U.S. Tech Giants Become Alternative Energy's Fairy Godfathers

While the failure of government-backed solar start-up Solyndra generated a lot of news headlines, it has also encouraged some discussion about the role of government in helping get new industries off the ground. It may also have highlighted the fact that venture capital companies and their investors may be starting to fall out of love with alternative energy, an industry that has proven it needs a long runway for take-off. Venture capitalists and investors, not always the most patient of people, seem to be increasingly wary about investing in technologies that are still in their infancy, or at least in their youth.

But as the news last week brought us the knowledge that the seven billionth human being entered the world somewhere in India, the need to move forward with alternative energy remains urgent. And move forward it will: though it may not find itself using government cash or traditional venture capital to do so. But before we talk about that: it's appropriate to talk about two bright spots in alternative energy that have something in common.

In the Mojave Desert, 40 miles southwest of Las Vegas and straddling the California/Nevada border, a new kind of solar facility is under construction on 3,600 acres of federal-owned land. It's a a $2.2 billion solar thermal power plant being built by BrightSource Energy. The facility, called the Ivanpah Solar Electric Generating System, is different from a standard solar array. The site, once completed, will feature arrays of mirror-like devices called "heliostats" that concentrate the sun's rays onto 459-foot tall "power towers," using the energy to boil water to create steam. The steam is then used to drive a turbine that generates electricity. The Ivanpah will ultimately consist of three separate power plants, each featuring a power tower and thousands of heliostats: about 173,500 in total.

Oakland, Calfornia-based BrightSource, which received a $1.6 billion federal loan guarantee to complete the project with the help of 800 construction workers, says that it when the facility is finished in 2013, it will be the largest solar thermal power plant in the world and will generate enough electricity to power 140,000 homes.

So while the project is using federal stimulus funds, it's also got a VIF – a very important friend – in the form of tech giant Google and its clean energy investment initiative. Google has invested $168 million in the project, which has already received buy-in from two California utilities: PG&E and Southern California Edison, both of which will purchase energy from the Ivanpah array.

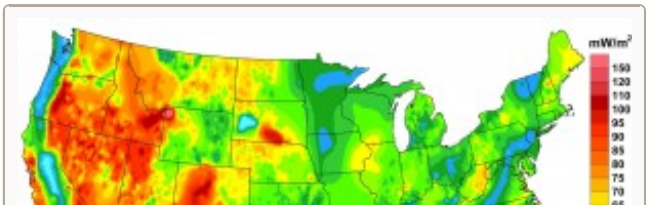
Contrasting with the nearly-complete Ivanpah facility is another alternative energy project, this one still in its infancy.

Researchers at Southern Methodist University (SMU) have recently finished a three-year project to map the entire United States to determine its full potential for geothermal energy. Turns out, the U.S. has far richer accessible geothermal resources than previously thought, especially in the tectonically stable eastern U.S. (It was once thought that geothermal energy could only be obtained from tectonically cranky parts of the world.)

Once upon a time, geothermal energy could be generated only in places where all the right factors – the right kind of accessible rock, underground magma chambers near the surface and a ready source of water – already existed. With newer geothermal technologies called Enhanced Geothermal Systems (EGS), water can be injecting into drilled wells in rock, creating steam that can be used to drive turbines and generate electricity. All that's really needed is water and the right kind of rock. With EGS technologies, there is potential geothermal energy to be tapped in all 50 United States.

The mapping project, which was carried out by Southern Methodist University's (SMU) Geothermal Laboratoryled by geophysics professor

David Blackwell, found that the U.S.'s real geothermal potential (called "Technical Potential" in geothermal lingo) for energy production exceeds that of installed coal capacity in the U.S. by 10 times over. The project took into consideration both known resources and tens of thousands of new thermal data points and readings called "bottom hole temperatures" in order to create the



most detailed U.S. geothermal image to date. (If you're a Google Earth junkie, you can see the entire geothermal picture in an updated Google Earth layer.) The research will be formally presented at the Geothermal Resources Council Annual Meeting.

The U.S. is a more geothermally hopping place than previously thought.

Under a new international geothermal protocol, in order for geothermal resources to qualify as having "Technical Potential, they must be between 3.5 to 6.5 kilometers (between 2.2 and 3.4 miles) underground. Anything between 6.5 to 10 kilometers (about 6.2 miles) is labeled "Theoretical Potential." Also, to be considered of "Technical Potential," the geothermal resources can't be located in certain impractical or impossible areas, such under national parks or protected land. Even looking at only the Technical Potential for the continental U.S., resources exceed 2,980,295 megawatts. (Compare this to the fact that current traditional geothermal generating capacity is estimated to be only 9,000 MW worldwide).

Currently, the U.S. generates about 2,700 MWh of electricity each year from existing geothermal installations using traditional technology. This works out to about 60 million barrels of oil each year, or enough energy to power 3.5 million homes – but without the corresponding 22 million tons of carbon dioxide, 200,000 tons of sulfur dioxide, 80,000 tons of nitrogen oxide and 110,000 tons of particulate matter that the fossil fuel energy would bring along for the ride.

Researchers say it's just the beginning. Imagine what EGS installations all over the country could accomplish toward a clean energy future.

"This assessment of geothermal potential will only improve with time," said Blackwell. "Our study assumes that we tap only a small fraction of the available stored heat in the Earth's crust, and our capabilities to capture that heat are expected to grow substantially as we improve upon the energy conversion and exploitation factors through technological advances and improved techniques."

So what does this new Geothermal Map of North America project have in common with the Ivanpah solar thermal project? It was financed by Google.

These two projects aren't Google's only clean energy investments. The company, which last year was granted a license by the Federal Energy Regulatory Commission to buy and sell power in the manner of a utility, also has heavy investments (about 37.5 percent of the upfront capital) in the Atlantic Wind Connection (AWC) project, which is seeking to build wind turbines about 10 to 15 miles along a 350-mile stretch of the U.S.'s Atlantic coast line. Last year, the company also made a $38.8 million investment in a wind project located on the plains of North Dakota.

Google is currently operating a program its calling "RE<C," (which symbolizes renewable energy becoming cheaper than coal). RE<C is pursuing a goal of developing one gigawatt of renewable energy – enough to power a city the size of San Francisco, says the company – at a price cheaper than coal in years, not decades. In addition to the solar and wind projects, the company has invested in a project to develop something called a "solar Brayton engine," a kind of turbine engine powered by sunlight.

But Google isn't the only cash-rich tech company in the United States, nor does it have a lock on being the only Fairy Godfather to alternative energy projects designed to bear fruit in both the near term and long term.

Not to be outdone, social networking behemoth Facebook has decided to generate some green headlines of its own as of late. We learned in October that Zuckerberg *et al.* are embarking on the construction of three giant server halls just south of the Arctic Circle. The installation will cover an area the size of 11 football fields in northern Sweden, near the town of Luleå at the northern tip of the Baltic Sea and only 62 miles south of the Arctic Circle.

"The climate will allow them to just use only air for cooling the servers," said Mats Engman, chief executive of the Aurorum Science Park. "If you take the statistics, the temperature has not been above 30C [about 86F] for more than 24 hours since 1961. If you take the average temperature, it's around 2C [35.6F]," said Engman.

That's not to say the region stays at chilly refrigerator temperatures year-round: Facebook will still need to buy some energy off the grid. In its location in Northern Sweden, however, the data center will be able to buy electricity for supplemental cooling from renewable sources, notably hydroelectric dams on the nearby Luleå river.

While Facebook's green policies are more internally focused than Google's – the social networking giant does not have an arm dedicated to investment in experimental alternative energy or public projects with a philanthropic face – the company has been in a race with Google to slim down its own eco-footprint, particularly as Facebook has been a frequent target of environmental groups (Greenpeace, most notably) over the efficiency of its many data centers. (Not to mention its legions of users, many of whom have demanded that Facebook begin using 100 percent renewable energy in its operations.)

Facebook has also begun experimenting with using solar energy to help supplement the energy needs of many of its data centers. The company is currently in a testing phase to figure out how photovoltaics (PV) can best be put to use to help it meet its enormous power needs. The company's first PV installation is a modest 100-kilowatt photovoltaic array that was recently unveiled at its enormous new data center in Prineville, Oregon.

"We started the solar project as an opportunity to learn how to integrate onsite renewable energy sources into the complex operating sequences found in data centers," said Jonny Thaw of Facebook's Open Compute Project, which shares some of its green IT successes with the rest of the IT world, such as the process it went through to make its Prineville servers 38 percent more efficient than EPA standards, which the company says has cut operations costs by about 25 percent.

Apple, never one to be left behind, has been less publicly pursuing its own alternative energy agenda. The company has a massive solar project in the planning stages to support its new data center in Maiden, North Carolina. (The "less publicly" refers to the fact that news reports about the solar project only popped up after the newspaper the Charlotte Observer dug up the permits for the solar installation).

Apple's newest 500,000-square-foot data center is five times larger than its previous data center in Newark, California (and has also been heartily criticized by Greenpeace, which points out that no matter how efficient the data center is, it's still located in North Carolina, a "dirty energy" state.) The $1 billion facility was built to power Apple's new iCloud service, which offers Apple users up to five GB of free "cloud-based" online storage. Apple's permits for the solar farm (codenamed "Project Dolphin") pertain to a nearby 171-acre plot of land that will presumably host solar arrays to power the data center.

So will Facebook and Apple, and others of their ilk (paging Oracle!) ever step up the alternative energy plate in quite the same way as Google, seeing a clean energy future for the U.S. part of their responsibilities? Maybe. Even without the willingness to finance the kind of speculative, adventurous clean energy projects that Google seems happy to fork out cash for, organizations like Facebook and Apple are still bringing practical alternative energy solutions forward faster and more economically – and without the political flak – than federal and state loans could ever do.

Perhaps the idea is that while venture capital and the federal government may have been burned – either for real or the in world of politics and public relations – too many times to keep any forward momentum and enthusiasm for funding alternative energy technologies, the country's technology giants may decide they are the ones best suited to carry the ball.

Here's to "not being evil."