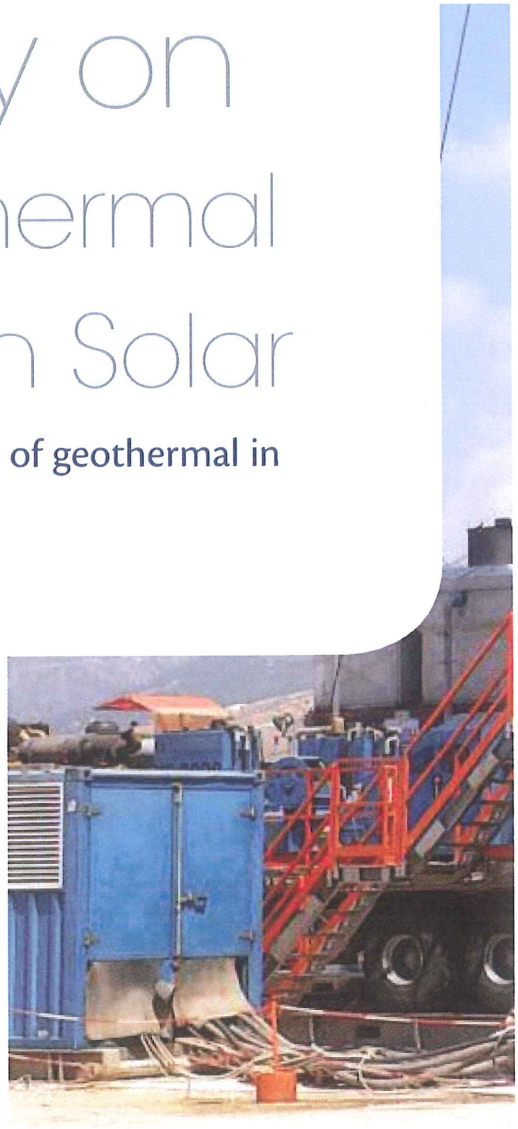
The Take Away on Cost: How Geothermal Can Compete with Solar

As executives work to improve the perception of geothermal in the energy industry, service providers are finding ways to decrease the up front cost of developing the resource.



JENNIFER DELONY, *Associate Editor*

NV Energy's Jack McGinley recently put the U.S. geothermal industry's current challenge in succinct terms: Geothermal is not competing with solar PV on cost, and when it comes to utility power procurements, "low cost wins."

McGinley is executive of regulatory and legislative strategy at NV Energy. Speaking at the Geothermal Resources Council 39th Annual Meeting in Reno, Nev., in September, McGinley explained that in the request for proposal (RFP) process for utilities, low cost, while not the only driver, is the primary driver.

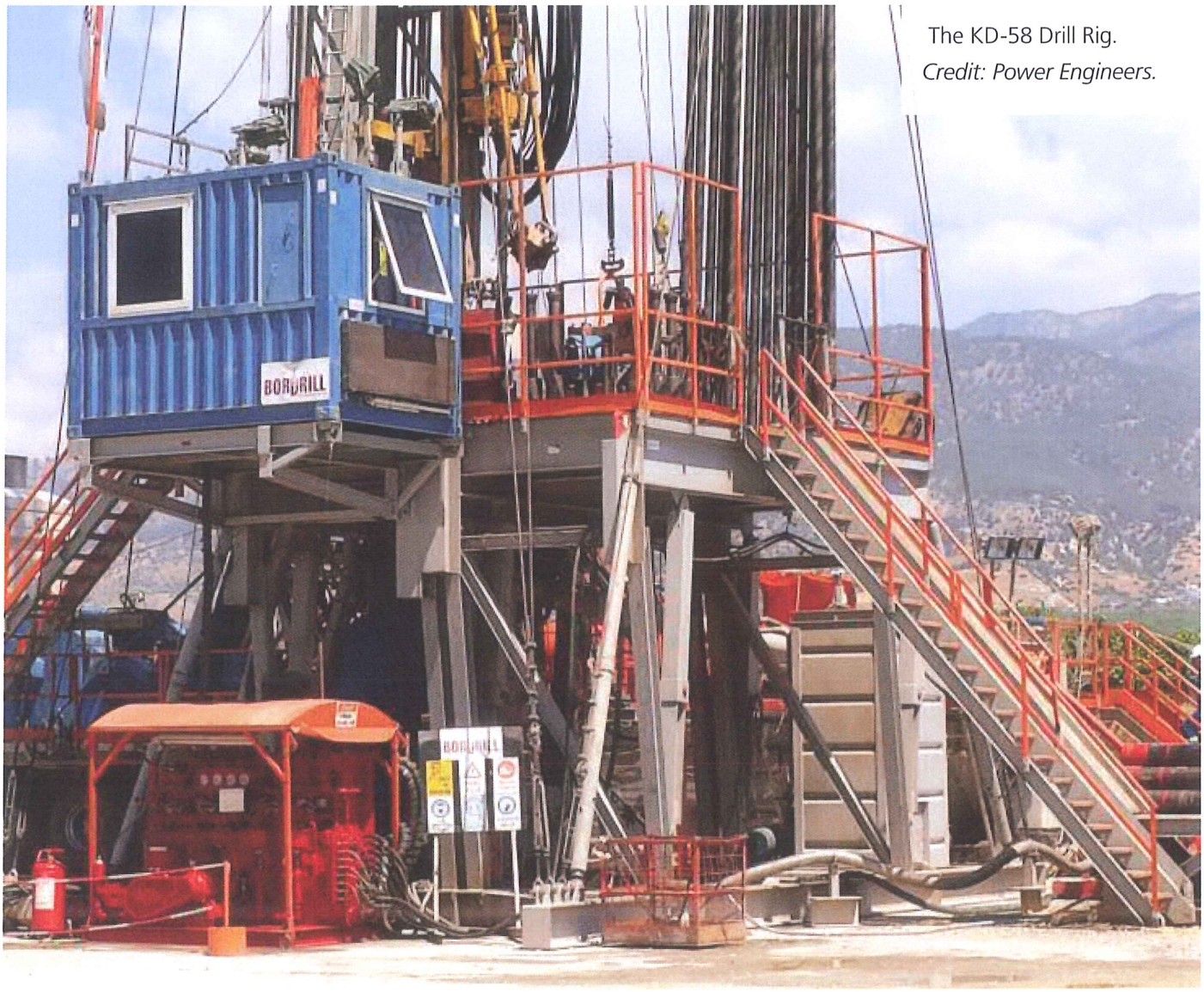
"When you're signing contracts at 3.8 cents and 4 cents a kilowatt-hour, it's tough to beat that," he said.

NV Energy's most recent RFP went entirely to solar. Utility-scale solar project owners are regularly securing power purchase agreements at 5 cents per kWh or less, according to Lawrence Berkeley National Laboratory's recent report "Utility-Scale Solar 2014." Whereas the cost for geothermal power can be anywhere from 5 cents per kWh to 8 cents per kWh.

The good news for geothermal, according to McGinley, is that large power customers are eager for renewables, and they do not want it all in solar or wind — they want a balanced clean energy portfolio, including geothermal. Those big consumers, however, have a limit on how much they will pay for that energy.

"You've really got to sharpen your pencils," McGinley said.

Further exacerbating the issue for the U.S. geothermal industry are the solar industry's favorable subsidies as compared to those given to geothermal. Solar currently receives a 30 percent federal tax credit, while geothermal receives 10 percent. Although



The KD-58 Drill Rig.
Credit: Power Engineers.

the solar federal tax credit is set to go down to 10 percent in 2017, solar also receives state tax credits/rebates and property tax exemptions as well as special rates and net metering. None of those additional incentives are extended to geothermal.

Isaac Angel, CEO of geothermal developer Ormat Technologies, said during the GRC annual meeting that the geothermal industry "has a problem," and it's "probably a perception issue."

According to Angel, geothermal can compete with solar on any day, if the costs of integration of intermittent power sources are taken into consideration.

"We have to convince decision makers that we have a great solution, and it is cost effective," he said. "It's a resource that is coming, it's available — when you build it correctly — and it exists for a long time."

Mike Long, senior project manager of the strategic consulting group at Power Engineers, agrees with Angel's assessment.

"If you talk about competitive issues facing the geothermal market, it's really related to utilities not fully placing

integration costs onto solar and wind," Long said in an interview. "Geothermal is a great base load power; it can be flexible, and under the right conditions, geothermal can be a load follow, but when utilities are really loading up on solar, they are not accounting for the fact that they have to put in a heavy transmission infrastructure that only supports a generation technology that is producing 40 percent of the time."

Zorlu Alasehir Geothermal 45 MW Power Plant. *Credit: Power Engineers.*

Improving to Compete

Long said that, despite current challenges, the opportunities for geothermal to begin competing with solar and wind can come through technological advancements that will make exploration and development less expensive and drive down the cost per kilowatt hour.

The U.S. Department of Energy's Frontier Observatory for Research in Geothermal Energy — FORGE — program, for example, is looking for ways to identify systems that provide stimulation techniques that improve production of wells or help reduce the number of dry holes that are drilled.

Kevin Wallace, renewable generation lead at Power Engineers, said in an interview that more targeted drilling and better results from drilling programs will help save developers money.

The economics of drilling are especially challenging, and one goal for developers is to reduce the risk of the exploration phase.

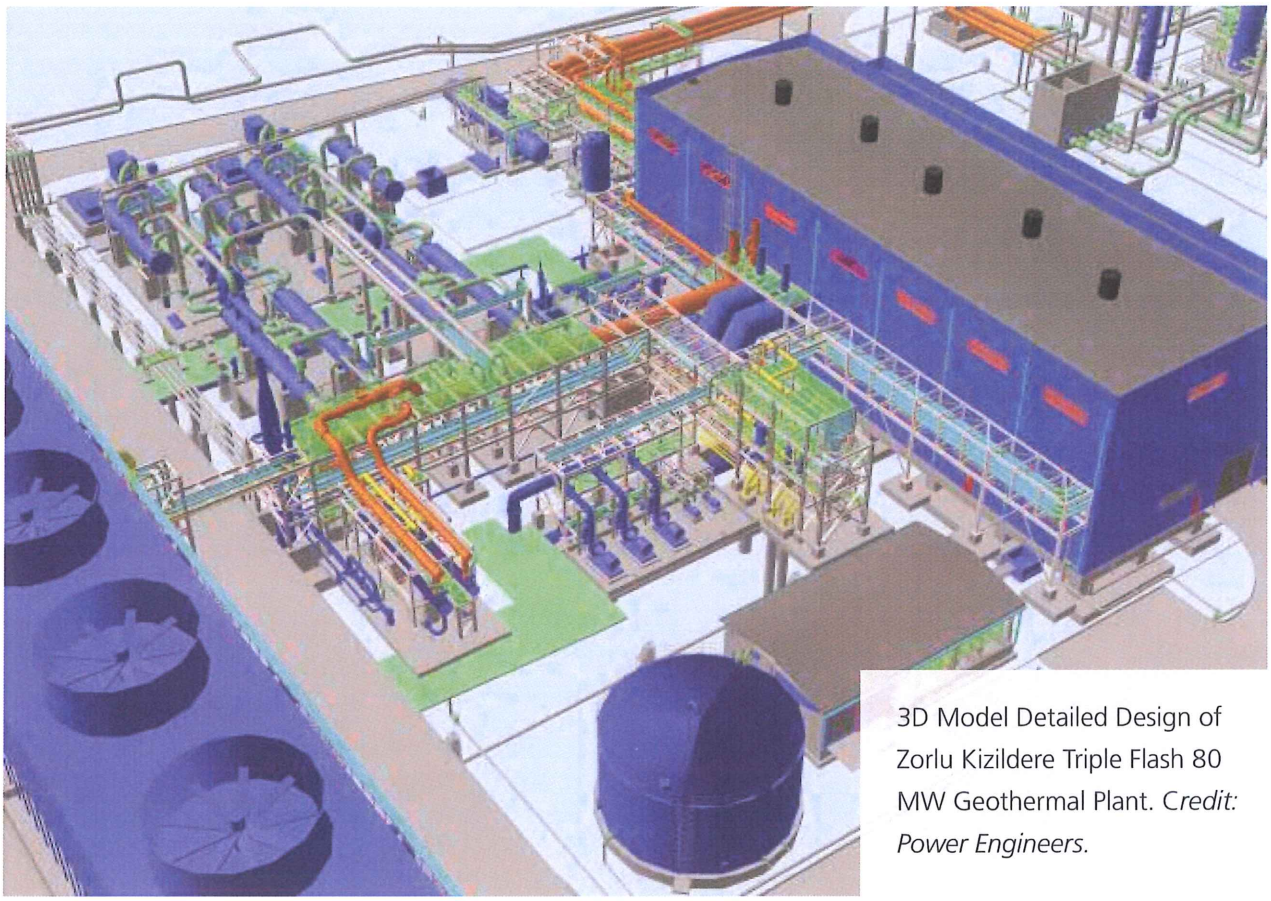
"Usually, one out of the first three holes you drill is dry," Wallace said. "That represents not a small amount of money."

50 MW Los Azufres Geothermal Plant. *Credit: Power Engineers.*

According to Long, drillers realize a 50 percent success rate during the initial exploration phase, which goes to 75 percent during the confirmation stage, and 80 to 90 percent for final production wells.

With information that can be gathered through seismic testing, gravity surveys, geochemistry, geophysics and geology, Wallace said, surface studies are improving, and developers are turning to those technologies more and more.

"They are learning how to integrate all the various information available from the different studies and come up with a comprehensive model that will help in deciding where to drill," he said.



3D Model Detailed Design of Zorlu Kizildere Triple Flash 80 MW Geothermal Plant. *Credit: Power Engineers.*

William Osborn, VP of Geothermal Resource Group, said that one of the biggest mistakes that the company's customers make is not studying a geothermal resource enough before embarking on a drilling campaign, which is both expensive and risky.

"We've worked on projects where they not only do a poor job of selecting where they're going to do their first drilling, but they're also unprepared to drill when they get out there with the drilling rig," he said. "It's simple things like ensuring they have a good supply of diesel fuel and contingency plans."

According to Osborn, the company's standard advice to its customers is to do more upfront research and due diligence than they were originally planning for because it is much cheaper relative to drilling, which can cost between $35,000 and $100,000 per day.

"The geology, the geophysics, the geochemistry; that is what I mean when I say due diligence," he said. "When we look out across the landscape, how are we to decide where to drill the first hole?" The only way to know, he added, is with geoscience.

"Developers just don't do enough of that," he said. "People are intrigued by drilling a hole — they think that drilling a well will prove their resource, but the problem is, it's very easy to miss."

Geothermal Resource Group is also helping its customers at the time of drilling by working with DOE and Sandia National Laboratories to advance drilling technology through development of microboreholes.

Historically, drillers in the geothermal industry used large diameter boreholes (about 8.5 inches) to prove the resources,

according to Osborn. In the mid-1990s, he said, the industry began to drill a smaller diameter borehole (about six inches), which is called a slim hole. Today, with government support, Geothermal Resource Group is working to advance a much smaller diameter hole (three inches), called a microborehole.

"We have a lot of micro-tools and instruments that are available that we didn't have in the '90s that allow us to measure resource conditions in these microboreholes," he said. "We think that is where geothermal resource exploration is heading, and every time we decrease the size of the hole, drilling gets cheaper."

Osborn added that it is feasible for those boreholes to become smaller and smaller in the future.

"It takes stronger materials and smaller instruments, but that's where we're headed," he said.

Market Competition

According to Wallace, an increase in competition within the geothermal market, on both the flash and binary sides, also could begin to drive down prices naturally.

He said that the recent acquisition of Alstom by GE will serve to heat up competition on the flash side, as the company will now go up against Fuji, Toshiba and Mitsubishi.

"Those are four very strong players," Wallace said.

In addition, Ormat, Turboden, Atlas Copco and Exergy currently operate in the binary market, he said, adding that "between those four vendors, there is a lot of competition." ◑