

Abstract

An attempt toward a techno-economic assessment of concentrating solar power (CSP) plants in India has been made in the present study so as to facilitate a comparison with other renewable (solar PV and onshore wind) and fossil fuels based electricity generation. Feasibility assessment of wet cooling at potential locations for CSP plants in India has been made and the impact of the other condenser cooling options (dry and hybrid) on the levelized cost of electricity (LCOE) has been studied. Using an inventory of materials based approach, the capital costs of CSP plants have been estimated and the same have been used to estimate the LCOE for CSP plants in India while taking into account the effect of location, nominal capacity of the CSP plants as well as capacity (hours) of thermal energy storage. A preliminary attempt has also been made to assess the potential of capital cost reduction with indigenization and adoption of emerging technologies. The extent of some of potential incentives such as viability gap funding, interest subsidy, generation-based incentives, investment/production tax credit, etc. required for the LCOE to match with average power purchase cost (APPC) of the utilities has also been estimated. Since CSP plants with thermal energy storage (TES) can deliver electricity during peak demand periods, the break-even value of time-of-delivery tariff for the electricity delivered has also been estimated.

Results obtained show that only 28 (out of a total 95) locations in India with potential for CSP generation are suitable for wet-cooled CSP plants (while harvesting both rainwater and groundwater). Compared to PTSC (wet/dry), the CTR based plants with the provision of TES can deliver electricity at relatively lower LCOE. With the adoption of emerging CSP technologies and indigenization of some of the components, there is potential for reduction in LCOE up to 40.3%. The extent of incentivization (even with combination of two/three incentives) required to achieve APPC is found to be very large in many cases. With increasing APPC for electricity distribution utilities, a provision of levying time-of-delivery tariffs for electricity delivered by CSP plant with the provision of TES is likely to improve

the financial attractiveness considerably. From the analysis and results presented in the thesis it is possible to identify locations in India where wet cooling of condenser in CSP plants is feasible. It is also noted that even with indigenization and adoption of emerging CSP technologies the LCOE is likely to be significantly higher than the average power purchase cost of distribution utilities and thus, suitable incentivization measures would be required in the initial phase. Appropriate time-of-use pricing of electricity delivered by the CSP plants with thermal storage would be directly relevant in this regard.