

BACKGROUND

GEOLOGICA GEOTHERMAL GROUP, provides high quality global geothermal resource exploration, development, and assessment services and environmental consulting services for private and public sector clients.

After 15 years as Principal of **GEOLOGICA, INC**, President Jill R. Haizlip founded **GEOLOGICA GEOTHERMAL GROUP** in late 2014 in order to continue and expand on the success and capabilities of the Geologica Geothermal Team. The **GEOLOGICA GEOTHERMAL GROUP** team is led by senior professionals, with over 30 years, in disciplines related to geothermal resources from the initial stages of exploration, development, assessment, production and operations as well as environmental consulting experience. We provide senior level technical and management expertise, strategic planning, risk assessment and mitigation, and project coordination.

GEOLOGICA GEOTHERMAL GROUP'S technical expertise includes geology, hydrogeology, geochemistry, geophysics, reservoir engineering, numerical simulation, data management, geographical information systems, remote sensing and reservoir assessment and management, environmental science, permitting, and regulations as well as geotechnical, and civil engineering services. We have excellent associations with experts in, drilling, power generation, and project design including wellfield, gathering system, and surface facilities.

GEOLOGICA GEOTHERMAL GROUP'S mission is client satisfaction. We assemble the most qualified team of people with expertise in the critical areas required by each client and/or project.



GEOTHERMAL SERVICES

GEOLOGICA GEOTHERMAL GROUP personnel have contributed to all phases of geothermal resource development. Highlights include:

- Preliminary and detailed geoscientific studies (geological, geochemical, hydrogeological, volcanological, geophysical) for evaluating resource potential for development and sustainable operations
- Environmental studies, risk assessment, permitting and regulatory compliance
- Resource characterization and assessment for due diligence, financial valuation of undeveloped resources and developed and operating projects
- Resource monitoring and maintenance programs for sustainable reservoir management
- Targeting, planning, drilling and logging of exploration, production and injection wells
- Well flow testing-data collection and analysis
- Geochemical sampling and data evaluation – steam, thermal and cold waters, soil gas, exploration/production well fluids, power plants, water, soils, rocks and other solids
- Exploration and field development planning
- Geothermal project feasibility studies for power generation and direct use
- Due diligence assessments of resource, environmental conditions and existing facilities
- Database development to support geothermal resource exploration, development and management
- Numerical reservoir simulation and reservoir engineering and management
- Conceptual and spatial reservoir modeling and assessment in 2D and 3D
- Resource design criteria/parameters for power plant and gathering system design including scale mitigation, gas loading and corrosion mitigation hydrogen sulfide abatement
- Steam purity analysis at power plant inlets
- Air quality, water quality and waste management

REPRESENTATIVE PROJECT EXPERIENCE

Western U.S. Geothermal Areas

Open Mountain Energy, UBS Global Asset

- Resource evaluation and development forecasts for investment due diligence in multiple projects in Nevada, California and Hawaii

Coso Geothermal Field

Coso Energy/Coso Operating Company/TerraGen

- Reservoir characterization: temperature, reservoir saturation using hydrochemistry for reservoir management, injection strategy.
- Environmental permitting for water extraction and transfer for injection supplementation

U.S. Navy Geothermal Program Offices

- Annual geochemical evaluation for geothermal reservoir characteristics as part of U.S. Navy's monitoring of the Coso Geothermal Resource.

The Geysers

Western GeoPower Inc./US Geothermal/Ram Power

- Resource evaluation of the southwest area at The Geysers, CA using geochemistry.
- Mass flow, enthalpy and noncondensable gas projections for select development scenarios.
- Corrosion potential and mitigation
- Performed evaluation of noncondensable gas loading for gas ejection and gas emission control sizing.
- Environmental review of soil and groundwater contamination, prepare and implement soil and hazardous materials clean-up

Paisley Geothermal Field

Surprise Valley Electric Company

- Reservoir evaluation and on-going resource management support for a 3 MW project in Paisley, Oregon.

Salton Sea

CalEnergy, multiple power plants

- Provided groundwater monitoring evaluation for discharge pond permitting.
- Drill site geology, fluid geochemistry for reservoir management
- Fluid chemistry for air emissions/permitting

SQM

- Geothermal resource assessment for due diligence as potential investor in Hudson Ranch geothermal and mineral extraction

Western Turkey

Zorlu Energy

- Provided flow testing and evaluation on 15 wells, geochemistry, environmental assessment and resource development plan, resource and chemical design criteria, start-up testing for the 75MW expansion of the **Kizildere Geothermal Field, Denizli Province, Turkey**
- Resource Assessment, Well testing, and analysis, Feasibility Study, Design Criteria 45 MW **Alasehir Geothermal Project, Turkey.**

Gurmat Energy (Power Engineers/Veizades)

- Collected resource data through production and injection tests, interference testing and geochemical sampling. Resource development plans and power plant design criteria for a 45 MW geothermal power project, a conceptual resource model and numerical simulation for the **Germencik Geothermal Field, Aydin Province, Turkey.**

Sis Enerji

- Provide well test planning, implementation, and data evaluation as well as reservoir modeling, and well targeting support for the Sogukyurt and Ozmen geothermal fields near **Alasehir, Turkey.**

Africa

Electricite de Djibouti

- Performed a resource evaluation and target confirmation, well design, and drilling specifications as part of the planning, oversight, and evaluation of multiple exploration wells in **Fiale Caldera, Lake Asal, Djibouti.**

Geothermal Development Company (GDC)

- Geochemical Survey of Suswa Geothermal Area: Exploration and Capacity Building Program, Conceptual Model+Well Targets (with EFLA)
- Technical Support for Transaction Advisory for GDC Geothermal Development and Steam Sales at Menengai (with GreenMax Capital)

Kalahari GeoEnergy

- Provided Preliminary Resource Assessment, Exploration Drilling Plans, Updated Resource Assessment and Additional Exploration Plans for a Geothermal Field in **Kafue Trough, Zambia**



OVERALL PROJECT EXPERIENCE

INTERNATIONAL PROJECTS

Kizildere Geothermal Field, Denizli, Turkey
Geothermal Resource Assessment, Feasibility Study of 75 MW Expansion, Testing and Management

Germencik Geothermal Field Aydin, Turkey
Flow Testing: Design and Implementation
Geothermal Resource Assessment and Development Feasibility Study + Start-up Support

Tuzla Geothermal Field, Turkey
Resource Evaluation and Assessment

Sogukyurt-Tepekoy Geothermal Areas, Turkey
Well Testing, Well Targeting, Resource Evaluation

Gumuskoy Geothermal Field, Western Turkey
Geothermal Resource Assessment and Well Testing

Alasehir Geothermal Field, Turkey
Preliminary and Detailed Feasibility Studies
Well Testing and Reservoir Modeling

Alasehir-Manissa-Kavaklidir, Turkey
Resource Assessment and Geophysical Exploration

Denizli-Salavatli-Tekkehamam, Turkey
Preliminary Geothermal Resource Assessment
Well Planning and Testing

Aydin, Turkey
Preliminary Resource Assessment

Kutahya Geothermal Area, Turkey
Geothermal Resource Review

Olkaria, Kenya
Resource and Environmental Assessment

Lochinvar, Zambia
Preliminary Resource Assessment and Exploration

Lake Asal, Djibouti
Resource Review and Exploration Drilling Oversight

Hot Dry Rock, Australia
Geochemical Evaluation of Geothermal Resource

American Samoa
Evaluation of Geothermal Resource Potential

Tenerife, Canary Islands
Geochemical Evaluation of Geothermal Potential

Island of St. Vincent, Carribean
Geothermal Exploration and Environmental Baseline

Dominica, Carribean
Environmental Mitigation Plan

Island of Nevis, Carribean
Geothermal Resource Development Strategy

El Tatio, Chile

Environmental Monitoring and Mitigation

San Jacinto II and III, Nicaragua
Silica Scale/Steam Purity Study

Lihir Geothermal Field, Papua New Guinea
Geothermal Resource Assessment and Development Feasibility Study

Mahanagdong, Upper Mahio and Malitbog, The Philippines
Steam Chemistry and Power Plant Efficiency

Sarulla, North Sumatra, Indonesia
Due Diligence for Geothermal Resource Development

Ulubelu, Sumatra, Indonesia
Silica Scale Potential Study

Indonesia
Survey of Geothermal Development Opportunities

Darajat, West Java, Indonesia
Geochemical Analysis and Resource Evaluation

Cibuni and Ciater, West Java, Indonesia
Preliminary Resource Assessment

Bedugal, Island of Bali, Patuha, West Java, Indonesia
Geochemical Resource Characterization and Exploration

Central Java, Indonesia
Preliminary Resource Assessment

Tutuila and Manu'a Islands, American Samoa
Preliminary Resource Assessment
Geothermal Geological and Geochemical Exploration
Geophysical (MT) Surveys

DOMESTIC PROJECTS

The Geysers, CA
Steam Chemistry, Evaluation
Geothermal Resource Potential
Soil and Groundwater Investigation and Clean-up
Air Quality, Permitting, Steam Sampling

Coso Geothermal Area, China Lake, CA
Geochemical Evaluation and Monitoring
Coso Hot Spring Monitoring

Haiwee Geothermal Lease Area, CA
Haiwee Programmatic EIS

Rose Valley, Inyo County, CA
Rose Valley Water Transfer to Coso Geothermal Project EIR

Island of Hawaii and the Puna Geothermal System
Resource Review for Power Generation Potential



OVERALL PROJECT EXPERIENCE

Nevada

Geothermal Resource Potential of Mineral Lease

Hycroft, NV

Resource Assessment/Preliminary Feasibility Study of Hycroft Mine

Star Peak-Rye Patch-Humboldt House, NV

Data Review and Preliminary Resource Assessment

Clifton Hot Springs, AZ

Arizona Geothermal Resource Potential

Colorado

Statewide Geothermal Resource Review

Salton Sea, CA

Groundwater Monitoring

Resource Management and Drilling Support

Air Emissions, Permitting

Star Peak-Rye Patch-Humboldt House, NV

Preliminary Resource Assessment-Due Diligence

East Mesa Geothermal Field, El Centro, CA

Environmental and Resource Due Diligence

Casa Diablo and Heber, CA

Environmental and Resource Due Diligence for Geothermal Asset Sale

Medicine Lake Highlands

Fourmile Hill Geothermal Development Project-Engineering Analysis for the ATC/PTO Permit

Long Valley Caldera, Mammoth Lakes, CA

Geothermal Resource Characterization

Technical Support for Environmental Documentation

Newberry Volcano, Deschutes County, OR

Geothermal Resource Characterization, Environmental Assessments, Well Sampling

Florence, CO

Preliminary Resource Assessment and Exploration

CLIENT LIST

Allied Nevada Gold

American Samoa Power Authority

Amoseas Indonesia

Arizona Public Service

Ayvacik Geothermal Energy

BM Energy

CalEnergy/CalEnergy International

Calpine

Cerberus

Coso Energy

Davenport Power

EBRD

EFLA

Electricite de Djibouti

ESA Inc.

Fina Enerji

Global Power Solutions

Greeneco Energy

GreenMax Capital Advisors

Growth Capital Holdings

Gurmat Energy

Imparator Energy

International Finance Corporation (World Bank)

Inyo County

Kalahari GeoEnergy

Karadeniz Energy

Kayen Kayi Electric

KenGen

Lihir Gold

Mammoth-Pacific Ltd.

Marco Power

Maspo Energy

Meridian Power, LLC

MHA Environmental Consulting Inc.

Mono County Energy Management

Nemrut Geothermal

Northwest Geothermal Company

Open Mountain Energy

OMV

Ormat Energy Systems Inc.

Pandawa Energy

Petratherm

Power Engineers, Inc.

Presco Energy

Ram Power

Salt River Project

Sis Enerji

Stone & Webster-Shaw Group

Surprise Valley Electric Company

Terra-Gen Power, Coso Operating Company (COC)

Turcas BM Kuyucak Jeotermal

UBS Global Asset Management

U.S. Navy Geothermal Program Office

Veizades & Associates

Western GeoPower

Workmen Energy

Zorlu Energy



KEY PERSONNEL

GEOLOGICA GEOTHERMAL GROUP staff, associates, and affiliates are highly trained professionals who typically have advanced degrees and/or professional certifications in their fields of expertise. Brief summaries of key professionals available are provided below.

Jill Robinson Haizlip, President/Principal Geochemist. Ms. Haizlip is a geologist and hydrogeochemist who has spent more than 30 years working on the exploration and development of geothermal resources. Her primary expertise is in the area of applied hydrogeochemistry related to understanding geothermal systems and utilization and treatment of natural thermal and non-thermal waters for power generation and direct use. She has been the principal investigator on geothermal resource assessments, feasibility studies, as well as issues related to well testing, resource data collection, environmental compliance and geothermal fluid chemistry.

Leland Davis, VP of Operations/Environmental Geologist. Mr. Davis is Geologica's Vice President of Operations and Sr. Project Geoscientist. He is an Environmental Geologist who has spent nearly 10 years with Geologica working on the exploration and development of geothermal resources. His primary expertise is in reservoir data collection, well testing, and resource analysis including computer based GIS mapping and conceptual modeling. He has provided key technical support on geothermal resource assessments, feasibility studies, and wellfield management, as well as planning and execution related to well testing, resource data collection, and environmental compliance.

Maxwell Wilmarth, Senior Geologist. Mr. Wilmarth is a Geologist with 12 years' experience in environmental, hydrological, and geothermal geoscience. He has worked on a wide range of geothermal reservoirs in the exploration, development, and operational phases in a number of countries especially the U.S., Chile, and New Zealand. He has extensive experience in well site geology, well testing, exploration geophysics, MEQ interpretation, geochemical sampling, shallow temperature (2 m) probe surveys, conceptual modeling, regulatory agency liaison and compliance, and resource review supporting investment decisions. He has performed original research on the power density method of resource capacity estimation and on permeability mapping, and has published numerous articles in geothermal conferences and peer-reviewed publications on a variety of topics.

Key Additional Staff include:

Deven Vignali, Staff Geoscientist
Nicholas Prina, Staff Geological Engineer
Amanda Fishbin, Staff Geologist

Associates

Sabodh K. Garg, Principal Reservoir Engineer. Dr. Garg is a consulting Principal Reservoir Engineer for Leidos Inc.. He applies his expertise in modeling of multi-phase fluid flow in geologic media, pressure transient analysis, geothermal reservoir mechanics, geopressured reservoirs, and rock mechanics including shock physics to the evaluation and assessment of geothermal reservoirs, well test analysis and geothermal reservoir modeling. Along with his colleagues, Dr. Garg developed a geothermal reservoir numerical simulator and a wellbore simulator. He is the author of numerous journal articles on geothermal reservoir engineering including volumetric heat-in-place estimates and well test analysis. Recent projects include: Senior Reservoir Engineer for the Resource Assessment of the Kizildere Geothermal Field for Expansion including well test analysis, heat-in-place modeling and numerical simulation, Senior Reservoir Engineer for Resource Assessment and Well Test Analysis for numerous fields in Nevada for a private U.S. developer.

William Cumming, Principal Geophysicist, is an internationally recognized expert, specializing in geothermal exploration and development. His 32 years of experience in the geothermal industry include 20 years with Unocal Corporation (now Chevron) in positions from Geophysicist to Chief Geoscientist. Among his principal responsibilities in worldwide geothermal operations were conducting and interpreting geophysical surveys, integrating geoscience data sets, developing representative ranges of resource conceptual models, designing and coordinating well target and resource capacity risk analyses, and managing geoscience quality assurance.

As an independent consultant from 2000 to present, Bill provides technical and management consulting services for geophysical surveys, geothermal resource assessment and well targeting, geothermal investment due diligence analyses, professional training and geophysical research. In support of geothermal exploration and development, he has used a wide variety



KEY PERSONNEL

of geophysical methods, including MT, TEM, CSAMT, galvanic resistivity (VES), helicopter EM, reflection and refraction seismic, earthquake, gravity, precision gravity, leveling, dGPS, and aeromagnetic surveys.

Manon Stöver, Reservoir Engineer. Ms. Stover is experienced in designing and conducting geothermal well tests, including static PT and dynamic PTS surveys, injection, short-term production, and multi-well interference and tracer testing, and well test data analysis. In addition, she is experienced in numerical reservoir modeling of different types of geothermal resources applying the software programs Tough2 and TETRAD.

Associated Firms

Depending on project requirements, **GEOLOGICA GEOTHERMAL GROUP** typically teams with one or more of the following:

- Cumming Geoscience
- Middle Earth Geoscience
- Leidos
- Veizades & Associates, Inc.
- Eartha AG
- Steve Pye Consulting
- Terrane Apps
- Geothermal Resource Group
- EFLA Consulting Engineers
- Power Engineers, Inc.
- Global Power Solutions
- Panorama Environmental, Inc.
- APEX

Additional information including CVs available upon request.

CONTACT INFORMATION

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