SolarReserve's Shenhua Deal To Build 1 GW of Dispatchable Solar Day Or Night

May 11th, 2016 by Susan Kraemer

China's largest coal company, Shenhua Energy, has signed a MOU with SolarReserve to build the largest amount of completely dispatchable solar electricity in the world: 1 GW – about the capacity of a nuclear plant.

After a series of high-level visits to SolarReserve's Crescent Dunes project in Nevada, Shenhua wants to take the dispatchability in SolarReserve's Concentrated Solar Power (CSP) to the next level.

The 110 MW Crescent Dunes tower CSP project supplies 1,100 MWh per day of solar to light up Las Vegas by night or to be dispatched on demand when needed if the sun doesn't shine.

Shenhua Energy plans to build more than nine times that capacity: 1 GW of CSP. Paired with a comparable percentage of thermal energy storage as Crescent Dunes, this would provide 10,000 MWh of thermally stored solar *daily* for China.

Solar that is able to be dispatched whenever needed, on demand, or routinely after dark or before sunrise like CSP, is of great interest to China, as it faces very real consensus on the need to move away from coal power. Not only does climate change threaten China's water supply from the Himalayas over time, but China's immediate pollution is an everyday reminder that coal must go.

"They recognize for themselves: We can't breathe," Crescent Dunes site manager Rob Howe told me during a site visit this week. "They are selling more face mask filters than anything else in the country."

"China has a heavy mandate for renewable energy and they are looking to do quite a bit with CSP, because they are having the same issues everybody else is having with PV and wind: the intermittency and not being able to meet the peak evening demand," Mary Grikas, SolarReserve spokeswoman added.

Howe pointed out that the mandate has affected Shenhua, which is China's biggest coal company.

"They are reading the tea leaves," he said. "And I think they are just well positioned to take advantage of this mandate, as they are already in the energy market. So why not?"

The deal: who will do what

Shenhua will develop, permit, build and operate the power block side, leveraging its experience in building and operating state-of-the-art coal plants.

SolarReserve spokeswoman Mary Grikas and site manager Rob Howe showed me around Crescent Dunes last week.

Every kind of generation driven by steam involves a massive amount of steel construction, which will be familiar ground for Shenhua.

Howe is confident that it will also be able to handle building the physical solar plant, even down to these specialized heliostat mirrors.

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Obviously, all the construction of the solar harvesting heliostat system and the thermal energy storage side of CSP will be new to a coal company, but SolarReserve will show the way, down to the unique requirements of the heliostat mirrors.

"The glass is ultra pure, but China can do that; they do that with their PV panels. So they are fine with that," Howe said.

"If you give them a spec for purity and clarity, they'll get it. I mean I'm sure they'll have birthing pangs like with any other technology, but they'll get through it. The rest of the structure is just structural steel, that's easy for them."

For what what Grikas described as "our rocket science" — the electronic brains that operate this heliostat solar collecting system; SolarReserve will serve as a supplier of the critical technology that monitors and controls the heliostats, and ties the solar harvesting system to the thermal storage and the power block.

In 2014, SolarReserve bought Rocketdyne's CSP business – and folded its actual rocket scientists into the company – and now owns all the patents and IP rights related to its invention of the molten salt receiver, the heliostat designs and collector field control systems running molten salt technology for storing solar. (According to Howe, Spain's 20 MW Gemasolar was developed through a FOIA to the US Department of Energy, using the same technology back when Rocketdyne's DOE invention was "open source.")

A division of responsibilities utilizes the strengths of both parties:

For the China project, SolarReserve will supply consulting services for development, technical, engineering, project management, construction and operations.

The vastly larger and much better capitalized Shenhua will now handle a lot of what SolarReserve had to pull together to get Crescent Dunes off the ground as a startup.

The power block of a CSP plant is essentially the same as any other thermal plant, whether geothermal, nuclear, coal, or combined cycle natural gas.

Scott Frier, who developed the 250 MW Mojave and 280 MW Solana CSP projects in the US for Abengoa Solar, a subsidiary of the (then much more secure-seeming) global Spanish infrastructure firm Abengoa, and who left to work with ACWA Power, told me what a challenge that was for SolarReserve.

"It is just a miracle what SolarReserve has been able to achieve," he said. "That they were able to develop and permit and get financing in record time throughout the extremely rigorous Department of Energy requirements to qualify for a loan guarantee. But it strained them to their limits."

In partnering with Shenhua, SolarReserve will now be able to hand off all the kind of development, permitting, financing and EPC management of construction that it took to build Crescent Dunes, while being critical technology suppliers.

That makes this big step from 110 MW to 1,000 MW possible.

Why China is so well positioned to take CSP to the next level:

China's miraculous economic growth rate has long been based on unflinching state support for infrastructure investment.

About half of China's GDP is derived from state-supported investment spending, higher than any major economy in history.

State-owned companies tend to have access to what amounts

to a permanent loan guarantee program that never gets overturned by opposing political factions.

This level of government support enabled China's miraculous growth, including in developing massive energy projects like hydropower, and coal-based energy. That exuberance led to far too much coal power plant construction, even after applying the brakes, resulting in "ghost cities" of unused and unusable coal plants once the target switched to renewables.

But that same unstoppable velocity won't need to be braked, once loosed on a real necessity: building *renewable* energy.

"Shenhua has been a coal company, but China is just like countries everywhere that are starting to pack up their coal plants, like Port Augusta in Australia." said Grikas.

Shenhua Holdings is state-owned but the energy division is traded on the stock exchange. The financing Shenhua will be able to access to build this 1,000 MW of SolarReserve's CSP technology will be much less expensive than that obtainable by any startup innovating any new solar technology – like SolarReserve.

Here is what 1,100 MWh/day of stored sunlight takes: a very big solar thermal energy storage tank

(According to Howe, this hot tank actually had to be suspended a little above ground so that cooling air can be blown under it, "or else we'd overheat the concrete foundation underneath.")

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The heart of SolarReserve's technology is that it can store a day's sunshine in molten salts inside a gigantic thermal energy storage tank. After being heated in the tower receiver by the reflected "suns," the salts are stored at 1050 degrees F in a hot tank.

On the other side of a three-story-tall heat exchange system is the cold tank, which is the same size. Cold is relative, of course, at 550 degrees F the salts are still in liquid form, but it is this temperature difference between the two that gets extracted in the heat exchanger.

This extracted heat creates steam – pushed through huge pipes you couldn't wrap your arms around – that runs a turbine generator system that's about the size of a big rig.

This is what it takes to store sunlight from Crescent Dunes 110 MW project to supply NV Energy with power to light Las Vegas for ten hours each night.

The CSP deal with Shenhua will help deploy more PV and wind in China

SolarReserve's thermal storage capability will also be used to store – not only its own solar harvest – but also to store other surplus renewable energy from the grid.

This will provide grid stability for new long distance transmission lines being built through Western China to transport China's fast-growing PV and wind generation.

China is already beginning to experience solar and wind curtailment in the north and west where the best wind and solar resources are, and siting these CSP projects with their integrated thermal energy storage in this region makes it possible to mitigate the problem of "spilled" solar and wind.

"Our projects will be located in the north and west where the best solar resource is located in China," said Grikas, citing the region's ideal combination of high DNI and high altitude.

"Our technology has the added benefit of being able to absorb significant excess grid power," she added. "This will mitigate the solar and wind curtailment events currently occurring in China, allowing those intermittent generators to continue operating."

The potential is huge and growing fast: by the end of 2015, according to official figures, China had 129 GW of cumulative installed wind power, a 33% increase over 2014, and installed

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PV then came to 43GW, an increase over 2014 of 74%.

Storing spilled solar and wind in China – which now leads the world by a long shot in installed PV and wind – could well lead to the deployment of CSP on a big enough scale to really drive down costs for this dispatchable kind of solar.

Shenhua's foresight, to see in this technology a new solar direction for the company's unique capabilities in building thermal energy plants, can be attributed to its CEO Dr. Ling Wen, who has a long time interest in cleaner energy for China.

Tags: China, SolarReserve, US

About the Author

Susan Kraemer writes at CleanTechnica, CSP-Today and Renewable Energy World. She has also been published at Wind Energy Update, Solar Plaza, Earthtechling, PV-Insider, and GreenProphet, Ecoseed, NRDC OnEarth, MatterNetwork, Celsius, EnergyNow, and Scientific American. As a former serial entrepreneur in product design, Susan brings an innovator's perspective on inventing a carbon-constrained civilization: If necessity is the mother of invention, solving climate change is the mother of all necessities! As a lover of history and sci-fi, she enjoys chronicling the strange future we are creating in these interesting times. Follow Susan on Twitter @dotcommodity.

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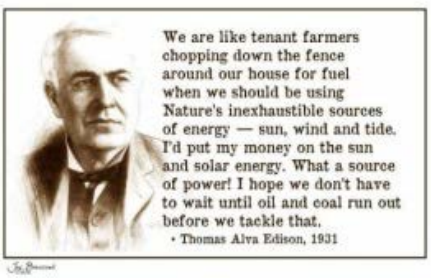

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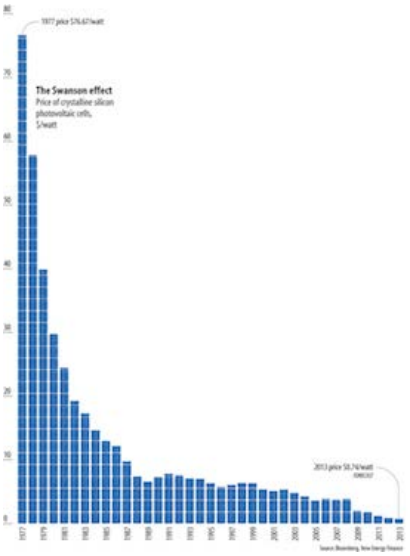

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