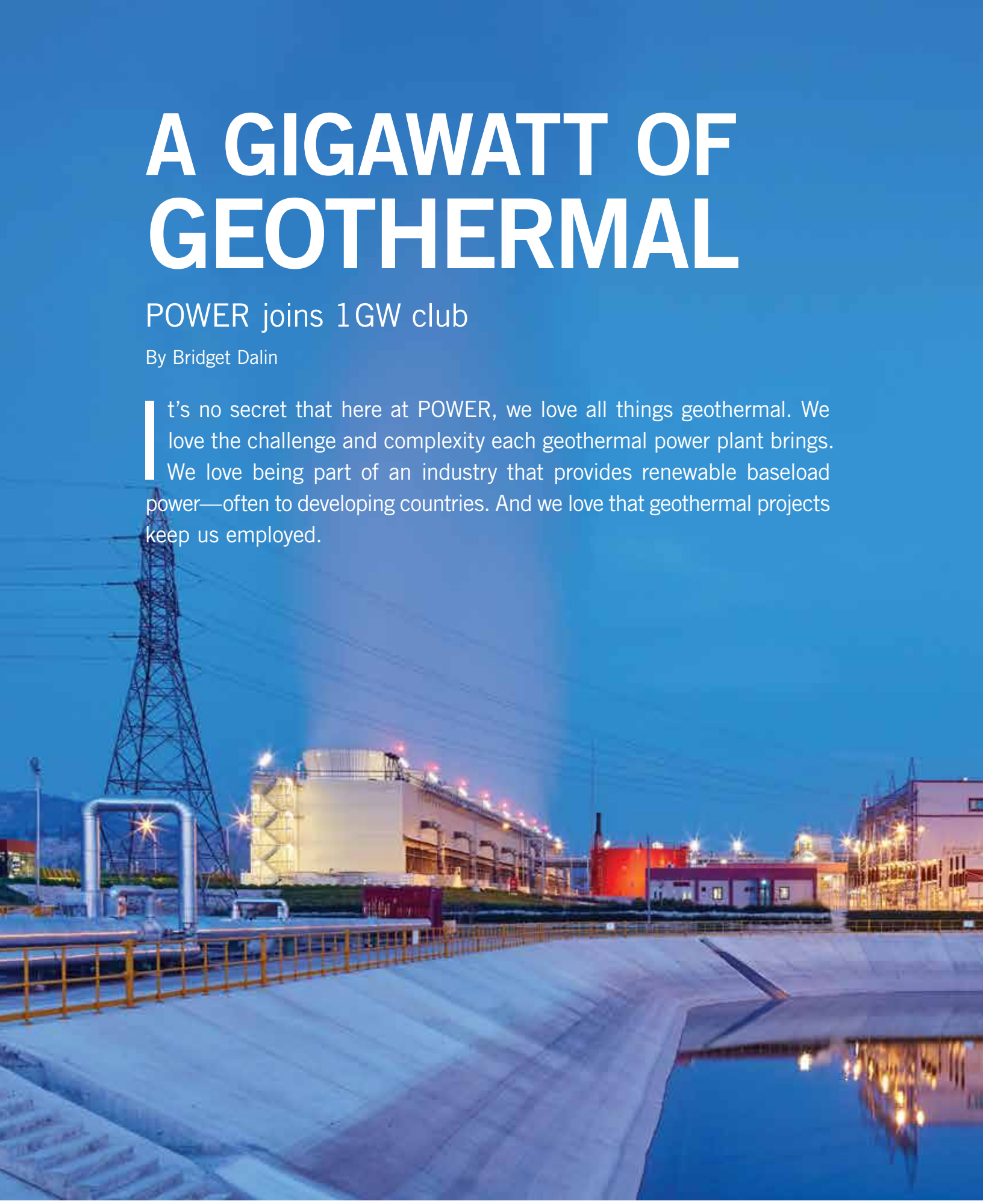
A GIGAWATT OF GEOTHERMAL

POWER joins 1GW club

By Bridget Dalin

It's no secret that here at POWER, we love all things geothermal. We love the challenge and complexity each geothermal power plant brings. We love being part of an industry that provides renewable baseload power—often to developing countries. And we love that geothermal projects keep us employed.



That love, along with hard work, long hours and many transoceanic flights, has brought POWER into the rather exclusive 1GW club. With the completion of Kizildere-3 Unit 1 earlier this year, we have now designed more than 1,000 MW of installed geothermal capacity.

What's the big deal?

One GW may not seem like a big amount. In the fossil fuel industry, a 1,000+ MW project is not uncommon at all. In fact, POWER is currently supporting Gemma Power Systems with design of the Freedom Generating Plant—a 1,050 MW combined cycle electric generating station located in Pennsylvania. That's 1,050 MW from a single project! Even the wind and solar industries see tens of thousands of MW come online every year. However, geothermal is a completely different animal.

Our geothermal design projects average about 40 MW. And because the geothermal industry is small, there are not a lot of projects up for grabs each year. Since geothermal projects are only feasible in certain places of the world (think Pacific Ring of Fire), it's tough to be prolific in the industry. However, for the past three decades, POWER *has* been successful in geothermal. Designing 1,000 MW of completed projects proves that.

"Reaching 1GW is a huge milestone for us," says POWER-Hailey's Kevin Wallace, director of geothermal projects. "Getting to 1,000 MW takes time and dedication."

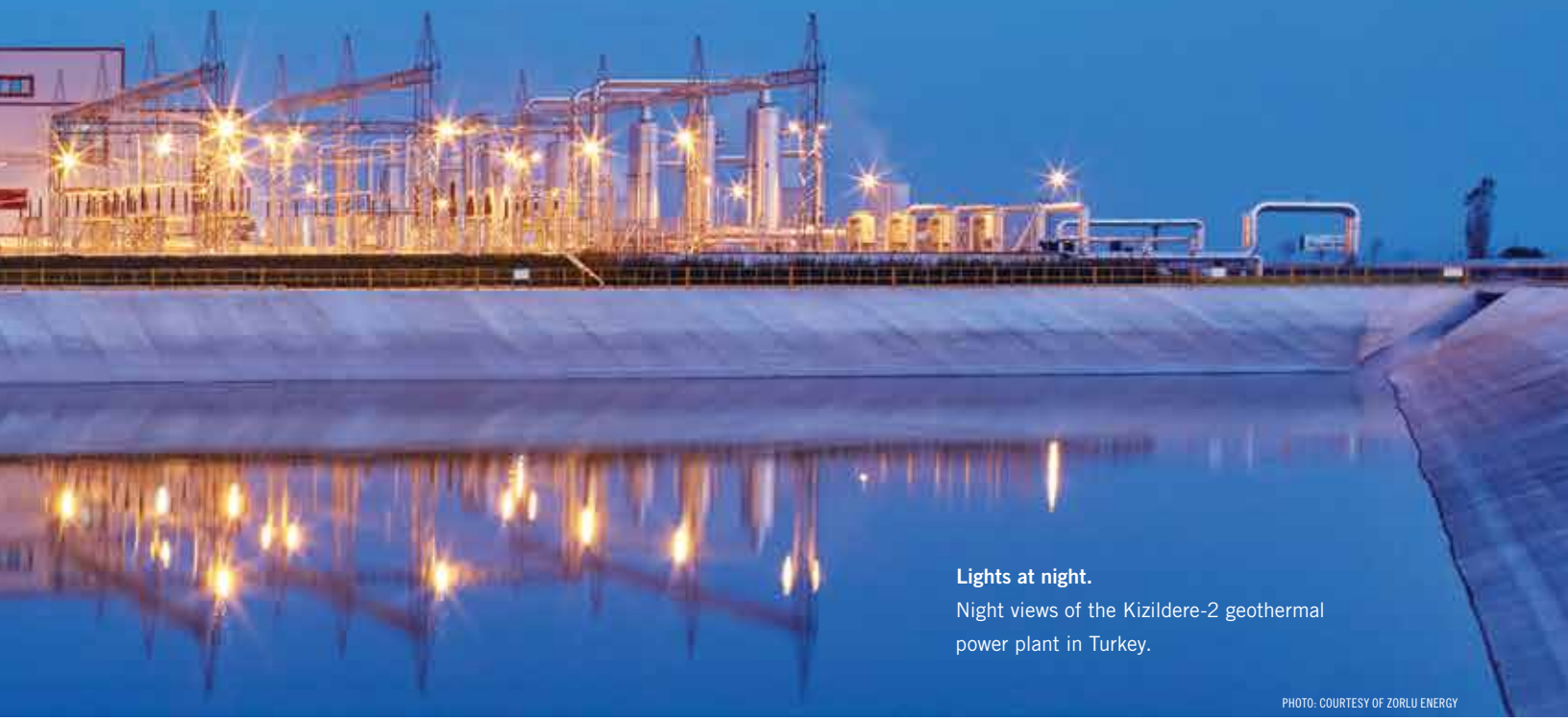
Getting to 1,000 MW

POWER's foray into geothermal began in the late 1980s with the design of some well-fields, which collect hot fluid from production wells for delivery to the power plant. When EPC prime contractor Stone & Webster declined the well-field design and build-out portion of the East Mesa Geothermal Plant in California, they recommended a small engineering firm by the name of POWER Engineers to the client, GEO East Mesa Limited Partnership.

POWER-Boise's Mike Lidinsky, senior business development manager, was the Lead Controls Engineer at Stone &Webster at that time.

"We knew POWER would do a good job, but they were not really big enough to be any real competition for us in the geothermal market."

He was wrong about that! The project introduced POWER to Mitsubishi Heavy Industries, which ended up taking us all over the world to work on big geothermal projects—the first being the 52 MW plant in Mindanao, Philippines, in 1997. Geothermal plants in Costa Rica, Mexico and Kenya quickly followed. Thanks to Mitsubishi, POWER became one of the most well-known designers of geothermal power plants in the world.



Lights at night.
Night views of the Kizildere-2 geothermal power plant in Turkey.

PHOTO: COURTESY OF ZORLU ENERGY


PHOTO: MATT FISHMAN

Geothermal powerhouse. The Alaşehir geothermal power plant in Turkey. Pictured is the powerhouse and electrical buildings (back left), the gas extraction system/NCG removal system (front left), the binary plant equipment (front right), and the HP turbine exhaust stack (back middle).

Teamwork in Turkey. (Right) POWER-Boise's Matt Fishman, left, and POWER-Hailey's Justin Diedrick, right, in front of Kizildere-3 Unit 1 in Turkey.

"Our design teams are the industry's best," says POWER-Hailey's Tim Dunford, project engineer. "Everyone works very well together and we provide great field support."

Each plant designed taught POWER something new and contributed to our overall MW count. A few of the more noteworthy geothermal plants POWER designed include the 121 MW Darajat III geothermal plant in Indonesia, the 76 MW San Jacinto plant in Nicaragua, the 47 MW Stillwater and 19 MW Salt Wells plants in Nevada, and the 50 MW Los Azufres plant in Mexico. In conjunction with full detailed design, our efforts on feasibility studies, operating plant solutions and due diligence efforts all helped to develop our collective wisdom.

In 2007, we began designing geothermal plants in Turkey. The first, Germencik I, was the largest geothermal plant in Turkey at the time. Next came Kizildere-2, where our team applied an innovative combined cycle using hybrid flash/binary technology to take advantage of the particular resource conditions. We even received a patent on our cycle design. Kizildere-2 set a new standard for innovative and ambitious heat recovery from a renewable energy resource.

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The 1 GW club…and counting

This year, with the competition of Kizildere-3 Unit 1, POWER joined the 1 GW club. The project also ushers Turkey into the "1 GW country" club, of which there are only three other members worldwide: the United States, the Philippines and Indonesia. (We have worked on geothermal projects in all four of the countries that have more than 1 GW of installed geothermal capacity.)

Turkey, along with Indonesia and Kenya, is leading the world in geothermal capacity additions. We are well-positioned to contribute to many of those additions through feasibility studies, detailed plant and well-field design, and owner's or independent engineering. Our geothermal teams are hard at work on studies and plant designs in countries such as Costa Rica, Kenya, Indonesia, Nicaragua, Saint Lucia, Turkey and the U.S. It looks like more transoceanic flights are on the horizon for our teams.

"Our geothermal projects send us all over," says POWER-Boise Mechanical Engineer Matt Fishman. "I get to travel to interesting sites that I ordinarily would not have had a chance to visit if my focus was purely in the U.S."

Fishman is part of the next generation of engineers at POWER who are working towards our next gigawatt of installed geothermal capacity. As long as countries like Turkey and Kenya continue to develop their geothermal resources, we will continue to design cutting-edge geothermal technology that makes the world just a little more sustainable.

Bridget Dalin is a marketing and proposal coordinator for Generation in Boise.

PHOTO:PHOTO: COURTESY OF ZORLU ENERGY

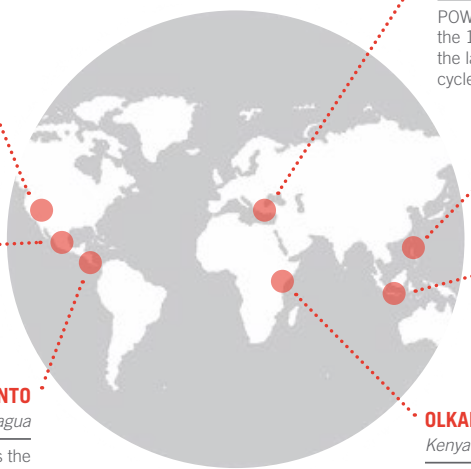
GEOTHERMAL 101

Geothermal is the process of producing power from the heat of the earth. Wells are drilled into the earth at approximately 3 to 10 kilometers. Steam, liquid, gas, or a mix of all three, is then extracted. This is called a resource. The geofluid from a resource can be harnessed directly as steam, flashed into steam or used to boil a second fluid that turns a turbine connected to a generator, which then creates electricity.

A geothermal power plant is designed specific to the resource, and no two are alike:

- Dry steam plants use steam directly from a geothermal reservoir to turn turbine-generators. Dry steam plants are rare and found in only a few locations on earth.
- Flash plants take high-pressure hot water from the earth and convert it to steam to drive turbine-generators. When the steam is cooled, it condenses to water and is injected back into the ground to be used again. Flash plants are the most common type of geothermal power plant.
- Binary cycle power plants transfer the heat from geothermal hot water to another liquid. The heat causes the second liquid to turn to vapor, which is used to drive a turbine-generator. Binary plants are designed for lower-temperature resources.
- Combined cycle plants combine two types of geothermal technologies, such as a flash plant with a binary cycle.
- Hybrid geothermal power plants combine geothermal with another renewable resource such as solar.

NOTABLE GEOTHERMAL PROJECTS



KIZILDERE-3 UNIT 1
Turkey
POWER and Turkey enter the 1 GW club with the largest combined cycle unit to date.

MINDANAO I & II
Philippines
POWER designs our first single and double flash plants with Mitsubishi!

DARAJAT III
Indonesia
POWER designs one of the largest plants in a single casing at the time.

OLKARIA II
Kenya
POWER designs three flash plants, providing critical baseload contributions to Kenya.

STILLWATER & SALTWELLS
United States
POWER designs two custom binary plants which later receive solar PV and solar thermal augmentation.

LOS AZUFRES
Mexico
POWER provides a 50 MW axial flow design — a first of its kind.

SAN JACINTO
Nicaragua
POWER enters the Nicaragua market with a Fuji turbine.

Global reach.
From the Philippians in Southeast Asia to the deserts of Nevada, our geothermal experience spans the globe.