CSP's plunge to a single-digit tariff: a starting point towards a global trend

ACWA Power's recent bid of $94.5/MWh for Dubai's solar-tower project has shown that with just 5 GW of global installed capacity, CSP's cost has gone down by more than half since 2012. In comparison, the cost of PV power has fallen to around $50/MWh, but only after global installed capacity surpassed 300 GW.

Year	Global installed CSP capacity
2012	2 GW
2013	3.8 GW
2014	4.5 GW
2015	4.7 GW
2016	4.9 GW
2017 (as of July)	5 GW
Source: CSP Today Global Tracker	

An even lower CSP tariff was made in Chile's power generation auction which was completed on August 17, 2016. SolarReserve had bid its Copiapo CSP project with a capacity of 240 MW and 14 hours of thermal energy storage at a record-low price of $63/MWh.

While no CSP projects were selected in this auction, in which developers could bid all types of power generation, the technology demonstrated its competitiveness against fossil fuels, Kevin Smith, CEO of SolarReserve, told New Energy Update. Many natural gas combined cycle projects in the tender were bid above $70/MWh, with some exceeding $80/MWh, he said.

Subsidy-free

In the Middle East and North Africa (MENA), Noor 1 with concessionary financing brought down CSP tariff to $189/MWh in 2012, whereas Noor II and Noor III reduced the cost further to $156/MWh and $163/MWh respectively in 2014.

Recently completed and upcoming CSP tower projects

Project title	TES capacity	TES medium	MWe	Status	$/MWh	Country
Khi Solar One	2 hrs	Steam	50	Operation	$268	South Africa
Ivanpah	none	-	377	Operation	$200	U.S.
Crescent Dunes	10 hrs	Molten Salt	110	Operation	$169	U.S.
Noor III	7.5 hrs	Molten Salt	150	Construction	$163	Morocco
DEWA CSP Project Phase I	8-12 hrs	-	200	Planning	$94.5 (bid)	UAE
Copiapo	14 hrs	Molten Salt	240	Planning	$63 (bid)	Chile
Source: CSP Today Global Tracker						

Today, and without subsidies, Dubai Electricity and Water Authority's project could enable CSP to reach a single-digit price. Unlike most operational CSP plants today, Dubai's solar-tower tender has no embedded subsidy and gives the private sector the freedom to innovate and optimise.

"The Dubai tender is very straightforward. It says give me solar power from 4pm to 10pm (throughout the night) at the lowest possible price for 25 years, and I will give you the land and nothing else. Thus, it's easy to see that the tariff is without other clutter such as peak premium and tax rebate," Paddy Padmanathan, president and CEO of ACWA Power told New Energy Update.

On the other hand, the Chilean tendered tariff of $63/MWh was based on a unique set of terms and conditions. One such condition was that the contract allows the supplier to purchase power from the grid, store and mix it with self-generated CSP and sell it.

"The tariff was therefore based on an operating model of power from CSP mixed with power purchase from the grid and sold at a presumably higher price during peaks. We do not know how much but it is a considerable proportion. So, this was not a clean CSP-generated electricity tariff," Padmanathan noted.

Nevertheless, Chile's solar resource is superior and if an adjustment was made only for that, a $94.5/MWh tariff in Dubai would plunge to below $70/MWh in Chile, according to Padmanathan. Direct Normal Irradiance (DNI) in Chile ranges from 3,000-3,800 kWh/m2/year, whereas in Dubai it hovers around 2,200 kWh/m2/year. This has a huge and direct influence on CSP capex.

"What is clear from all this is that electricity generated and dispatched on a flexible basis (following the load at any time of the day/night and not just when the sun is shining) with CSP plus molten salt storage is getting very close to being able to compete with combined cycle gas-fired electricity, much faster than the world was expecting, and is racing way ahead of PV + battery," Padmanathan said.

Scaling up

By the time Dubai's 200 MW CSP project comes online in April 2021, China should have 20 CSP projects operating with a cumulative installed capacity of 1,350 MW. The plants are part of the government's CSP pilot program and will each receive a 20-year feed-in-tariff of 1.15 Yuan/kWh ($170/MWh) if they connect to the grid by December 2018.

"It has been obvious for a long time that the demand for CSP was low because the costs were high, and the costs were high because demand was low. Something was needed to pull CSP out of this trap, by scaling up its use," Jonathan Walters, independent energy economist and former World Bank regional director in the MENA region told New Energy Update.

The record-low price in Dubai combined with China's plans to double global CSP capacity over the next four years, will help achieve those economies of scale and make the supply chain more industrial, Walters noted. "It may also diminish the faith that grid-scale lithium ion batteries will become economic in the foreseeable future. What's happening to CSP costs will soon be challenging the prevalence of gas-fired power," he said.

However, the CSP tariff proposed in Dubai might not be possible in the Chinese market today, according to Tao Ni Song, R&D engineer and business development manager at Shouhang European, the CSP R&D subsidiary of Beijing Shouhang IHW Resources Saving Technology Co.

"Dubai's tariff is quite aggressive for the CSP industry and cannot be compared with what we have in China, where the tariff is fixed for 20 years. DEWA's project is based on the Independent Power

Producer model which entails investment and operation of the plant for 25 years. The developer can gain money in different ways, which helps reduce the plant's final tariff," Ni Song explained.

Shouhang IHW is involved in several parabolic trough and solar tower projects in China as owner, developer and EPC contractor, and has participated in bidding for Dubai's project with Saudi Arabia's Alfanar.

"It's too early to say if we will be able to reduce the cost of CSP in China because the plants are still not operating. We need to complete the first round of demonstration plants and evaluate the results," Raúl Navío, chief technical officer at Shouhang European told New Energy Update.

Working with experienced foreign companies could help make the CSP pilot program a success. "It's not just a question of foreign companies entering China; Chinese firms must go out and be more proactive. They cannot just sit and wait for help; they have to get out and be open."

China already benefits from a comprehensive supply chain of CSP components. For instance, Shouhang IHW manufactures most of the CSP equipment for its plants with help from European engineers. That said, the group takes a neutral approach to sourcing components.

"If we find the same product on the market with the same quality at a lower price, we will switch to the other product. This approach has helped us do better than our competitors in China. We cannot do it alone. To lower the costs and construct feasible CSP plants, we have to work together, not just in China but internationally," Ni Song said.

New funding

The next stimulus for the industry might be the use of the Green Climate Fund (GCF) for CSP investments in regions such as MENA and sub-Saharan Africa. "That could make the apparent withdrawal of the US from the GCF look particularly short-sighted," Walters noted.

According to Stratos Tavoulareas, principal energy advisor at the International Finance Corporation (IFC), a World Bank Group member, the Clean Technology Fund (CTF) will stop accepting new applications at the end of this month and will be replaced by the GCF.

GCF is a financial mechanism under the UNFCCC which helps fund climate finance investment in low-emission, climate-resilient development. The fund launched its initial resource mobilization in 2014 and gathered pledges worth $10.3 billion as of June 2017.

Several financial institutions including the European Bank for Reconstruction and Development and Inter-American Development Bank have signed agreements with the GCF, and the IFC is in the final stages of signing this contract. The agreements will enable the banks to receive and use GCF capital and raise further funds from private sector investors.

"We hope that soon we will have financing available to projects. Our objective as IFC is to see CSP technology launched on fully commercial terms; concessional financing is not something we want to see forever. New technologies face many barriers so very often, preferential financing is important," Tavoulareas said.

IFC has supported numerous CSP projects mainly through the CTF. It provided stapled debt financing to ACWA Power's Noor 1, and has been involved in four projects in South Africa, three with Abengoa and one with ACWA Power and SolarReserve – Redstone - whose power purchase agreement has yet to be signed.

“We have shown commitment and interest in supporting CSP and we will continue to finance it in markets where it makes sense. The MENA region is where it makes more sense and we hope that after Dubai, we’ll see CSP developing in countries like Jordan and Egypt,” Tavoulareas highlighted.

“CSP is a very good fit for GCF because of project size,” he added. “Usually with small projects, transactions are difficult and costs are high. For the GCF, projects costing less than $30 million don’t make sense. Therefore, large CSP projects are quite suitable for GCF funding.”

By Heba Hashem