

In the race to achieve India's National Solar Mission (NSM) targets, one important solar technology is slowly disappearing. Concentrated Solar Power (CSP), a solar thermal-based technology for power generation, which showed considerable technical potential, is being sidelined. It is losing out due to economics compared to its rival, solar photovoltaics (PV).

The cost differential between a 5 MW CSP plant and PV plant of the same capacity is around Rs 55 crore. However, CSP's decline has been caused by multiple agents, and we try to shed some light on the key reasons.

This article also highlights the technical advantages of CSP over PV and the need for such a system to co-exist.

PV's cost advantage

Solar PV has been the most widely adopted technology in India to meet the NSM targets. According to the Ministry of New and Renewable Energy (MNRE), out of the 13.9 GW of installed solar capacity in India, PV's contribution is to the tune of 96.5%. The remaining 3.5% is contributed by CSP.

Currently, the cost of a PV system, per MW, is around Rs 4 crore, whereas for CSP it is still over Rs 15 crore, which is extremely high.

Due to a large reduction in the capital costs of PV, the cost of generation has also reduced (less than Rs 5 per kWh); it is competing well with conventional sources of power generation. This is mainly due to mass production of solar cells by China, along with innovative financing schemes.

India introduced NSM in three phases. Phase 1, which was from 2009 to 2013, gave equal weightage to CSP and PV in terms of installation targets. During this phase, the capital cost of PV systems was slightly higher than CSP. Post phase 1, PV costs have been declining, making CSP the more expensive option.

The cross-over in cost coincided with phase 2 of NSM in 2013, which is currently active and technology agnostic. Due to the low cost of PVs, investors started adopting it as the preferred technology.

This resulted in a cascading effect on PV costs, leading to a large disparity in price between CSP and PV over successive years. Hence, investors started preferring PV over CSP in Phase 2.

Advantages of CSP

Even though the price of PV-generated power is low, CSP has its own inherent advantages, such as a relatively firm power supply and poly-generation ability. Sharp fluctuations in power supply, which is seen in PV-based generation, is a problem for the power grid.

A CSP system is relatively free from the problem of intermittency because of the thermal characteristics of the system, which offsets the fluctuations in solar radiation.

Apart from generating electricity, a CSP plant can supply thermal energy, which can be used for process heating applications or powering thermal-based desalination plants (poly-generation).

The other distinct advantage of CSP is, when coupled with thermal energy storage, it is more cost effective compared to a PV with battery storage system.

This is because intermittency in solar radiation leads to frequent cycling of batteries. As a result, the batteries have to be regularly replaced, adding to the maintenance cost of a PV system.

To corroborate this point, let us consider a 100 MW CSP and PV plants with eight hours of thermal and battery storage respectively. Our analysis shows that the CSP plant can generate electricity at Rs 3.9–4.5/kWh, considering the interest rates offered in developed countries.

Whereas PV will be more expensive, at over Rs 10/kWh. Further, Mehos from National Renewable Energy Laboratory (NREL) has also indicated that CSP with over eight hours of storage may be cheaper than PV with equivalent storage.

Some of these advantages show that an investor should consider the long-term benefits of CSP systems in addition to the short-term implications, such as large capital investment.

Also, the capital costs of CSP can decrease to PV levels if mass production of the various components is undertaken through technology transfers from countries such as Germany and Spain.

This can happen when largescale CSP plants, as well as manufacturing units, are set-up in large numbers, leading to huge components demand. By taking an unbiased view on investment and installation of CSP systems, India can save the CSP technology from dying a slow death and possibly awaken a giant.