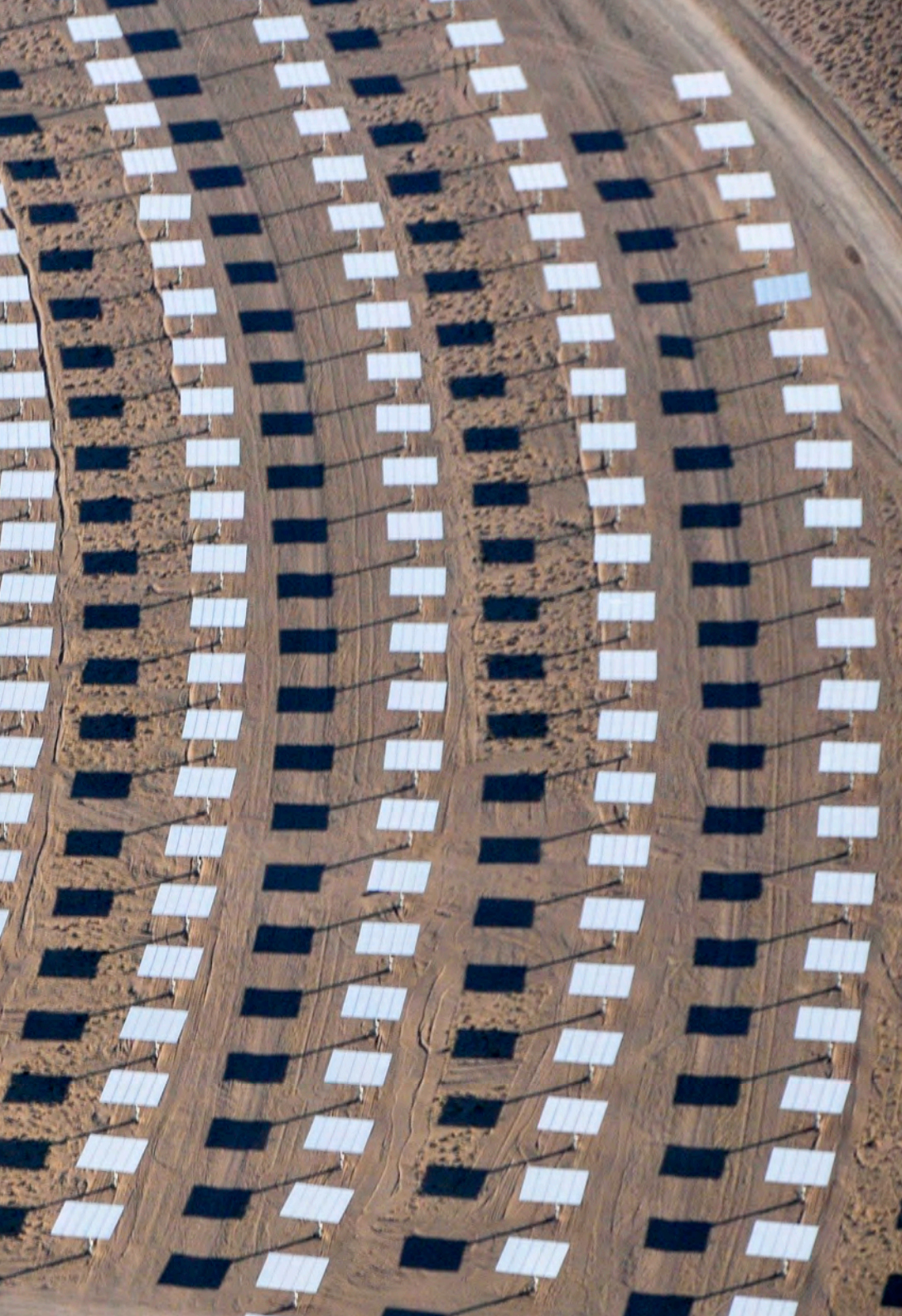


CSP-PV HYBRID TO DELIVER 90% OF MINE'S ENERGY NEEDS – INTERVIEW WITH SOLARRESERVE CEO, KEVIN SMITH



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Kevin Smith
CEO
SolarReserve

California-based SolarReserve is currently negotiating with a mining company operating in Northern Chile to supply a CSP-PV Hybrid solution. In this Q&A Interview, Kevin Smith, the CEO of SolarReserve, lays out the economics, the drivers for the project and the wider opportunities for CSP for mines

Q: How do you see the market evolving for solar for mines globally – where do you see the biggest opportunities in the near-term in terms of location and project type?

A: The opportunities we're addressing today are large mines with high energy costs and suitable sunlight. In the past six months we've interfaced with iron, copper, gold, silver, and uranium mines in Australia, Chile, Peru, Mexico, South Africa, Saudi Arabia, and the United States. The very best opportunities are in locations such as Western Australia, where fuel cost for diesel is more than \$300 per megawatt-hour because they're trucking it in from the coast. In the

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right locations, we can provide energy for well under half of that, and we're able to deliver a reliable 24-hour per day power solution.

Some miners will start with solar by integrating photovoltaics (PV) into their diesel power systems for fuel abatement. We offer this solution as well. It's a good way to save some fuel and incrementally reduce costs – PV energy can replace roughly 30% of the mine's fuel use and be cheaper than diesel fuel – but the transformative change comes when you have a large amount of storage to provide solar energy around the clock. I expect the first few solar installations at mines will be PV integration because it's a small step, but ultimately the market leaders will move toward a more meaningful 24-hour solution like our solar thermal power plants with energy storage.

Q: Can you share some of the details of SolarReserve's project for a mining off-taker?

A: We are negotiating with a mining company operating in northern Chile. We recently offered them 100% of their energy supply for 25 years at a fixed price that is cheaper than the spot market for grid supplied electricity.

Spot market energy prices are a major challenge for this mine – they're exposed to an extremely volatile spot market with average prices at about \$150 per megawatt-hour over the year. The mine's demand is roughly 100 megawatts (MW) on peak and 80 MW on average, and of course they operate 24 hours a day. We configured a hybrid CSP-PV plant with 100 MW of CSP, 14 hours of molten salt storage, and 75 MW of PV. This configuration is truly a baseload generator – it generates 100 MW or more for roughly 90% of the hours in the year. When we supply more than or less than the mine's load, SolarReserve would instead buy or sell on the spot market.

SolarReserve would finance the project and sell the energy to the mine under a long-term PPA at less

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than the current spot market average. If the mine decides to invest equity as well, which may come at a lower cost of capital, we can reduce the PPA price and provide further savings.

Q: What were the main criteria for the mine with this project and how did you tailor your offering to meet the mine's needs?

A: They are looking for 100% of their energy supply, fixed at a below-market price. In this case, the renewable energy aspect of the project is actually not that important to them – it's all about economics. We're cost-competitive with coal and natural gas in northern Chile in addition to providing a more sustainable solution.

In order to fully supply the mine's requirements while minimizing our spot market risk, we configured a hybrid CSP-PV plant to operate at a very high capacity factor. The PV mixes in some lower-cost energy during



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the day, but the CSP provides the majority of the energy over the 24-hour period. Our CSP plant would run like a baseload plant – 24 hours a day, 7 days a week, at full contract capacity about 90% of the time.

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Q: How did this type of project differ from a traditional project with a utility off-taker?

A: Utilities manage portfolios of generating assets, but mines are often off-grid or supplied directly by a particular source. A utility might buy around 10% of its requirement in any given solicitation, but a mine is more likely to look for a complete stand-alone solution.

Utilities are also typically overseen by energy regulators and are required to buy a certain amount of renewable energy, whereas in our experience the mine’s energy choice is economically-driven rather than policy-driven.

Also, energy procurement is core to a utility’s business model, whereas the minerals are really the focus for the mining company. It’s helpful to provide an end-to-end solution to a mine operator so that they can solve their energy needs long term and refocus

on their core activities.

So, for this specific project in the Atacama, the difference is that we can provide a more complete, stand-alone solution than we would otherwise bid to a utility, and we focus on competing economically with grid supplied power rather than the green aspect of solar generation.

Q: Where would SolarReserve’s storage solution work best for a mining operation? What conditions need to be in place?

A: Sunlight is free fuel, so a good solar resource is key. It’s also necessary for us to have a large, somewhat flat, contiguous area to build our solar field and tower if we’re offering CSP. Just like a mine, we also screen out culturally or environmentally sensitive areas.

The most important condition is whether the mine is looking for a comprehensive solution or not. If they are interested in a 24-hour supply, then long-duration storage is the enabler for solar energy. Our molten salt is actually pretty cheap – batteries will cost hundreds or thousands of dollars per kilowatt-hour of storage capacity, not to mention degradation and replacement costs, but molten salt is between \$50 and \$100 for a kilowatt-hour of storage and will last for 30 years or more.



We are able to offer cost-competitive solar hybrid plants that integrate CSP with storage, PV, and fossil fuels for the entire supply of a mine's energy. With an off-grid hybrid, we would dispatch the CSP with storage around the PV generation to meet the mine's load on a minute-by-minute basis, and use fuel to heat our molten salt when there isn't enough sunlight to do it. We can fully replace conventional infrastructure, or we can integrate into it.

Really the best condition for us is a mine operator who is willing to move aggressively to reduce fuel costs. We recognize that fossil fuels have been the conventional solution for a long time, but as we all know, the energy industry is changing, and innovations like ours will be the way of the future.

Q: How far away do you think we are from a 100% renewable solution for a remote mine where we can do away with diesel all together?

A: We've never had a mine ask for 100% renewables. What they want is lower cost energy. Zero diesel is not really our goal – getting 5% or 10% of your energy from diesel or other fossil fuels can be helpful, and storing fuel for a rainy day is pretty cost-effective. So perhaps the best 100% renewable scenario is to use a little bit of biodiesel alongside our high capacity factor CSP – and we could do that already, today.

Another good way to cut out fossil fuel is to have the mine load be responsive to storage levels. If the storage tank is running low, perhaps the mine could curtail certain non-essential operations. This could really help in the rare event that there is extended, multi-day cloud cover at one of our facilities. So far, mines have not been willing to consider this strategy, but I think it would be a conversation worth having; the last few percentage points of energy reliability are the most expensive ones. Again, if a mine were willing to have a somewhat responsive load, we're already able to do 100% renewables.



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Q: What is your message to the mining sector about the capabilities of solar for powering mining operations?

A: Solar energy can reduce energy costs and exposure to market volatility, but the only cost-effective way to store sunlight for 24-hour supply is molten salt. We offer mining companies the most reliable fully baseload solar generation on the planet, enabled by our world-leading CSP and molten salt storage technology. SolarReserve is the leader in commercially proven and financeable molten salt power tower systems. ■

SolarReserve are participating in the **Renewables and Mining Summit and Exhibition**, Toronto, October 15-16. Details at www.energyandmines.com/toronto