing of adjacent lands** where a new discovery has been made; and
- **Provides geothermal exploration test projects a limited categorical exclusion** provided the lands involved present no extraordinary circumstances.

The U.S. Senate Energy and Natural Resources Committee voted in late July to **approve the proposed legislation** by a vote of 18-4.

Presentations from the 2015 Geothermal Technologies Office Peer Review Available Online

The **Geothermal Technologies Office (GTO)** of the U.S. Office of Energy Efficiency and Renewable Energy (EERE) conducted its **Peer Review**, a rigorous public evaluation of its geothermal project portfolio, in the spring. Peer Review provides a forum for independent, expert evaluation of the technical progress and merit of GTO's technical portfolio.

This year, the four-day event in May brought together nearly **300 participants from eight countries** —representing industry, national labs, government, and academia—to Westminster, Colorado, to review **110 GTO projects** and an additional **21 posters** on GTO-funded research. The event attracted a national and international audience in this sector, and opened a dialogue with other experts in geophysics, geochemistry, modeling, down-hole tools, and more.

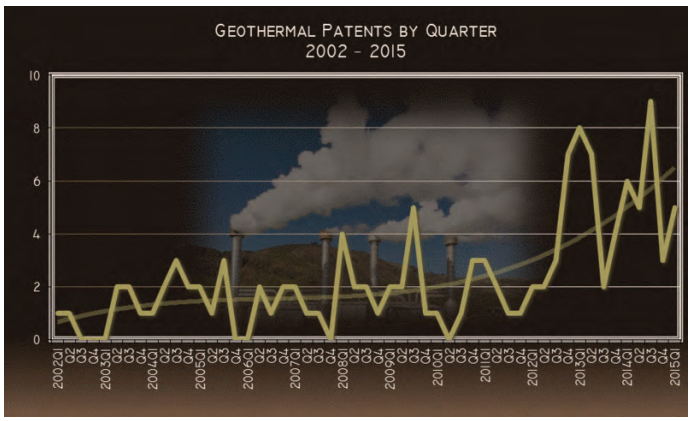
Presentations from the **GTO 2015 Peer Review** are now available at: http://energy.gov/eere/geothermal/2015-peer-review-presentations-geothermal-energy. *(Thanks to EERE/GTO)*

Innovative Activity in Geothermal Energy Continues to Increase

The **Clean Energy Patent Growth Index (CEPGI)**, published quarterly by the **Cleantech Group** at **Heslin Rothenberg Farley & Mesiti P.C.**, provides an indication of the trend of innovative activity in the U.S. Clean Energy sector, reports *Lexology*.

Results from the first quarter of 2015 reveal the CEPGI to have a value of 851 granted U.S. patents, which is the **fifth highest total for any quarter on record** with the other top four all occurring within the prior year and a half.

Geothermal patents (5) are up two compared to the fourth quarter but down one compared to the same quarter a year prior.



Patents awarded to innovations in geothermal have increased every year in recent years. COURTESY HESLIN ROTHENBERG FARLEY & MESITI P.C.

Imperial Irrigation District Launches Antitrust Lawsuit Against CAISO

The energy company hoping to develop geothermal resources around the Salton Sea in Southern California has sued the entity that manages California's electricity grid, saying that it is making it difficult for them to send electricity to coastal cities via the district's power lines. This is restricting development of renewable energy projects in the area, especially geothermal energy.

According to a news release, the **Imperial Irrigation District (IID)** has filed civil litigation in U.S. District Court, Southern District of California, against the **California Independent System Operator (CAISO) Corp.,** alleging deliberate and systematic marginalization of IID, its ratepayers and all renewable energy generators seeking to develop projects in the district's service area.

IID claims that through its actions over many years, CAISO has exercised its monopoly power to **manipulate the import capability values, or deliverability** it assigns to IID to stifle competition, create uncertainty in the marketplace and effectively take over IID's energy balancing authority area.

"The abundance of renewable energy resources found only in this region will go untapped," said IID General Manager **Kevin Kelley**, "if CAISO continues to manipulate the deliverability it assigns to IID."

Imperial Irrigation District to Buy 50 MW of Geothermal Energy from Salton Sea

The Imperial Irrigation District (IID) Board of Directors has approved the purchase of geothermal energy from the local **Salton Sea Known Geothermal Resource Area**, reports *Imperial Valley Press*.

The IID will enter into a **10-year contract** with **Cal Energy** to purchase **50 MW** of its geothermal portfolio. This would bring geothermal energy to 9.3 percent of IID's renewable energy requirement.

Flow Test Confirms 30 MW Resource at U.S. Geothermal Geysers Project

U.S. Geothermal Inc. announced the company has successfully completed a flow test program on the three largest production wells at the **WGP Geysers project** in northern California confirming the existence of approximately **30 MW of steam**.

The three production wells with the highest flow rates were tested. All three wells produced **superheated steam** with estimated flow rates at or above the rates measured when the wells were first drilled between 2008 and 2009, confirming that the **wells are open and available for production**.

GRC Group Member **GeothermEx Inc.** designed and monitored the flow tests, and collected test data for their analysis. The reservoir report is expected by the end of August, and will be used to guide final development of the project.

"With approximately 30 megawatts of steam drilled, tested and ready for production at Geysers, we are actively pursuing discussions in support of a power purchase agreement for this, our most advanced stage development project" said **Dennis Gilles**, CEO of U.S. Geothermal and GRC Board Member.

Ormat 40 MW Casa Diablo IV Geothermal Plant Project passes Groundwater Test

The **Mono County** Superior Court released its decision for the **Great Basin Unified Air Pollution Control District (Great Basin)** to uphold its conditional approval for a new geothermal project by Ormat located in the Casa Diablo area of the Inyo National Forest, reports *Sierra Wave Media*.

In his decision, **Superior Court Judge Stan Eller** rejected the arguments of the **Mammoth Community Water District (MCWD)** and two union groups who alleged that the project approvals did not comply with the California Environmental Quality Act (CEQA).

The geothermal reservoirs and the drinking water aquifers are located approximately two miles away and separated by a layer of impermeable rock. The Court held that the extensive record of evidence, including expert opinions and scientific studies, established "substantial evidence that there **is no connectivity between the deep geothermal reservoir and MCWD's groundwater aquifer**."

However, as part of the Great Basin's approvals, **a groundwater monitoring plan must be approved by the federal and state agencies and implemented by Ormat before drilling any new geothermal wells**. Ormat has obtained assistance from the California Energy Commission for two new monitoring wells and agreed to the location of those wells with the Water District to ensure that geothermal operations do not affect Mammoth Lakes' domestic water supply.

The final project will include the construction of **a new 40 MWe geothermal power plant**, up to 16 new production and injection wells, multiple pipelines, and an electric transmission line.

*A **GRC Fieldtrip** will visit Casa Diablo Hot Springs and the Ormat Mammoth Pacific Power Plants, including the Casa Diablo power plants, as part of an excursion to the **Long Valley, September 18-20**, before the **GRC Annual Meeting & GEA Geothermal Energy Expo**.*

China May Invest in Geothermal in Canada

The Rocky Mountain Goat, a local newspaper in British Columbia (BC) reports that the Chinese government is interested in investing in foreign alternative energy in the area, and a geothermal project in the **Canoe Reach** valley, just south of **Valemount**, might fit the bill.

Craig Dunn, the chief geologist and spokesperson for **Borealis Geopower**, the Calgary-based company that has been conducting exploration for geothermal resources in the Canoe Reach was quoted a saying "**It's an exciting new opportunity**," though he admits he's stopped getting too excited about interim discussions, and this one is preliminary so far.

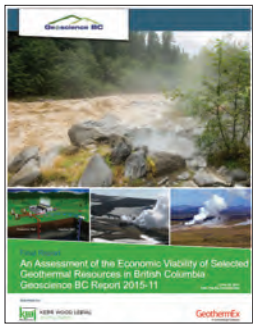
The company has been approached by a Canadian branch of the **China Overseas Investment Union (COIU)** that is interested in investing in a geothermal power project in BC.

Study Estimates 400 MW of Geothermal Resources in British Columbia

An assessment of 18 sites in British Columbia, Canada by **Geoscience BC** has resulted in an **estimated total capacity of just 400 MW**. The authors also conclude that geothermal compares unfavorably when it comes to cost.

To better understand the economic viability of geothermal energy in British Columbia, Geoscience BC and partner **BC Hydro** retained **Kerr Wood Leidal Associates Ltd. (KWL)** in January 2015, who with its partner **GeothermEx Inc**., a GRC Member company, undertook a high level technical and economic assessment using publicly available information for 18 specified geothermal sites around the province.

However, the report was criticized by the **Canadian Geothermal Energy Association (CanGEA)** for using outdated data, including drilling costs from 2012 (the peak of the shale boom) and a decade low foreign exchange rate. CanGEA wants to promote the use of current data that better reflects the actual cost of geothermal projects.



Download the *Economic Viability of Selected Geothermal Resources in British Columbia* report at: www.geosciencebc.com

Mexico Awards Geothermal Energy Sites to CFE

Mexico's energy ministry awarded **five geothermal concessions and 13 permits for exploration** to national power utility **Comision Federal de Electricidad (CFE)** in July, reports *SeeNews Renewables*.

The company will study geothermal resources of a possible **448 MW capacity** in the states of **Baja California, Michoacan, Nayarit and Puebla,** while the five reserved fields are **Cerro Prieto, Tres Virgenes, Los Azufres, Los Humeros and Cerritos Colorados**, located in Baja California, Baja California Sur, Michoacan, Puebla and Jalisco, respectively. The assigned areas will allow the company to **increase its geothermal power output by 50%.**

Also, private investors will have the opportunity to develop some **5,000 MW of probable geothermal resources** in the country, according to deputy minister of planning **Leonardo Beltran. The first private bid round for geothermal is expected to open in August**. Also, the private sector would be allowed to form alliances with CFE to develop projects.

French Companies to Help Develop Geothermal Energy in Mexcio

Diario Rotativo reports that the head of the **Mexican Federal Electricity Commission (CFE), Enrique Ochoa Reza**, signed a *Memorandum of Understanding and Cooperation* with French energy company **Engie**, and a *Letter of Intent* with the **French Development Agency (AFD)** to help develop geothermal energy projects in Mexico.

The cooperation and intellectual exchange is aimed at developing the **25 MW Los Humeros III – Phase A power project** in the eastern municipality of **Chignautla**.

CENTRAL AND SOUTH AMERICA

Tender Issued for Management of Geothermal Development Facility Latin America

The German government-owned development bank, **KfW** - on behalf of the **German Federal Government**, the **European Union** and the **Stakeholder Group** - has issued a request for suppliers to participate in the negotiated tendering procedure for the procurement of Fund Management services for the **Geothermal Development Facility Latin America (GDF Latin America).**

The GDF Latin America aims to overcome existing barriers for the development of geothermal energy in Latin America by providing (i) a tailored **Geothermal Risk Mitigation Fund** in order to mitigate geothermal resource risk during the exploratory drilling stage of the project as well as (ii) a **Technical Assistance Forum** in order to coordinate activities and programs of the GDF Latin America stakeholders with the respective partner governments.

The GDF Latin America is the first coordinated multi-donor scheme to support geothermal energy on a regional scale in Latin America and hopes to promote geothermal energy development in the region. It is expected to facilitate at the very minimum the development of up to **7 geothermal plants** with a cumulative **capacity of at least 350 MW** and a total estimated investment volume of at least EUR 1,000,000,000. **The deadline for submissions was August 8.**

Caribbean Update

There has been a series of announcements on progress in geothermal energy projects on Caribbean islands. News updates are from **St. Vincent, St. Kitts, St. Lucia, Dominica** and **Grenada**.

The geothermal energy project on **St. Vincent** is on track to start-up in 2018, according to **Peter Williams**, a representative of **Emera Caribbean Limited**, one of the companies that is partnering with the government of St Vincent and the Grenadines to execute the project.

Williams reported in July that his company is on track to move to the **drilling phase** of the project which **should be completed by the second quarter of 2016**.

Location of Caribbean islands with geothermal projects in development.

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Exploratory drilling on **St. Kitts** has been completed and plans have been announced for a feasibility study for developing geothermal energy on the island.

According to *SKNVibes*, St. Kitts and Nevis Minister of Energy **Ian Liburd** said **plans for a feasibility study** for the establishment of geothermal energy is part of a strategy for reducing the high cost of electricity.

"The government is looking at the legislation and bringing it up to speed to deal with feeder tariffs, geothermal development and other renewable energy resources," Liburd said.
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Drilling in the Roseau Valley for **Dominica's geothermal project** has officially come to an end and the project is now entering a new stage. **One production well and two re-injection wells have been drilled**.

The Finance Minister said, "Within the next two months, we expect to conclude negotiations with a French investment consortium, who are partnering with us in a joint venture, to build and operate the domestic plant, and the plant to export electricity to Guadeloupe and Martinique.

"The *Geothermal Development Bill*, a critical piece of legislation to facilitate investment in geothermal energy, has been drafted and will be tabled in Parliament by the end of September."

"Funding has been identified to aid construction. Both the **World Bank** and the **Agence Francaise de Developpment (AFD)** have offered financing under highly concessional terms and discussions in that regard are ongoing."

Construction of a **7.5-8 MW geothermal plant is planned to begin in 2016**.

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St. Lucia's Ministry of Sustainable Development, Energy, Science and Technology announced in late June that the second round of **public consultations** on the geothermal exploration project in Soufriere **has started**.

"The sessions will provide project updates for residents and key stakeholders, inform residents of important activities that will be undertaken within the coming weeks, and seek feedback," the Ministry said in a statement.

A special aircraft is expected to conduct **Light Detection and Ranging, or LiDAR, surveys** to help map the geothermal resource. A geologist will then conduct an assessment of the data collected and a report which will be completed in August.

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Results of a survey on **Grenada** indicate presence of a considerable (4-8km2), high-temperature geothermal resource (**200°C to 290°C**), reports *Caribbean News Now!*

The geology, geophysics and geochemistry surveys (3Gs surveys) were undertaken with the assistance of the **New Zealand government** and of **Jacobs New Zealand Ltd**.

Discussions were also held to set out a road map for the development of Grenada's geothermal potential.

Drilling Resumes at El Ceibillo Project

U.S. Geothermal Inc. announced that the company's wholly owned subsidiary, **U.S. Geothermal Guatemala, S.A.**, has started drilling **well EC-2 at the El Ceibillo Project**.

The well, which has a planned depth of 1,968 feet (600 meters), will test a high temperature anomaly identified by a 2014 temperature gradient drilling program.

Drilling was suspended after well EC-1 was drilled in June of 2013 until the project schedule for the concession could be modified. The Guatemala **Ministry of Energy and Mines** approved the modified project schedule in July. U.S. Geothermal expects to receive the amended concession contract before the end of August.

The new modified schedule has the **commercial operation date** for the first phase of the project occurring during the **second quarter of 2018**.

Drilling on EC-2 at El Ceibillo. COURTESY U.S. GEOTHERMAL INC.

Bolivia to Develop Apacheta I Geothermal Energy Project

Bolivia is studying 11 renewable energy projects, including geothermal, with the aim to develop 420 MW by 2020, **Eduardo Paz**, CEO of state-owned power company **Empresa Nacional de Electricidad (Ende)** announced.
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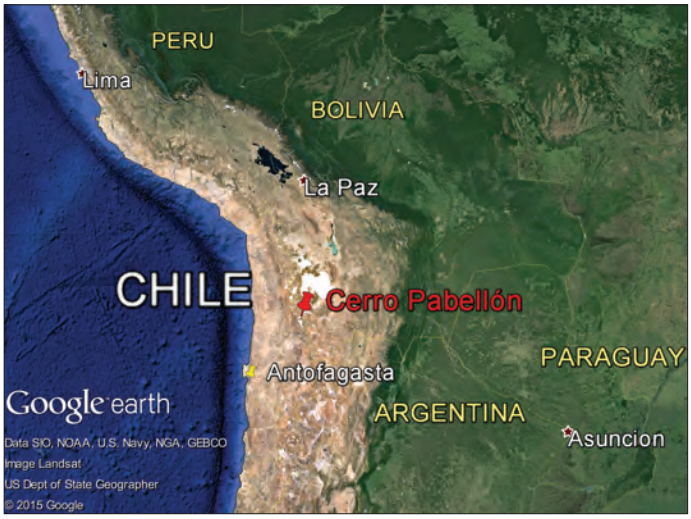
The package, worth some USD 600 million (EUR 542.4m) includes the **Apacheta I geothermal energy project** managed by **Empresa Electrica Corani SA**.

Work Starts on Only Geothermal Power Plant in South America

Enel Green Power and the Chilean state-owned company **Empresa Nacional del Petróleo (ENAP)**, have begun construction in Chile on the **48 MW Cerro Pabellón project**, the first geothermal plant in South America since a small binary demonstration plant in Argentina was decommissioned.



Location of the Cerro Pabellón geothermal project in the municipality of Ollagüe, in the region of Antofagasta.

Cerro Pabellón, located in the municipality of **Ollagüe**, in the region of **Antofagasta**, on the Andean Plateau near the border with Bolivia, will also be the first geothermal plant in the world built at over 4,500 meters above sea level.

The plant, owned by **Geotérmica del Norte SA**, a company controlled by Enel Green Power Chile Ltda with a 51% stake and 49% by ENAP, will comprise **two 24 MW units** for a total gross installed capacity of 48 MW. Once fully operational, Cerro Pabellón will be able to generate nearly **340 GWh per year**.

Work will be **completed in early 2017** after a total investment of around **USD 320 million**.

Enel Green Power Chile Ltda, also signed a long-term agreement for around 25 years of energy supply from Cerro Pabellón and for the sale of green certificates with Chile state utility **Empresa Nacional de Electricidad SA**.

$60 Million Renewable Energy Line of Credit for Chile

According to *The Financial*, the **International Finance Corporation (IFC)**, a member of the **World Bank Group**, has signed an agreement to provide **USD 60 million** to **Banco Consorcio** in Chile to finance non-conventional renewable energy projects in the country, **including geothermal energy projects**.

Banco Consorcio will also join the **IFC Global Trade Finance Program**, which will give it access to a trade line to help finance the growth of trade flows in the Latin America and Caribbean region, according to IFC.

Argentine Province gets 5 Bids for Domuyo Geothermal Studies

Argentina's **Neuquen** province has received five offers for studies in the **Domuyo geothermal area**.

Neuquen wants to develop the field as part of **a hydro-geothermal complex of at least 100 MW**. For Domuyo, the province needs a conceptual model of the geothermal field and estimates for commercial-scale power generation.

The five bidders are the consortia **Teranov-Hidrotec, Adage Geothermal-Quantec Geoscience Argentina, Geotermia Andina-DTP Laboratorios-Consultora Demison, ENAL-Proinsa**, and **Grupo Minero Aconcagua**.

Local investment promotion agency **ADI-NQN** has set a budget of USD 661,000 and nine months for completion of the services.

AUSTRALASIA

Increase in Geothermal Energy will Allow New Zealand to Close its Last Coal Plant

Because New Zealand has done so well in recent times in developing renewable resources, especially geothermal energy, the country **is able to retire all of its coal-fired power plants**.

New Zealand Energy and Resources Minister, **Simon Bridges** said **Genesis Energy's** decision to **close its two remaining coal units by 2018** is a sign of the times and reflects the growth of New Zealand's world-leading renewable energy industry.

"Historically coal has played an important role in ensuring the security of New Zealand's electricity supply, particularly in dry years where our hydro-lake levels are low. But significant market investment in other forms of renewable energy in recent years, **particularly in geothermal**, means that a coal backstop is becoming less of a requirement," said the Minister.

Inside Geothermal

Geothermal generation in New Zealand has more than doubled over the past decade and for the first time in 40 years, geothermal electricity generation contributed **more electricity than natural gas** during 2014.

Contact Energy to Become Independent Company

Major New Zealand geothermal energy producer **Contact Energy** will become an independently governed company for the first time since privatization in 1999, after cornerstone shareholder **Origin Energy**, based in Sydney, Australia agreed to **sell its 53.1 percent stake** to "a broad range of Australian, New Zealand and international equity market" investors, reports *Scoop*.

The transactions end Contact's 16 years under the effective control of a foreign-owned majority shareholder following the original sale of a 40 percent shareholding to **Edison Mission Energy** of California in 1999, in the first partial privatization of a state-owned electricity company. Contact will also seek a dual-listing on the Australian Stock Exchange, which it abandoned in the mid-2000s.

Contact Energy runs the **166 MW Te Mihi**, the **132 MW Wairakei**, the **38 MW Poihipi**, the **28 MW Te Huka** and the **65 MW Ohaaki** geothermal power stations.

Geothermal Figures Large in NZ Energy Excellence Award Nominations

The **Deloitte Energy Excellence Awards** provide an annual opportunity to recognize excellence and achievement across the electricity, oil, gas and petroleum industries in New Zealand. Geothermal energy, as the biggest renewable energy producer in the country, was well represented.

Mike Dunstall, a GRC Member, General Manager Geothermal Resources and Development at **Contact Energy** won **Energy Executive Of The Year**.

Contact Energy was the winner for **Energy Project of the Year** for it's **Wairākei Investment Program** that includes the **166 MWe Te Mihi** geothermal power station.

In the **Community Initiative of the Year** category, **Mighty River Power** and **Tauhara North No.2 Trust - Mauri Waiariki** were nominated for their "**Harnessing the life force of geothermal energy for community good**" campaign.

Two New Geothermal Plants Planned for Far North of New Zealand

There is a plan to **triple the output** of the **25 MW Ngawha geothermal power station**.

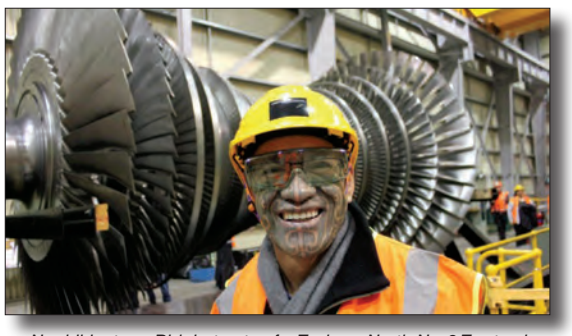
According to *The Northern Advocate*, **Top Energy**, the main electricity provider in the Far North of New Zealand, is applying for a raft of consents from the **Northland Regional** and **Far North District councils** to build two new geothermal power plants at **Ngawha**, east of **Kaikohe**.

Location of Ngawha in the Far North of New Zealand.

Each new plant would generate 25 MW, as much as the two existing plants combined. **The total 75 MW** produced would make the Far North an electricity exporter because even at peak demand the district consumes just 70 MW.

New Triple Flash Turbine Installed at Nga Awa Purua Geothermal Power Station

Mighty River Power and **Tauhara North No.2 Trust** marked the installation of a new turbine at the **138 MW Nga Awa Purua geothermal power station** in August with a Maori blessing, reports *Stuff* media.



Ngahihi o te ra Bidois, trustee for Tauhara North No. 2 Trust, grins widely. COURTESY ROBERT STEVEN, WAIKATO TIMES

The plant is operated by Mighty River Power under a joint venture (65%/35%) with the Maori trust.

Geothermal operations manager **Paul Ware** said the rotor was part of the **largest single shaft geothermal triple-flash turbine in the world**. "The triple-flash means it uses three different steam pressures to drive the turbine." It weighs 62 tonnes and is 8.7 meters long.

He said during a routine inspection of the Taupo power station in October 2013, a fault in the rotor was identified. Temporary repairs enabled the power plant to remain in operation, albeit at only 95 per cent production. The replacement rotor built by **Fuji Electric** in Kawasaki, Japan, will bring the station back up to full production.

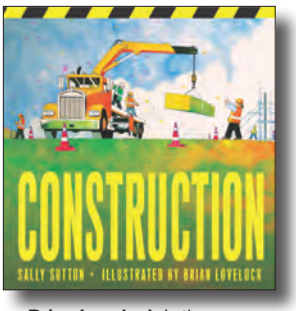
Everyone is happy to see a new turbine installed. COURTESY MIGHTY RIVER POWER

Geothermalist is Finalist for NZ Book Award

Geothermalist and book illustrator Brian Lovelock. COURTESY NEW ZEALAND BOOK AWARDS FOR CHILDREN AND YOUNG ADULTS

Geothermal science and illustrating children's books are two interests you would not expect to go hand-in-hand. Fortunately scientist **Brian Lovelock** somehow finds the time to do both, reports *stuff.co.nz*.

Lovelock has been nominated as a finalist for the **New Zealand Book Awards for Children and Young Adults**. *Construction*, written by fellow Aucklander **Sally Sutton**, was selected as a finalist in the picture book category. It is the third book Lovelock has illustrated for Sutton's Roadworks and Demolition series.



Brian Lovelock *is the illustrator for this children's book.* COURTESY NEW ZEALAND BOOK AWARDS FOR CHILDREN AND YOUNG ADULTS

Lovelock, who lives in the Auckland suburb of Mt Eden, has illustrated seven children's books over the last 10 years while juggling his career as a **geothermal scientist** at the international technical professional services firm **Jacobs**.

Drilling Started at American Samoa Geothermal Project

Radio New Zealand reports that the **American Samoa Power Authority** has announced that scientists have discovered that the geothermal resources on the island are adequate for producing electricity.

Drilling was scheduled to start in August at three sites in American Samoa identified as potential locations for a geothermal power plant.

The authority says that **by 2020, 30% of the territory's electricity will be generated from renewable sources** such as sun, wind, and geothermal, which will save the territory about 8 million dollars a year in fuel costs.

ASIA

Japan Update

Asahi Shimbun reports that the **Japanese Environment Ministry** will **lift restrictions on drilling operations underneath national parks and quasi-national parks** to make 70 percent of geothermal energy reserves in Japan available for development.

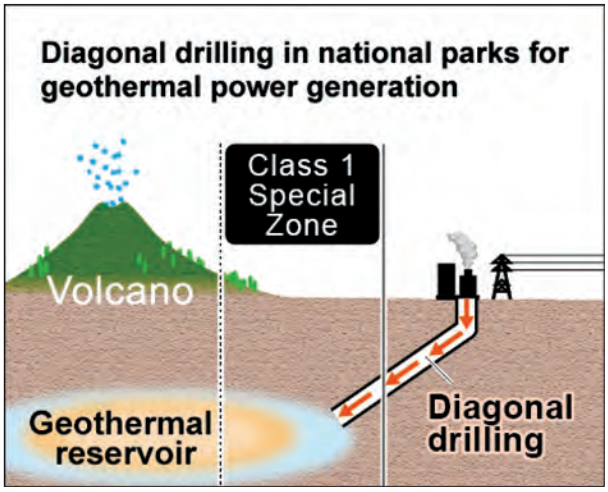
An expert panel of the ministry in July approved the plan to attain more renewable energy sources. The ministry plans to **issue an official notification in autumn**.

The new guidelines will allow geothermal development **of Class 1 Special Zones**, or areas within Japanese national parks that require significant preservation efforts. Development within **Special Protection Zones**, the most heavily restricted of national park areas, will remain prohibited.

But geothermal power resources underneath Class 1 Special Zones **can only be tapped through buildings constructed outside these areas**. Operators will be able to **drill diagonally from outside** the zones to reach the geothermal reservoirs.

Inside Geothermal

In areas outside the two zones, generation facilities can have a height of more than 13 meters **if they blend into the environment**. The exteriors of the turbine hall and other buildings of the facility, for example, could be painted in colors that match the surroundings or be hidden with plants or landscaping.



COURTESY THE ASAHI SHIMBUN

30 percent of geothermal energy reserves in Japan will remain inaccessible because they are under Special Protection Zones that form the central part of many national parks.

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New Zealand research institute **GNS Science** and the **Japan Oil, Gas and Metals National Corp (JOGMEC)** have announced an agreement to cooperate on geothermal energy development.

The pact calls for technical cooperation in environmental impacts, survey methods, improving exploration accuracy and sustainability of geothermal reservoirs and supporting public acceptance of geothermal projects.

Japan wants to tap into New Zealand expertise as they seek to raise their geothermal output, GNS Science said. The agreement follows a meeting in Japan earlier in 2015 between New Zealand's energy and resources minister and Japanese officials.

New Zealand Energy and Resources Minister, **Simon Bridges**

New Zealand Energy and Resources Minister, **Simon Bridges**, commented on the agreement: "**Globally, geothermal energy is experiencing a renaissance**, and I'm pleased that our two countries can share their pioneering experience - characterized by innovative, sustainable and respectful management of geothermal resources".

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The **Japan Oil, Gas and Metals National Corp (JOGMEC)** is to provide **24.99% of the required financing** in fiscal 2015 for the exploration work at the **7 MW Iwate geothermal project**.

Under the terms of the deal, JOGMEC may take as much as a 50% stake in the project, Japan's Ministry of Economy, Trade and Industry (METI) announced.

The funding will be given to **Iwate Geothermal Power Co Ltd**, which is the entity in charge of exploring and developing the resources in the **Matsuo Hachimantai** area in the north-east of **Honshu Island**. Previously, the firm was carrying out a private research project.

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A short-term flow test has been performed on the "**Musadake SMMG - 2D**" Geothermal Exploratory Well in **Hokkaido**, northernmost Japan.

Over a test period of 14 days, **26 tons of steam per hour** and **16 tons of hot water per hour** were confirmed.

Japan Petroleum Exploration Co., Ltd., Mitsubishi Materials Corporation and **Mitsubishi Gas Chemical Company, Inc.** have been conducting drilling investigation for a

Short-Term Flow Test of "Musadake SMMG-2D" COURTESY JAPAN PETROLEUM EXPLORATION CO., LTD
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geothermal power plant in the Musadake area since 2013, with the financial support from **Japan Oil, Gas and Metals National Corporation (JOGMEC).**

The companies had previously reported that if the location proves promising, they will build a **15 MW geothermal power plant**, aiming to start its operations **in or around 2023**.

Philippines Update

The **10 MW expansion** of **Maibarara Geothermal, Inc.'s** (MGI) **20 MW geothermal plant** in Batangas is scheduled to **go online in two years' time**, reports *Business World*.

PetroEnergy's subsidiary, **PetroGreen Enery Corp.**, holds a 65% interest in MGI. Other stakeholders are **Trans-Asia Oil and Energy Development Corp.** (25%); and **PNOC Renewables Corp.** (10%).

Last month, PetroEnergy reported that MGI completed tests that **confirmed sufficient steam to support the 10 MW expansion** of the operational geothermal project in the municipality of Sto. Tomas.

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The latest **Philippines Department of Energy** (DOE) data show that the country is still heavily dependent on coal, oil, and gas for its electricity needs, comprising 67.10 percent of the country's capacity mix while renewable energy accounts for only 32.9 percent.

Geothermal energy accounts for 1,918 MW (10.69 percent) of installed capacity, behind hydropower (19.75%), but well ahead of wind (1.58%), biomass (0.75%) and solar (0.13%).

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Shareholders of **Emerging Power, Inc.** have approved an increase in its authorized capital stocks from P500 million to P2.4 billion, allowing the company to accommodate additional equity from **Nickel Asia Corp.**

This gives Nickel Asia **55% ownership** of the renewable energy company and allow it to convert its P446 million loan to equity to support the **40 MW Montelago geothermal project** in **Oriental Mindoro**. The P8-billion geothermal project is expected to be **on stream by the end of 2016 or early 2017**.

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Energy Development Corp. (EDC) will spend P58 billion in the next 25 to 30 years for the expansion of its **Leyte Geothermal Project (LGP)**.

The *Manila Bulletin* reports that EDC intends to expand its steam field production in Leyte by adding 7,106 hectares to the current 7,400 hectares for a total of 14,506 hectares.

EDC said the **Leyte geothermal field is experiencing substantial steam decline** after 30 years of operation, and has decided to develop the makeup and replacement drilling program to **keep power generation at 700 MW**.

The project entails opening new access roads, construction of new well pads and sumps, installing new pipelines and drilling of additional wells while maintaining total power plant capacity of 700 MW. **No new power plants will be built**, however.

Indonesia Update

Indonesia **President Joko 'Jokowi' Widodo**

President Joko 'Jokowi' Widodo has instructed his economic ministers to prioritize the development of environmentally friendly power generation including geothermal energy. **The President singled out Indonesia's 28,000 MW geothermal power potential.**

"On this particular day, today, I instruct the Menko (Coordinating Minister), the BUMN (State Enterprises) minister and the ESDM (Energy and Mineral Resources) minister to ensure that in the future, **environmentally friendly power plants will be given higher priority.** This is because we have potential," Jokowi said in his speech.

President Widodo attended the **inauguration of the 35 MW 5th unit of the Kamojang geothermal power plant**, near Bandung, West Java in July. He also announced ground-breaking on **another 6 geothermal power plants** in Indonesia: The 3rd and 4th units of **2x55 MW Ulubelu** geothermal power plant, Lampung Province; 5th unit of **2x20 MW Lahendong** in North Sulawesi; 1st unit of **30 MW Karaha** in West Java; 1st and 2nd units of **110 MW Lumut Balai** in South Sumatra; 1st unit of **55 MW Hululais** in Bengkulu, and the 1st unit of **55 MW Kerinci** geothermal power plant in Jambi.
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British **Prime Minister David Cameron** met President Widodo in July and promised loans of up to GBP One billion (USD 2.1 billion) to Indonesia to help finance infrastructure projects including **GBP 66 million (USD 140 million)** for **geothermal power projects.**

AFRICA

Ethiopia Update

Ethiopian Electric Power and the **Corbetti Geothermal Company**, whose investors include **Reykjavik Geothermal, Berkeley Energy**, and **Iceland Drilling,** have signed a *Power Purchase Agreement* for the first 500 MW from the 1,000 MW **Corbetti geothermal project**. The state agreed to purchase power at **7.53 U.S. cents per kilowatt hour**.

The partners announced that the Corbetti project - located 200 kilometers (124 miles) south-west of the capital Addis Ababa - **will be built in two phases**, with **the first 500 MW phase to be completed in 2018**. The second phase is expected to be finished in 2021. Upon completion, it will be Africa's largest geothermal facility.

In addition, negotiations are underway for Ethiopian Electric Power to sign a *Heads of Terms* agreement with Reykjavik Geothermal to develop the **additional 500 MW of geothermal energy**, reports *Independent Online*.

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The first new well at the **70 MW Aluto Langano geothermal power plant expansion project** in Ethiopia has begun **producing steam**.

According to online media *2merkato*, the **Japanese Government** and the **World Bank** provided financial support for the expansion in 2013, to increase the generation capacity to 70 MW power from the current 7 MW at the plant located 200 km south-east of Addis Ababa

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The **Ethiopian House of Peoples' Representatives** has endorsed three loan agreements, including one for the **Tendaho geothermal project**, according to *Ethiopian News Agency*.

The House approved 9 million and 7.5 million Euro loan agreements secured from the **French Development Agency (FDA)** for the implementation of the first phase of the Tendaho Geothermal Development Project in **Afar state**, 600km north-east of the capital city, Addis Ababa near the border with Djibouti.

Kenya Update

Akiira Geothermal Limited (AGL) has announced it will be able to start drilling at the **70 MW Akiira One project** after the company received insurance coverage for the exploratory phase of the initiative from Germany-based insurer **Munich Re**.

The "**multi-well exploration risk insurance**" offered by Munich Re is designed to mitigate some of the risk associated with the early stages of geothermal projects', allowing drilling to get underway.

GRC member **Hezy Ram**, chief executive of **Ram Energy**, one of the founding shareholders of AGL, said the new project could prove strategically significant for Kenya. "Geothermal heat offers an immense reservoir of base load energy," he said. "Akiira will be a pilot project for us, so that other projects can follow."

Akiira One is jointly owned by **Centum** and **Frontier Investment Management**, a Danish investment firm. Ram Energy, Inc. and **Marine Power** will construct the power plant located south of Lake Naivasha in Nakuru County, located in Kenya's Rift Valley Province.

EUROPE

France and Iceland Sign Geothermal Energy Cooperation Agreement

Mme Segolene Royal the minister for Ecology, Sustainable Development and Energy in the government of France visited Iceland upon the invitation of Icelandic Foreign Minister **Gunnar Bragi Sveinsson** and Minister for Industry and Trade **Ragnheidur Elin Arnadottir**.

During the minister's visit in Iceland, the **Iceland Geothermal Cluster Initiative** and its sister organization in France **GEODEEP** signed an
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The agreement was signed at the Blue Lagoon. COURTESY ICELAND GEOTHERMAL

agreement to cooperate in creating **a framework of standardized model licenses for exploring, realizing, and developing geothermal energy resources**.

First Hybrid Biomass/Geothermal Power Plant in the World?

Italian company **Enel Green Power** has laid claim to the **first hybrid biomass/geothermal power plant in the world**.

Enel Green Power SpA announced the completion of a **5 MW power plant** in Italy's Tuscany region that uses biomass to add heat to existing geothermal steam.

The new facility was built next to the existing **13 MW Cornia 2 geothermal power plant** and is expected to increase the latter's output by more than 30 GWh annually. Enel Green has invested over EUR 15 million (USD 16.6m) in the biomass project.

The newly-installed power station uses virgin forest biomass to heat steam from an initial temperature of 150-160°C to 370-380°C. This boosts net electricity production capacity because of the increased enthalpy of the steam and the improved efficiency of the cycle, Enel Green explains.

However, it has been brought to our attention that a hybrid biomass/geothermal power plant has been running in **Lassen County** in Northern California, USA, since 1989.

The **Honey Lake power plant**, owned by **Greenleaf Power, LLC** – headquartered in Sacramento, California – is a **net 30 MW** woody biomass electrical generation facility that also uses geothermal groundwater from local wells to preheat its boiler feed water, reducing the plants consumption of biomass.

Unless we hear otherwise the **first hybrid biomass/geothermal power plant in the world is in California, USA.**

JV Launched for Exploration for Geothermal Energy in Greece

The Russian exploration company **Rosgeo**, and **Damco Energy** of Greece, have signed an agreement to work together on exploration for hydrocarbons and solid mineral resources, as well as promote geothermal energy in Greece, reports *Interfax Information Agency*.

4 MW Akça ORC Geothermal Plant Successfully In Operation

Italian turbine manufacturer **Exergy** has announced the operational launch of the **4 MW Akca geothermal plant** in Turkey for client **Akça Enerji**. Exergy claims the ORC binary installation is the world's first equipped with 2-pressure-level cycle on a single-disk turbine.

The Akça plant, situated in the Denizli region, generates 4 MW from a **fluid temperature of 105°C/220°F**.

Exergy will be exhibiting at the GRC Annual Meeting & GEA Geothermal Energy Expo, *being held September 20-23 at the Peppermill Resort Spa Casino in Reno, Nevada, USA.*

USD 720 Million Financing to Finish 170 MW Efeler Geothermal Power Plant

The **170 MW Efeler Geothermal Plant** in western Turkey is on course to be finished later this year after a huge influx of financing.

The **European Bank for Reconstruction and Development (EBRD)** is providing a USD 200 million loan, alongside additional loans of USD 325 million from **Türkiye İş Bankası AŞ (İşbank)**, USD 130 million from **Turkiye Sınai Kalkınma Bankası A.S. (TSKB)** and USD 65 million from the **Black Sea Trade and Development Bank (BSTDB)**.

The Efeler geothermal plant is being built by a subsidiary of **Güriş Holding**. The plant's five units – three of them already operational – are situated near the western town of **Germencik**, in **the Buyuk Menderes Graben**, the area in Turkey with the greatest potential for geothermal energy.

U.S. Agency Aids 13.2 MW Kuyucak Geothermal Study

The U.S. Trade and Development Agency (USTDA) has awarded a grant to **Turcas BM Kuyucak Jeotermal Elektrik Üretim A. Ş. (TBK)**, a Turkish joint venture owned primarily by **BM Holding** and **Turcas Energy Holding**, to fund a feasibility study of the technical and financial specifications for the **13.2 MW Kuyucak geothermal energy project** in Aydın Province, western Turkey.

In addition, *Daily Sabah* reports that Istanbul-based **Turcas Petrol** has signed an agreement with **Azalternativenerji**, which operates within Azerbaijan's State Agency on Alternative and Renewable Energy Sources (SAARES), to cooperate on joint projects to invest in renewable energy, including geothermal energy in **Turkey and Azerbaijan**.

Turcas Petrol CEO **Batu Aksoy** said "In the first phase of this strategy, we plan an investment worth **$65 million** in a geothermal power plant project that we are conducting in **Kuyucak, Aydın, Turkey**."

EDUCATION

Stanford Geothermal Workshop – Abstract Submission Now Open

22-24 February, 2016
Frances C. Arrillaga Alumni Center, 326 Galvez St., Stanford, California

The goals of the conference are to bring together engineers, scientists and managers involved in **geothermal reservoir studies and developments**; provide a forum for the exchange of ideas on the exploration, development and use of geothermal resources; and to enable prompt and open reporting of progress.

We strongly encourage all scientists and engineers involved in geothermal reservoir technology to attend the workshop.

- Abstract submission opened on **July 28th 2015**
- Abstract submission closes **October 27th 2015**
- Notification of abstract acceptance/decline **November 27th 2015**

More Information at: https://pangea.stanford.edu/researchgroups/geothermal/stanford-geothermal-workshop

We Have Winners!

In the May/June *GRC Bulletin* we announced a contest to win a special book!

The book *La Tierra de Fuego* (Land of Fire) by **Sofía Otero** is a compendium of Chilean geothermal myths, legends, and accounts, published by the Chilean **Centro de Excelencia en Geotérmia de los Andes**, better known as **CEGA**.

Two copies of La Tierra de Fuego donated by Sofía to the GRC were offered in a drawing. The two winners are **Ricardo Alonso Escobar** of El Salvador and **Reed Baker** of the Colorado School of Mines in the USA. Congratulations!

SCIENCE & TECHNOLOGY

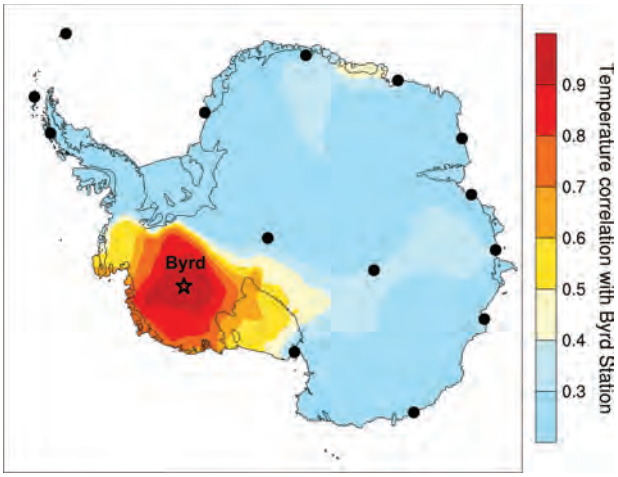
Geothermal Source Speeds Glacial Flow in Antarctica

A new frontier for geothermal energy exploration has been found. Unfortunately it is deep below a glacier in pristine Antarctica.

A recent paper on the *Science Advances* website suggests an **extraordinary heat flux below the Byrd glacier** in the **West Antarctic Ice Sheet (WAIS)**. The results provided ammunition for climate change deniers as something other than human activity was seen as affecting glacial melt and sea-level rise. However, by itself a geothermal anomaly in Antarctica is interesting.

The team from the **Whillans Ice Stream Subglacial Access Research Drilling (WISSARD)** Science Team report the first direct measurement of geothermal heat flux into the base of the West Antarctic Ice Sheet, below subglacial Lake Whillans, determined from the thermal gradient and the thermal conductivity of sediment under the lake.

The **heat flux at this site is 285 ± 80 mW/m^2**, significantly higher than the continental and regional averages estimated for this site using regional geophysical and glaciological models. Independent temperature measurements in the ice indicate an **upward heat flux through the WAIS of 105 ± 13 mW/m^2**.



The color intensity indicates areas around Antarctica that are likely experiencing comparable warming to Byrd Station. COURTESY JULIEN NICOLAS, OHIO STATE UNIVERSITY

Lead author **Andrew Fisher**, a professor of Earth and planetary sciences at **UC Santa Cruz**, in California, said that the geothermal heating could explain the existence of large sub-glacial lakes in the region that were detailed by other researchers. The amount of heating could also be responsible for the high glacial stream flows seen on the ice sheet. **These flows provide lubrication that could help increase the rate of melting of the ice**.

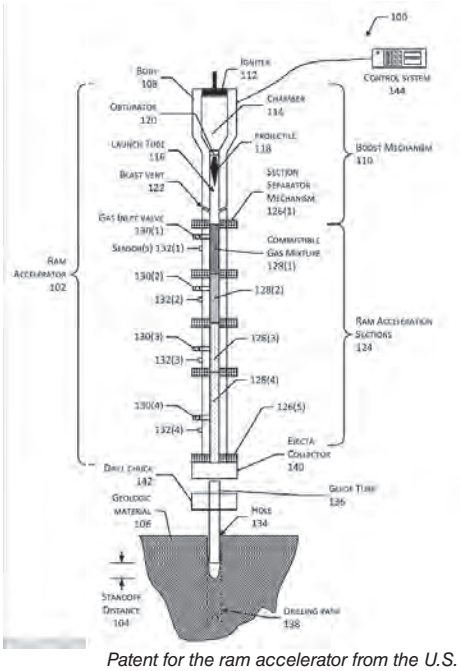
However, **Fisher** emphasized that the geothermal heating reported in this study **does not explain the alarming loss of ice from West Antarctica** that has been documented by other researchers.

Citation: A. T. Fisher, K. D. Mankoff, S. M. Tulaczyk, S. W. Tyler, N. Foley, and the WISSARD Science Team, **High geothermal heat flux measured below the West Antarctic Ice Sheet**. *Science Advances* 1, e1500093 (2015).

'Earth Gun' Could Speed Up Drilling

A company believes it has a solution to the slow drilling process involved in oil, gas and especially geothermal exploration by repeatedly firing projectiles to blast deep holes in the ground. Washington state-based drilling technology company **HyperSciences**, has been awarded a patent on a new type of **ram accelerator** funded by a $1 million grant from oil company **Shell**, reports the *Daily Mail*.

Aeronautical engineer **Mark Russell**, who heads up the company, says he believes **geothermal power is the future for creating electricity**.



Patent for the ram accelerator from the U.S. Patent Office

The latest patent details a system in which 'bullets' would fire at high velocity causing whatever is in their path to vaporize. The ram accelerator in this design serves as both the chamber and barrel of this '**Earth gun**'. Gas is pumped in and then ignited, pushing the bullet forward at speeds of up to 4,500 mph (2 km/s). **The company hopes the 'gun' could be used to reach geothermal resources at depths up to two miles, by being fired repeatedly**.

'Rock Glow' Can Help Explore for Geothermal

A recent article in *Phys.org* suggests that observing **the luminescence of a rock** can help determine its temperature history. This could help discover existing geothermal reservoirs.

Together with international colleagues, **Benny Guralnik** and **Christina Ankjærgaard** of the **Netherlands Centre for Luminescence dating (NCL)** at **Wageningen University** have developed the first method that can translate a signal in rocks that have experienced low temperatures (**between 35 and 80°C**) in the upper two kilometers of the Earth. Because of the new translation method, luminescence measurements on rock samples can give unique recent information about past temperatures, **dating back 10,000 to 100,000 years**.

The new method can be applied both above ground and underground, says Guralnik. "**Similar to oil prospecting, you can look for underground heat with this method. We still enormously under-exploit geothermal energy**, although it is a renewable source of energy."

More information can be found at "**OSL-thermochronometry of feldspar from the KTB borehole, Germany**," *Earth and Planetary Science Letters*, Volume 423, 1 August 2015, Pages 232-243, ISSN 0012-821X, dx.doi.org/10.1016/j.epsl.2015.04.032

CLIMATE CHANGE

U.S., Brazil, China Join in New Climate Goals

As reported by *Utility Dive*, the **United States and Brazil** issued a joint statement in late June, each committing to bolstering renewables and reducing greenhouse gas emissions.

The two countries pledged to take stronger action to reduce greenhouse gas emissions and global climate change, with **President Obama** committing the USA to **reduce its emissions by 26% to 28% below 2005 levels within a decade**.

The U.S. and Brazil are both targeting **20% renewable energy by 2030**, excluding hydropower resources, and Brazil will also work to restore 12 million hectares of forests by 2030.

In addition, **China** issued a **20% renewables goal**, and committed to **lowering carbon dioxide emissions by 60% to 65%** relative to the GDP.

As the *Washington Post* points out, those three nations are all top-10 greenhouse gas emitters, making the announcements a big positive for chances for the planet's health. At the same time, **South Korea** announced a plan to **reduce its greenhouse gas emissions by 37% by 2030**.

Spiritual Community Calls for Climate Change Action

Prominent members of both the **Roman Catholic Church** and the **Islamic community** are calling for more action on climate change.

In June, **Pope Francis**, leader of **1.2 billion Roman Catholics**, released a 180-page encyclical on the environment, at its core a moral call for action on phasing out the use of fossil fuels, reports *The Guardian*.

The Pope called on the world's rich nations to begin paying their "**grave social debt" to the poor and take concrete steps on climate change**, saying failure to do so presents an undeniable risk to a "common home" that is beginning to resemble a "pile of filth".

In August, **Islamic** environmental and religious leaders called on "all people, leaders and businesses ...to commit to 100% renewable energy," reports *BBC News*.

The **Islamic Climate Declaration**, drafted at an international symposium in Istanbul, says that the world's **1.6 billion Muslims** have a religious duty to fight climate change.

The Declaration urges politicians to agree to a new treaty to limit global warming to 2°C. It asks Muslims, in the words of the Koran, "**not to strut arrogantly on the Earth**."

Together the two communities number 2.8 billion, more than a third of the global population. ■

Have Your Say!

If you would like to comment on any column or article in the *GRC Bulletin* or have an opinion or suggestion on a topical subject that will interest our readers, please email the editor, **Ian Crawford** at icrawford@geothermal.org or mail to Geothermal Resources Council, P.O. Box 1350, Davis, CA 95617-1350.

Electric Youth: The GRC Student Committee

Excitement Growing for the GRC Annual Meeting!

As part of a regular series of columns the members the GRC Student Committee updates readers on their good work and news for the young and aspiring members of the global geothermal community.

The 2015-2016 school year is fast approaching, which means renewed activity and growth for GRC Student Chapters at universities around the world. This is shaping up to be an exciting year as more chapters get established and the existing ones grow and continue to have exciting and educational activities. One chapter even put their summer to good use!

In July, the Portland State University student chapter had the opportunity to tour Altarock Energy's Newberry Enhanced Geothermal System demonstration site, located on the flank of Newberry Caldera, just south of Bend, Oregon. The group included five students, two Portland State geology department faculty, and the chapter's industry liaison, Al Waibel, of Columbia Geoscience, who played an integral role in the initial siting of the Newberry wells. The tour was led by Altarock's Kyla Grasso and David Stowe.

In Bend, the group visited Altarock's storage facility which houses equipment between active injection events, including injection pumps and reels of fiber optic cable used for continuous temperature monitoring. On the top of Paulina Peak, Kyla Grasso and Al Waibel discussed the history of geothermal exploration in the area, and exposited on its complex geology, pointing out salient features clearly visible from the vantage of the summit.

At the demonstration facility, the group was shown the site's layout and equipment, including the injection well itself, and learned of Altarock's strategy to create permeability in the otherwise unforgiving aquifer system. The evening brought the group to a campsite at the edge of East Lake inside the caldera, beneath a canopy of brilliantly shining stars. Other highlights included a trip to the top of Lava Butte, beer tasting at Bend's Crux Brewing, and an attempt to create a small earthquake with a coordinated jump near the array of continuously recording seismometers at the EGS site.

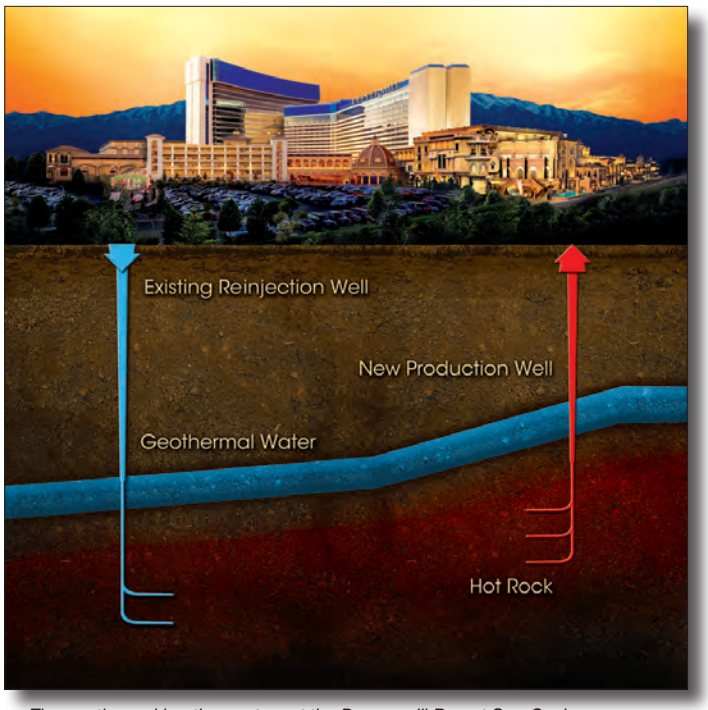
We have other plans for outings. The University of North Dakota (UND) student chapter is going to visit the site of North Dakota's first geothermal power plant for the ribbon cutting ceremony in mid-September. The low temperature Organic Rankine Cycle (ORC) system is a co-produced fluid demonstration project funded by the U.S. Department of Energy and spearheaded by a team of researchers from the UND College of Engineering and Mines. The students will get to tour the site with Will Gosnold and Mike Mann, the two principal investigators on the project. The UND student chapter hopes to use the event to gain the attention of students on the campus and teach the community about the benefits of using geothermal energy.

In other news other universities are creating active student chapters, such as at the University of Texas at Austin. Their group is being founded by graduate students from the Jackson School of Geosciences, one of the largest geoscience programs in the world. Student members will primarily include representatives from the Department of Geology, the Bureau of Economic Geology, and the Institute for Geophysics, but it is their intention to also attract interested students from the Department of Petroleum and Geosystems Engineering and McCombs School of Business. ■

Peppermill's Geothermal Green Initiative is a Winner

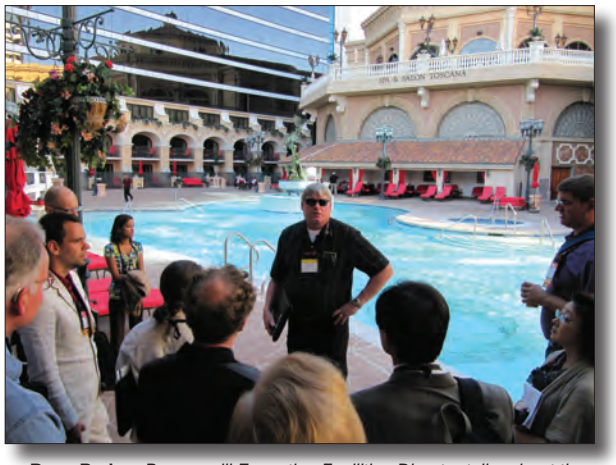
by Dean Parker, Peppermill Executive Facilities Director, and
Alan Baily, Geothermal Resource Group, Inc.

The Peppermill Resort and Spa has a long history as a participant in the geothermal industry. A frequent host to the annual Geothermal Resource Council (GRC) Annual Meeting and Geothermal Energy Association (GEA) Expo, the Peppermill takes great pride in being involved in a vibrant and very important international industry.



The geothermal heating system at the Peppermill Resort Spa Casino

The Peppermill has taken a pioneering role in environmental stewardship initiatives, as it is one of the few resorts in the USA that is completely heated by their own on-site geothermal deep well system. All water sources on the resort including pools, Jacuzzis, spas, domestic hot water, and mechanical hydronic water, are heated by this renewable energy source.



Dean Parker, *Peppermill Executive Facilities Director talks about the geothermal deep well system which provides heat for the resort's luxurious swimming pools and Jacuzzis.*

The Peppermill is located on approximately 50 acres, right on the edge of the Moana Geothermal Resource, and has several geothermal wells on location. All are direct-use wells, drawing from the tertiary volcanic's of the Kate Peak formation. Since the early 1980's, the Peppermill has used the resources of low-temperature thermal waters as a small heat source for an outer hotel building and a small outside swimming pool. Initially, two shallow wells (PW #1 and PW #2) were drilled as open loop wells to a depth of 934 feet (285 meters). The shallow wells produced approximately 127 degrees F (53°C), at 120 gallons per minute (gpm) (7.6 liters per second).

The Peppermill IW #4, was drilled in the early 1980's at the same time as #1 and #2 production wells, and then reworked in 1987 to a total depth of 3,307 ft (1,008 m) in the andesites of the Tertiary Kate Peak formation. It was initially drilled as a deep injection well for the shallow production wells, but the injectivity declined over the years due

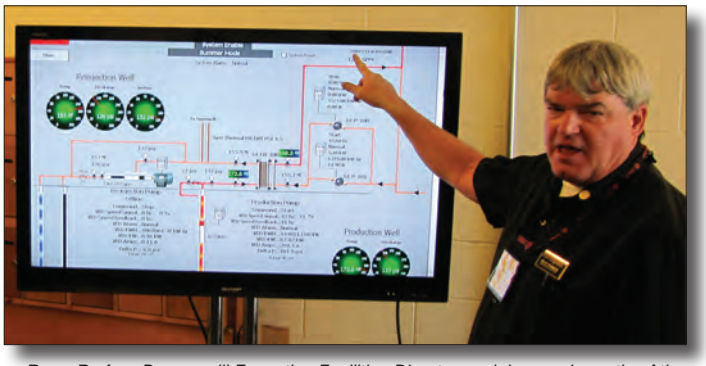
to scaling issues. It was just recently abandoned earlier this year with much regret. The Peppermill paid careful attention to the abandonment process in order to ensure that no cross contamination would occur between the Moana and Kate's Peak formations.

The Peppermill pools with the #8 Production Well being drilled in 2009 in front of the Central Plant facility. COURTESY PEPPERMILL

In 2006, the Peppermill began construction on a large expansion of their facility, adding an additional one million square feet (92,903 m2) to their facility, and the ownership decided to make geothermal an integral part of this development plan. In 2008, the shallow wells were shut down and completely overhauled with new submersible production pumps, heat exchangers, water storage tanks, and stainless steel piping. The new geothermal system was designed to provide partial domestic and mechanical heat to the new 600 suites in the Tuscan hotel tower, two outside swimming pools and Jacuzzi's, and was put back into production that same year.

New sources of geothermal heat allowed the Peppermill to retire its Cleaver Brook natural gas boilers in 2009.

In 2009, the Peppermill noticed significant energy savings from the geothermal shallow well operations at the Central Plant natural gas Cleaver Brook boilers, and elected to expand the capacity of its geothermal heating systems, making it the primary heat source for the entire 2.1 million square foot (195,096 m^2) campus. The shallow wells are now shut down due to the deep well operations but are still extant and considered viable. The Peppermill is currently evaluating methods of using those wells in the future.



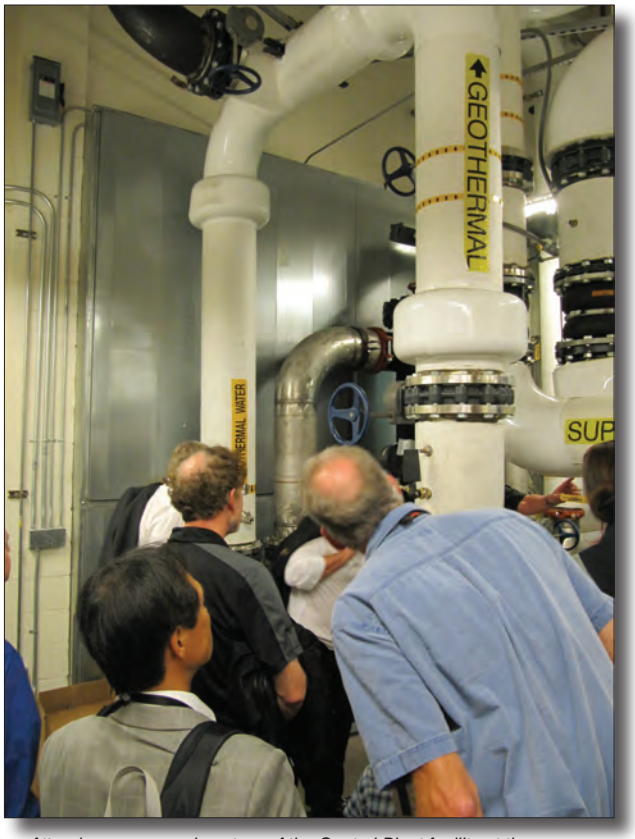
Dean Parker, *Peppermill Executive Facilities Director explains a schematic of the geothermal system.*

The Peppermill started drilling the new #8 production well in August 2009, and the #9 injection well in December 2009. The new production well is located on the North West side of the property, located adjacent to their Central Plant facility. The well reached a total depth of 4,421 ft (1,348 m) and produces 174°F (79°C) of heat to the facility. The production pump produces up to 1,200 gallons per minute (gpm) (75.69 liters per second), but has the capacity to produce up to 2,000 gpm (126.14 meters per section), if needed. The 400 horsepower production pump is controlled by a variable frequency drive, and is placed at a depth of 400 ft (122 M) within the well. In the summer months, the geothermal heat energy averages around 8,000,000 Btu's, and will reach a winter average around 33,000,000 Btu's. The geothermal water is pumped into the Central Plant, going through an Alfa Laval heat exchanger, and then discharged.

Before the spent water reaches the injection well, the heat averaging around 130 to 140°F is piped through smaller heat exchangers that provide an energy heat source to the outside swimming pools, and guest parking garage ramp snow melt system. The water is then discharged at the IW #9.

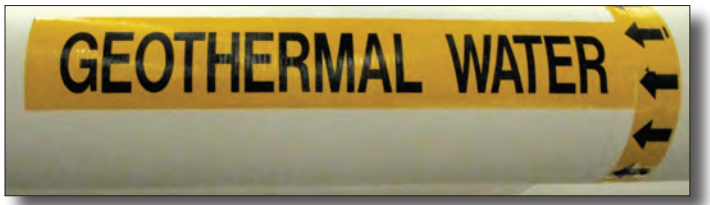
The injection well sites on the far south east side of the property, located approximately 1,500 feet apart, and connected using 10" schedule 80 steel pipe. The injection well was drilled to a total depth of 3,900 ft (1,189m), in the same Kate Peak formation, and can handle up to 2,000 gpm of spent geothermal fluids.

The new system has reduced the Peppermill natural gas consumption by 85%, which gave the property a 3.2 year rate of return (ROI) on their financial investment, making this a very sound business decision. In addition to the direct cost savings of the geothermal system, the Peppermill has also experienced a very positive green energy benefit in their marketing efforts. At this time, no future drilling is planned on the Peppermill property. The success of the deep drilling program at the resort has spurred a good deal of interest in developing the moderate temperature resource among other larger commercial applications that can benefit from this same deep-resource exploration. There has been some discussion of low enthalpy, utility grade-development as well, but further evaluation is still underway to determine if this resource has that potential. ■



Attendees on a previous tour of the Central Plant facility at the Peppermill observe the use of geothermal waters to provide heat at the resort.

A tour listens to **Dean Parker** *outside the Central Plant facility at the 2012 GRC Annual Meeting.*



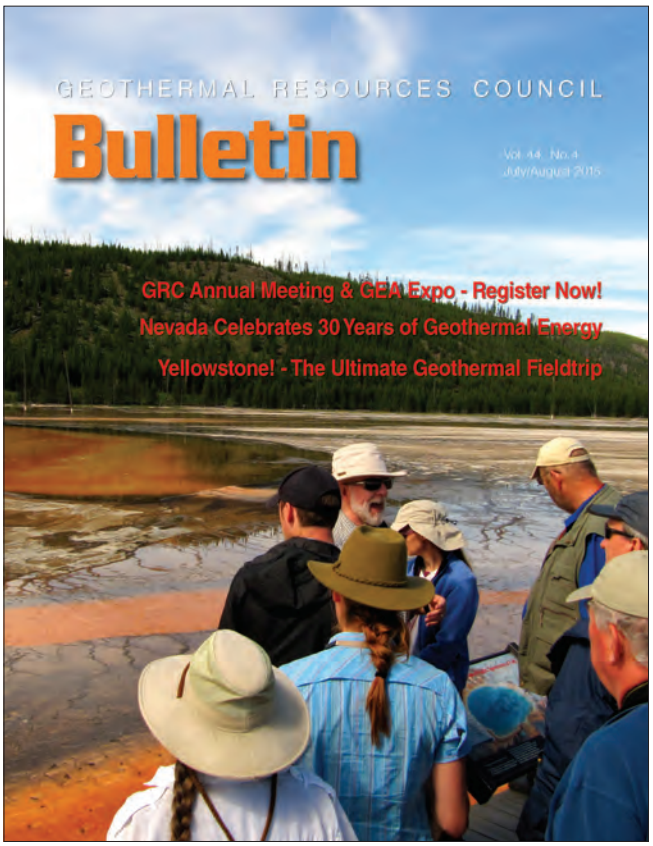
All water sources on the resort including pools, Jacuzzis, spas, domestic hot water, and mechanical hydronic water, are heated by geothermal water.

The GRC and the Peppermill are pleased to offer six tours of the Peppermill direct use geothermal system throughout the GRC Annual Meeting.

Monday: 12:40 – 1:20 pm and 4:40 – 5:25 pm (Two tours)
Tuesday: 12:40 – 1:20 pm and 4:15 – 5:00 pm (Two tours)
Wednesday: 12:00 – 12:45 pm (One tour)

Tours will depart from and return to the Tuscany Ballroom registration area.

No advanced registration required, however a sign-up sheet will be available at the GRC registration desk.



The GRC Bulletin

The premier geothermal energy magazine

The Geothermal Resources Council *(GRC) Bulletin* is a periodic publication (6 issues per year) that reaches the association's worldwide membership and paid subscribers. Current circulation is 1,200.

The GRC *Bulletin* provides a technology and issues forum for professionals involved in geothermal resource research, exploration, development and utilization. The GRC *Bulletin* also provides news and information that highlights the environmental and economic benefits of geothermal resource development.

Keep up-to-date with news from the global geothermal community by becoming a member of the GRC and receive your GRC *Bulletin* free, or subscribe for six issues a year.

Annual Subscription rates are:

Domestic - $90

International - $140 (includes additional cost to cover postage)

Back issues are available for $10 per issue.

Publications, Websites, Videos & Maps

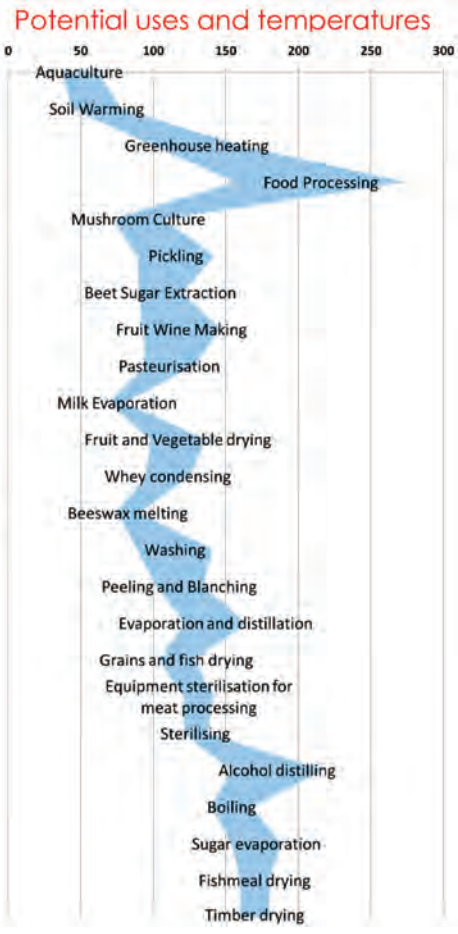
by Ian Crawford

Geothermal Use in Agriculture

The European Geothermal Energy Council (EGEC) has published a brochure on the use of geothermal energy in the agriculture industry.

EGEC states that the agricultural sector is a heavy energy consumer and Green House Gas emitter which needs to be more sustainable, competitive, and ensure food security. This gives it a specific and urgent energy challenge: it needs to find stable, low cost, and local renewable energy, and it needs to reduce its contribution to climate change.

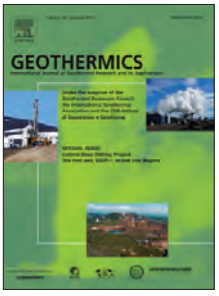
Much of the energy used by the industry is for low and medium level heat (less than 200°C), which is required at many stages of both production and treatment. Traditionally fossil fuels have been used, but fluctuating energy prices also expose the agri-food industry to risk. Geothermal is a solution for this fuel switch.



Uses of geothermal energy in food and agriculture (temperature in Degrees Celsius) COURTESY EGEC

Geothermal is increasingly being used in the agri-food industry as it meets many of the sectors' requirements. Low or medium temperature geothermal heat is available everywhere in the world and the systems enabling its use are simple and easy to maintain. Geothermal projects are installed locally and provide heating and cooling at competitive prices. They create direct and indirect jobs across the value chain.

Download the brochure *Geothermal Use in Agriculture* at: http://egec.info/wp-content/uploads/2011/01/Brochure-Agriculture-2015-DIGITAL.pdf



Geothermics, September 2015

The Table of Contents for* Geothermics *Volume 57 follows:

"Experiments on life cycle extensions of geothermal turbines by multi composite technology", by A.Buzaianu et al., pp.1-7.

"An iTOUGH2 equation-of-state module for modeling supercritical conditions in geothermal reservoirs", by L. Magnusdottir and S. Finsterle, pp. 8-17.

"Thermoeconomic cost evaluation of hydrogen production driven by binary geothermal power plant", by C. Yilmaz et al., pp. 18-25.

"Toward fracture porosity assessment by gravity forward modeling for geothermal exploration (Sankt Gallen, Switzerland)", by P. Altwegg et al., pp. 26-38.

"20 years of exploitation of the Yarragadee aquifer in the Perth Basin of Western Australia for direct-use of geothermal heat", by M. Pujol et al., pp. 39-55.

"Impact of coupled heat transfer and water flow on soil borehole thermal energy storage (SBTES) systems: Experimental and modeling investigation", by A. Moradi et al., pp. 56-72.

"Improved method for estimating static formation temperatures in geothermal and petroleum wells", by J.A. Wong-Loya et al., pp. 73-83.

"Seismic velocity structure of a fossilized Icelandic geothermal system: A combined laboratory and field study", by M. Grab et al., pp. 84-94.

"Modeling and experimental validation of a transient direct expansion geothermal heat exchangerOriginal", by C.Rousseau et al., pp. 95-103.

"Potential of ground source heat pump systems in cooling-dominated environments: Residential buildings", by M. Kharseh et al., pp. 104-110.

"Fracture transmissivity evolution due to silica dissolution/precipitation during geothermal heat extraction", by S.N. Pandey et al., pp. 111-126.

"Exploration of the Hot Springs Bay Valley (HSBV) geothermal resource area, Akutan, Alaska", by P. Stelling et al., pp. 127-144.

"Stratigraphy modeling and thermal conductivity computation in areas characterized by Quaternary sediments", by G.Teza et al., pp. 145-156.

"Thermal performance of a deep borehole heat exchanger: Insights from a synthetic coupled heat and flow model", by M. Le Lous et al., pp. 157-172.

"Empirical modeling of maps of geo-exchange potential for shallow geothermal energy at regional scale", by A. Galgaro et al., pp. 173-184.

"Hydrochemical characteristics and geothermometry applications of thermal groundwater in northern Jinan, Shandong, China", by J.Wang et al., pp. 185-195.

"Prediction of reinjection effects in fault-related subsidiary structures by using fractional derivative-based mathematical models for sustainable design of geothermal reservoirs", by A.Suzuki et al., pp. 196-204.

"Thermal investigation of in-series vertical ground heat exchangers for industrial waste heat storage", by P. Cui et al., pp. 205-212.

"Helium and carbon isotope composition of gas discharges in the Simav Geothermal Field, Turkey: Implications for the heat source" by H. Karakus, pp. 213-223.

"Proppant backflow: Mechanical and flow considerations" by McLennan et sl., pp. 224-237.

"Directly imaging steeply-dipping fault zones in geothermal fields with multicomponent seismic data", by T. Chen and L. Huang, pp. 238-245.

"Resistivity characterization of the Krafla and Hengill Geothermal Fields through 3D MT inverse modeling", by E. Gasperikova et al., pp. 246-257.

"Comparison of 3D MT inversions for geothermal exploration: Case studies for Krafla and Hengill Geothermal systems in Iceland", by G.K. Rosenkjaer et al., pp. 258-274.

"Corrigendum to 'Spectral analysis of aeromagnetic data for geothermal investigation of Wikki Warm Spring, north-east Nigeria' [Geothermics 50 (2014) 85–90]", by G.E. Obande et al., pp. 275-278.

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. Contact the IGA for the special discount code to be applied when ordering at: http://store.elsevier.com/product.jsp?isbn=03756505. ■

New GRC Members

New Members of the Geothermal Resources Council

The 2015 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 1,200 corporate and individual members of the GRC in cross-referenced lists for speedy access. In addition, this premier publication offers contact information for additional geothermal associations and a number of federal and state geothermal offices. This valuable publication is also available to non-members for a low price of $25. More information on ordering at: www.geothermal.org/roster.html

The following have recently joined the global community of the GRC and are not listed in the *GRC Membership Roster*:

Henderson, Frederick III	USA
Bayrante, Lauro	Philippines
Duncan, Neel	USA
Geiss, Dennis	USA
Ginn, Dewayne	USA
Gonzalez, Mario	USA
Laboso, Roselyne	USA
Newcomb, Robert	USA
Overacker, Justine	USA
Shurtleff, Paul	USA
Styron, Richard	USA
Yonge, Nancy	USA

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. ■

GRC MEMBERS receive a $100 discount on a 3-day registration at the GRC Annual Meeting.

Register now for the GRC Annual Meeting & GEA Expo!

Scan the QR code on the right to view the *Final Program* on your mobile device.

Register now using the GRC Annual Meeting *Registration Form* available on the GRC website at: www.geothermal.org/meet-new.html

OR

Register Online at: https://eseries.geothermal.org/

In Memoriam

Mike Pierce

The world geothermal community lost one of its very finest when Michael Pierce passed away on July 7, 2015 at the age of 60 from squamous cell carcinoma. Mike was a natural leader, whose deep technical knowledge of power plant workings and enthusiasm for the industry earned him universal loyalty among colleagues. He had an easy smile and was a master at calming the troops and staying cool even under the most stressful conditions. He was always willing to share his expertise and cared genuinely for employees.

Mike was raised in prime geothermal country: the Imperial Valley of southern California. Armed with a degree in Social Psychology from Imperial Valley College and a mechanical sense honed from working as a youth in his father's auto shop, Mike ultimately headed a major Philippines geothermal firm with over 700 MW of operating assets. Mike was known for his skills in getting plants on line and operating reliably, and using innovative technologies to attack difficult technical problems.

Mike's career began in 1977 in his own backyard at the East Mesa field, site of the world's first commercial binary geothermal plant. Mike spent 17 years there with Magma Power and Ormat, and worked his way up from Instrumentation Technician to Plant Superintendent and finally to General Manager of the 24 MW Ormesa binary plant. During this period he also headed Magma's instrumentation group for the 38 MW Vulcan plant at the Salton Sea, tackling aggressive brine chemistry to achieve successful commissioning and operation of this first commercial dual flash project in the U.S.

In 1995 Mike moved overseas and served as Plant Manager for CalEnergy's 130 MW Upper Mahiao plant in the Philippines, supervising construction, commissioning and operations. In 1998, he oversaw commissioning of CalEnergy's 60 MW Dieng 1 project in Indonesia under difficult conditions following the Asia financial crisis. He then returned to the Philippines where he then served as Plant and General Manager for the Upper Mahiao and 216 MW Malitbog plants through early 2008.

After a short stint with Contact Energy in New Zealand, in late 2008, Mike joined AP Renewables Inc. (APRI), a subsidiary of Aboitiz Power, which had won a bid to purchase two major plant complexes from the Philippine government: the 458 MW Mak-Ban and 289 MW Tiwi plants. Mike, who became President and COO of APRI, developed an award winning rehabilitation program that increased plant availability from 82.5 to 97.5% at Mak-Ban and from 73.1 to 97.8% at Tiwi.

Mike was preparing to shift his focus and lead Aboitiz' geothermal expansion efforts when illness struck. We will greatly miss his good fellowship and his good work.

Submitted by Erik Layman, with support from Jack Crane, Tony Menzies, Kevin Beavers, David Baldwin, Domeng Beraquit, Elliot Yearsley and Susan Pierce. ■

Transitions

Geothermal Resource Group Inc. (GRG) has announced that **Dr. Subir K. Sanyal, PhD**, has joined GRG as Senior Technical Advisor to assist in their geothermal consulting client base, including resource evaluation and feasibility studies, reservoir engineering, geosciences, and drilling engineering. Dr. Sanyal was formerly President and Senior Technical Advisor for GeothermEx Inc., a Schlumberger company, based in Richmond, California. ■

Calendar of Events

GRC Workshops
- Drilling and Risk Management
- Practical Aspects and Applications of Geochemistry
18-19 September, Reno, Nevada, USA
www.geothermal.org/meet-new.html

GRC Fieldtrip – Long Valley
18-20 September, Reno, Nevada, USA
www.geothermal.org/meet-new.html

GRC Fieldtrip - Steamboat Geothermal Power Plant Complex
20 September, Reno, Nevada, USA
www.geothermal.org/meet-new.html

39th GRC Annual Meeting & GEA Expo
20-23 September, Reno, Nevada, USA
www.geothermal.org/meet-new.html

GRC Fieldtrip – McGinniss Hills Geothermal Plant
23-25 September, Reno, Nevada, USA
www.geothermal.org/meet-new.html

TOUGH Symposium 2015
28–30 September, Lawrence Berkeley National Laboratory (LBNL), Berkeley, California, USA
http://esd1.lbl.gov/research/projects/tough/events/symposia/toughsymposium15/

2015 International Conference on Geothermal Energy in Taiwan
1-3 October, Taipei, Taiwan
http://140.112.56.220/~nep2ggfc/2015ICGEHome

UCTEA Geothermal Congress and Exhibition
14-15 October, Ankara, Turkey
www.jeotermalkongresi.org/english.asp

IGA Annual General Meeting (AGM)
18 October, Morelia, Mexico
www.geothermal-energy.org

European Geothermal Workshop 2015
19-20 October, Strasbourg, France
http://egw2015.sciencesconf.org

Geothermiekongress (DGK2015)
2-4 November, Essen, Germany
http://geothermie.de/aktuelles/der-geothermiekongress-2015/

Geothermal Congress for Latin America and the Caribbean (GEOLAC 2015)
18-19 November, Managua, Nicaragua
http://newenergyevents.com/geolac/

NZ Geothermal Workshop 2015
18-20 November, Taupo, New Zealand
www.geothermalworkshop.co.nz

United Nations Climate Change Conference (COP 21)
30 November-11 December, Paris, France
www.cop21.gouv.fr/en

Geopower and Heat Summit
1-2 December, Istanbul, Turkey
www.greenpowerconferences.com/GE1512TR

Stanford Geothermal Workshop
22-24 February, 2016, Stanford, California, USA
https://pangea.stanford.edu/researchgroups/geothermal/stanford-geothermal-workshop

GeoTHERM Expo and Congress
25-26 February, 2016, Offenburg, Germany
www.geotherm-germany.com/en/geotherm_evening_event

Iceland Geothermal Conference (IGC 2016)
26-29 April, 2016, Reykjavík, Iceland
www.geothermalconference.is/

European Geothermal Congress, EGC 2016
19-24 September 2016, Strasbourg, France
http://egec.info/events

GRC Annual Meeting
23-26 October, 2016, Sacramento, California, USA
www.geothermal.org/meet-new.html

6th African Rift Geothermal Conference (ARGeo-C6)
31 October to 1 November 2016, Asmara, Eritrea
http://theargeo.org/files/ARgeo-C6%20Flyer.pdf ■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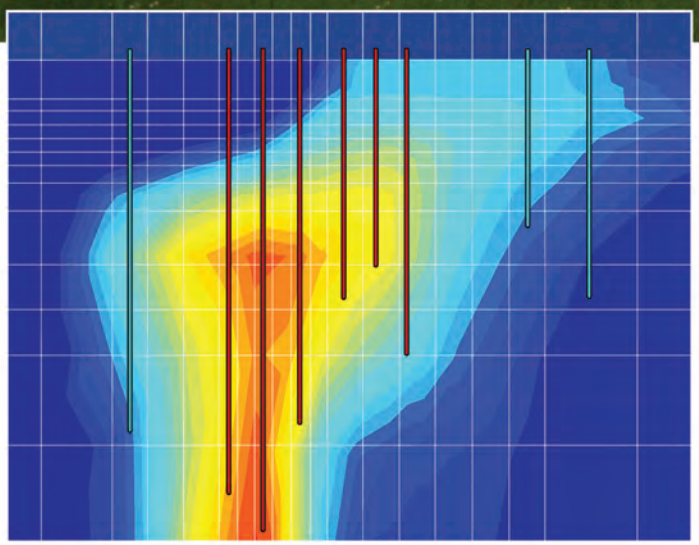

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