

A.T.E. SOLAR CONCENTRATOR BRINGS CHEERS TO THE COMMUNITY KITCHEN AT NLC DAHANU, MAHARASHTRA

Dadasaheb J Shendage¹, M Girish², and Vishal R Sardeshpande³

Background

The Girivanasi Educational Trust (GVET) operates the Nareshwadi Learning Centre (NLC), an educational facility for children from underprivileged families of the Warli tribal community, at Dhundalwadi, Dahanu taluka (Maharashtra), about 130 km from Mumbai. The NLC campus hosts a primary school, a secondary school, a vocational education and training centre, general hostels for girls and boys, school health centre, school farm, and a dairy. Seven hundred and fifty students attend the school, of which 450 children use

the boarding facility available on campus.

The management at NLC shifted to wood as a fuel for cooking in 2012 to reduce their dependence and expenses on LPG. Picture 1 shows photographs of the existing practices at NLC. The school kitchen prepares 1,200 meals per day in total (750 for lunch and 450 for dinner). The management wanted to reduce their expenditure on wood and LPG (and reduce concerns about the fuel availability, transportation, and storage throughout the year). According to Dr Gokhale, CEO, NLC, the management also wished

to improve the working conditions for the women staff who operated the kitchen.

Challenges Faced

The management at Nareshwadi Learning Centre (NLC) sought a complete cooking solution to cater to its requirement of 1,200 meals per day, throughout the year. Power supply to NLC was inconsistent with significant periods of low voltage that prohibited the use of an electric boiler. The tribal women, who operated the existing kitchen, would be responsible for operating the new kitchen too. The challenge faced was to customise the cooking solution within the existing infrastructure and resources with minimal disruption to the existing schedule.

CST Cooking Solution

The management at NLC invited A.T.E. to demonstrate their integrated solar-assisted steam cooking system. The A.T.E. team systematically addressed several requirements and offered a solution that integrated energy efficiency and renewable solar thermal energy. The CST-based steam cooking solution also include (i) A UPS backup system for the feed water pump and PLC operation;



Resident tribal school for 450 children



Abandoned LPG cooking practices



Wood-stove for cooking



Kitchen operated by 6-8 ladies

Picture 1: The tribal school at NLC, Dahanu, and examples of cooking practices in their kitchen

¹ Senior Manager, Energy Efficiency Solutions, A.T.E. Enterprises Private Limited, Pune; Email: atesolar@ateindia.com

² Senior Manager, Energy Efficiency Solutions, A.T.E. Enterprises Private Limited, Pune; Email: atesolar@ateindia.com

³ General Manager, Energy Efficiency Solutions, A.T.E. Enterprises Private Limited, Pune; Email: atesolar@ateindia.com

(ii) Simple-to-use water filter assembly; (iii) Insulated hot water storage system; and (iv) A wood-fired boiler for operation during monsoon period. The PLC interface was re-designed to improve user accessibility and the women staff in the kitchen were trained to operate the solar concentrator. Picture 2 shows photographs of the modified practices at NLC. Figure 1 is the schematic of the steam-based cooking system eventually implemented.

The requirement mainly comprises boiling loads with 105 kg rice (on dry basis), 24 kg lentils (on dry basis), and about 33 kg vegetables. The staff has found that the steam-

based system cooks food faster and has reduced the total cooking time by about 40 per cent from about 9 hours/day to about 5.5 hours/day. The cooking periods are usually



Performance

A.T.E. commissioned and handed-over the solar steam-based cooking system at the Nareshwadi Learning Centre in September 2014. NLC uses A.T.E. Solar’s integrated steam-based cooking solution to cook 1,200 meals/day—750 students at lunch (12:30–1:30 p.m.) and 450 students at dinner (6:45–7:30 p.m.).

Picture 2: Concentrated solar thermal-based steam cooking system implemented by A.T.E. Enterprises Private Limited at NLC Dahanu

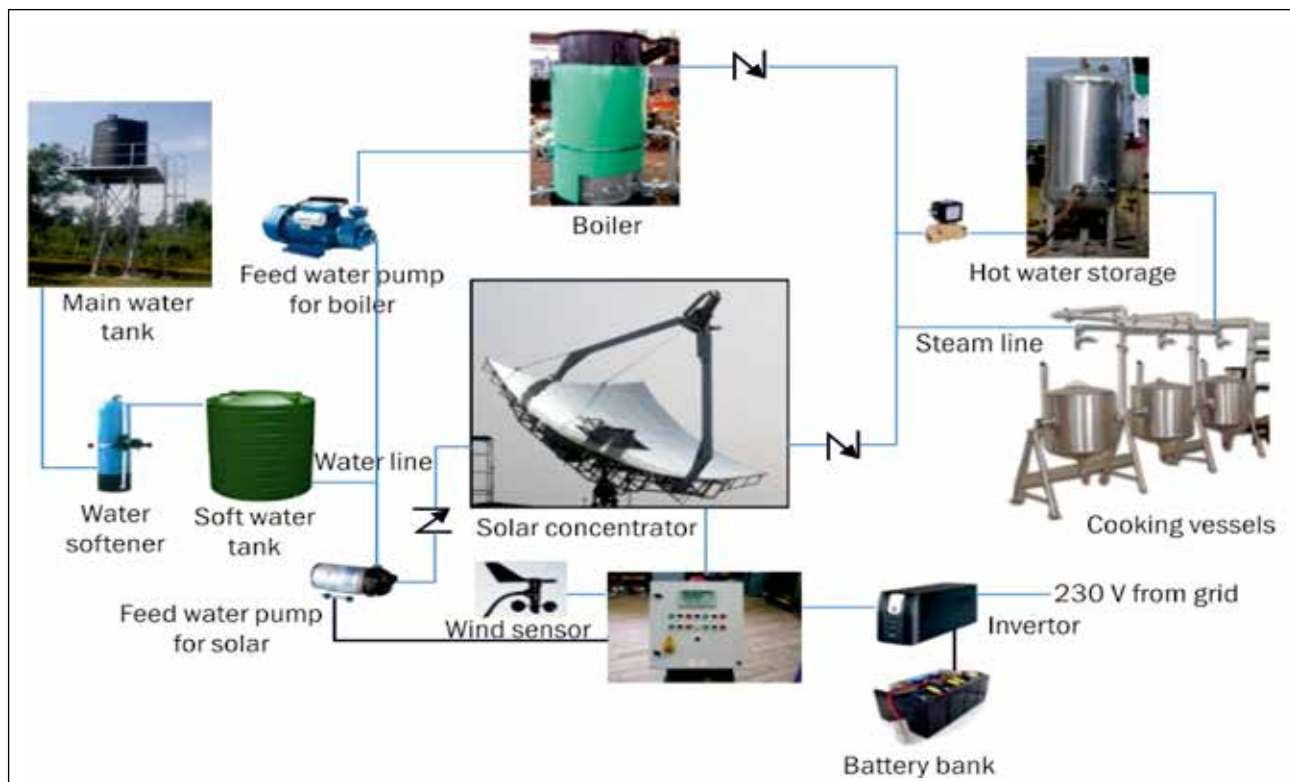


Figure 1: Schematic of the steam-based cooking system installed by A.T.E. Enterprises Private Limited at Nareshwadi Learning Centre, Dahanu.

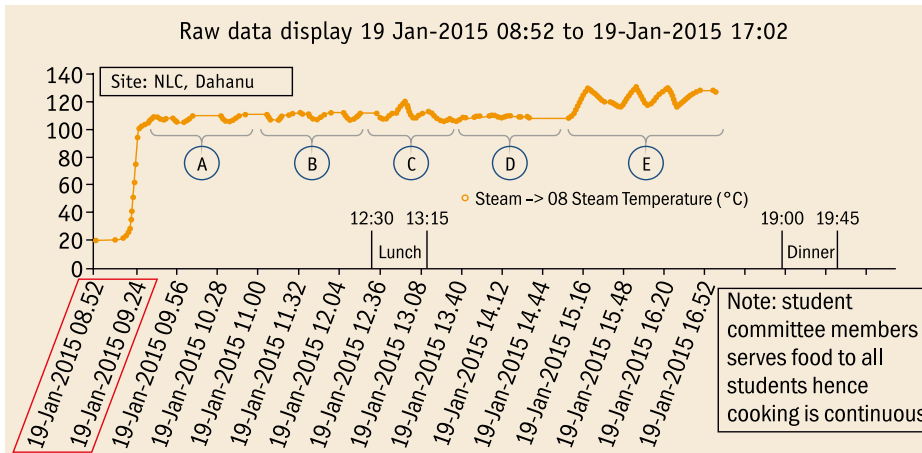


Figure 2: Variation in temperature of steam produced by the solar concentrator on a typical day (using remote monitoring data). A.T.E.'s innovative two-axis tracking system enables the concentrator to generate steam quickly on start-up. A–D denote the time intervals during which different food items are cooked. During period E, steam is not used for cooking, and is used to generate hot water that is stored.

Table 1: Details of the solar steam-based cooking installation at Nareshwadi Learning Centre, Dahanu

Customer	Girivanvasi Educational Trust (GVET), Dahanu, Maharashtra
Requirement	Cooking of 1200 meals per day
Thermal requirements Hot water @ 60 °C Steam @ 2 bar	180 litres 100 kg
Fuel consumption	200 – 250 kg of wood/day
Solution provider	A.T.E. Enterprises Private Limited, Pune
Month and year of commissioning	September 2014
Solution provided	Steam and hot water generation using CST technology based dual axis tracking paraboloid solar concentrator – 25 m ²
Steam output	100 kg/day
Conventional system	Open flame cooking on wood fired stoves
Savings	200–250 kg wood/day
Average operation /day	6-8 hours
Daily heat delivery of installation	60,000 kcal/day
Payback period	4 years

between 9 a.m.–12:00 noon and 2:30–4 p.m., but can also be continuous. Figure 2 illustrates the performance of the solar concentrator in terms of steam temperature during a typical day. During the non-cooking periods, the produced steam is sparged into insulated, non-pressurized storage tanks to generate hot water that may be used for cleaning and soaking.

NLC operates the solar steam-based cooking system for about 260 days/year. The wood saved by operating the solar concentrator is about 220 kg/day. Thus, the solar steam-based cooking system saves about 57 tonnes of wood annually. (Assuming previous kitchen was operated on very low efficiency i.e. 10 per cent).

Feedback from the User

In the words of Dr Patricia Gokhale, CEO, NLC, Dahanu, “A.T.E. Solar’s steam-based cooking solution reduced wood consumption notably and provided smoke-free environment to the cooking staff without reshuffling of food serving timings. It has improved the hygiene level during cooking. It has reduced drudgery, manual effort, time, and energy required during the cooking process.” 🌞

a quarterly magazine on **concentrated solar heat**

SUN FOCUS

CST Case Studies

Volume 3
Issue 4
April–June 2016



UNDP–GEF CSH Project
Ministry of New and Renewable Energy
Government of India