Energy

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Industry Brief

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Alternative Energy: Other

Solar Tower Technology Makes Its U.S. Debut

- Over the past two years, we've frequently written about the surge of large-scale solar adoption by U.S. utilities, with project announcements in the hundreds of megawatts becoming commonplace. Such projects have been divided into two broad categories: photovoltaics (PV) and concentrating solar power (CSP). The PV model uses a semiconducting material in a solar cell – most commonly polysilicon, but also newer compounds such as cadmium telluride – to generate electricity from sunlight. Because virtually all publicly traded solar companies focus on PV, it is by far the better known of the two established types of solar power. CSP is based on a steam turbine generator system – much like a conventional power plant – except that the steam is derived not from fossil fuels but rather sunlight that is concentrated via mirrors or lenses. Relative to PV, CSP has both advantages and disadvantages. Advantages include a higher capacity factor (roughly 30% vs. 15-20%) and a longer plant life (30-40 years vs. 20-25 years). Disadvantages include a more limited set of potential sites (unlike PV, CSP only works in areas with very high amounts of sunlight, such as the U.S. Southwest, Spain, Australia, and North Africa) and CSP's required water consumption.

- Both PV and CSP have their place in the market, and growth of both technologies is set to continue. But we would also draw attention to a third type of solar technology – which is only now making its debut in the U.S. market. This third category is called the "solar tower". Today came the announcement of the first solar tower contract signed by a U.S. utility. The solar tower developer is an Australian-based company, EnviroMission Ltd. (EVOMY.PK/$0.85), which is listed on both U.S. and Australian exchanges. The purchaser is the Southern California Public Power Authority (SCPPA), which brings together eleven municipal utilities in the region, the largest of which is the Los Angeles Department of Water and Power. The contract calls for the construction of a 200 MW solar tower plant in Arizona.

- How does the solar tower work? The concept is very straightforward, being based on the law of physics that hot air rises. The tower uses solar insolation and radiation to heat air beneath a large collector (greenhouse) that creates a constant flow of air to drive conventional turbines. The turbines are located at the base of the tower in the center of the collector, and the movement of the heated air through these turbines is caused by the updraft effect created by the tower. The process is passive, needing no outside energy input to start or maintain it. The only moving components in the system are the rotors of the turbine. (See illustration on page 2). While solar tower technology is brand new in the U.S., it has a prior operating track record in Spain (albeit a very limited one). A demonstration-scale plant (50 KW) operated from 1982 through 1989. EnviroMission holds the exclusive global license (not including China) for solar tower technology.

- While the solar tower is fundamentally more similar to CSP than PV, there is a variety of factors that differentiate it from CSP, and in general we look at the solar tower as a more advantageous technology. The table on page 2 provides a comparison of some of the key metrics, though we would underscore that most of these figures should be considered rough estimates. This is because the solar tower is an early-stage technology, especially within the context of the U.S. market, so a historical comparison is inherently impractical. Also, there are numerous subtypes of CSP, some of them as early-stage as the solar tower, so coming up with overall averages for CSP is also difficult. All that said, here are the principal advantages that we see in the solar tower. First, there is the likely prospect of superior project economics, both in terms of capital and operating costs. This is a function of several features, probably the most important of which is the fact that the solar tower's capacity factor is twice as high as CSP's. The solar tower has a longer and more efficient production cycle during a day because it captures both direct and indirect sunlight. Second, the solar tower's plant life is expected to be roughly twice as long, which also improves economics (over the long run) and adds to the sustainability profile of the project. The longer plant life in partly due to the solar tower's lower operating temperature and thus reduced wear and tear. Third, the solar tower does not require an external water supply, which of course is often scarce in areas with high sunlight, such as the Southwest. This makes finding plant sites easier, both from the standpoint of logistics as well as regulatory permits.

- As U.S. utilities individually decide which technology to use in their large-scale solar projects, the solar tower is set to join PV and CSP as a third commercially viable option. All three are part of the same long-term trend, which is an expansion of solar's market share – from levels that are currently minuscule – within the overall electric power market. This trend is driven by (1) steadily improving project economics; (2) government incentives, such as the federal Investment Tax Credit (ITC); and (3) renewable portfolio standards (RPSs), currently at the state level and potentially at the federal level as well.

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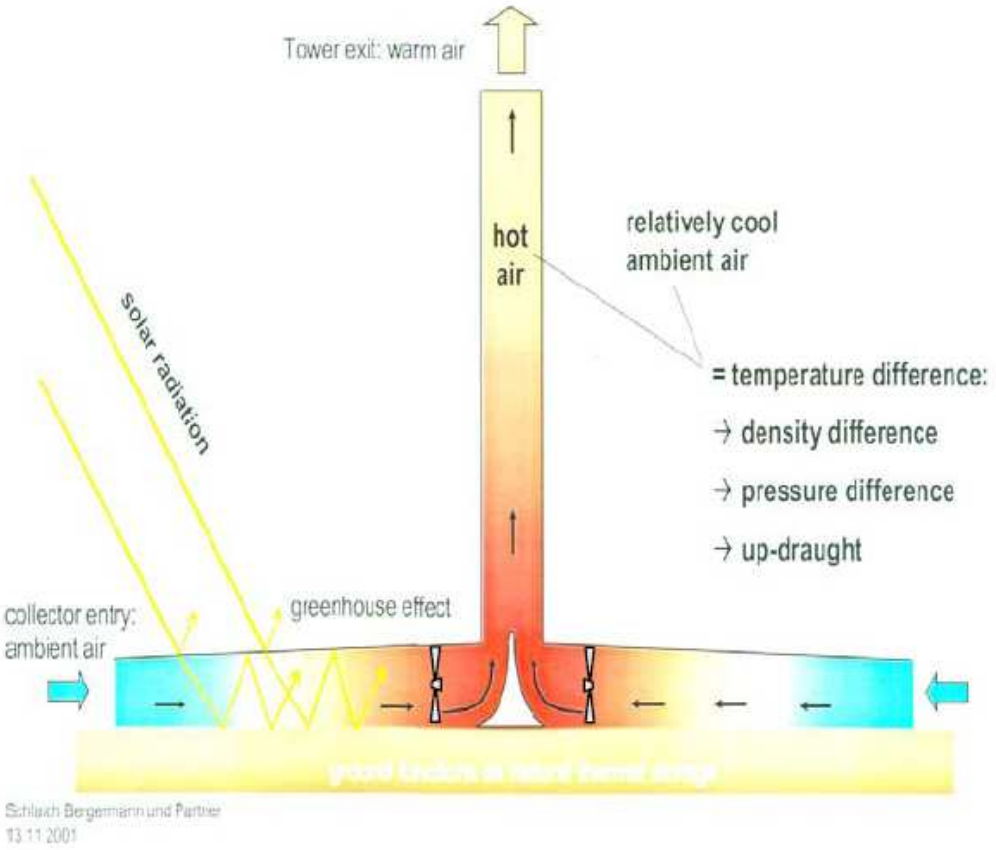

Source: EnviroMission

Solar Tower vs. CSP: A Comparison		
	Solar Tower	**CSP**
Examples of developers	EnviroMission (public)	Ausra (private)
		BrightSource Energy (private)
		eSolar (private)
Capital cost per MW	$3.75 MM	$5.0 MM
Capacity factor	60%	30%
Annual output of 200 MW plant	1,050,000 MWh	525,000 MWh
Capital cost per annual MWh	$761	$1712
Operating costs per MWh	$10	$50+
Plant life	75 years	30-40 years
Water use	Zero	500-800 gal / MWh
Operating temperature	< 200 °F	1,000 °F
Hours of output (without storage)	24	6-8
Power storage options	Many	Molten salt

Source: EnviroMission, RJ research

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