Abstract

(Ph. D. Thesis Entitled “Techno-economics of Institutional Solar Cooking in India”)

A study aiming at a better understanding of some of the techno-economic aspects affecting the deployment of institutional solar cooking in India has been made. Design and performance characteristics of some commercially available solar cooking systems have been reviewed. Using the performance characteristics of solar cooking systems, solar resource availability, and cooking energy demand, an attempt has been made to estimate the potential of solar cooking for six institutional applications in India. A framework to evaluate the financial performance of institutional solar cooking systems has been developed. The measures of financial performance (such as net present value, discounted payback period, benefit to cost ratio, and internal rate of return) have been estimated using the framework. The framework has also been extended to estimate the required extent of some of the potential incentives (viability gap funding, accelerated depreciation, interest subsidy, and investment tax credits) to make institutional solar cooking systems financially competitive with the existing conventional cooking options. Results of the calculations for 33 different locations spread across the country (capital city of each state/union territories) have been presented. Techno-economics of a potential approach of providing solar pre-heated water to institutional cooking applications with the use of mature solar collector technologies has also been presented.

Results obtained indicate an annual potential of saving of 5475 TJ of useful energy required for cooking in the six institutional applications considered in this study, which is approximately 57% of their gross annual useful energy requirement for cooking. As expected, the financial performance of institutional solar cooking systems varies with location as well as with the design and performance characteristics of solar cooking technologies considered. While the direct types of solar cooking systems are not found to be financially attractive at all of the locations considered in this study, a provision of incentive(s) is likely to make them financially viable at some of the locations (especially in hot and dry climatic zones). As an example, provision of 8.7% of capital subsidy for SK-23 solar cooker would reduce its estimated discounted payback period from 19.2 years to 15 years at Jaipur. On the other hand, the indirect (steam based) institutional solar cooking systems are financially attractive with the current provisions of incentives at majority of the locations in India. As an example, the estimated values of discounted payback period for a large-sized (i.e. 1000 meals capacity) Scheffler dish based solar steam cooking systems are 8.0 and 9.5 years at Jaipur (hot and dry climatic zone) and Shimla (cold and cloudy climatic zone) respectively. The proposed approach of providing solar pre-heated water for institutional cooking applications is found financially attractive at all the locations even without any provision of incentive(s). From the perspective of the government, the provision of accelerated depreciation (AD) for incentivising deployment of solar cooking systems appears to be the least cost option.