



Solar Thermal Solutions for Textile Sector



1. Industry Overview

Textile manufacturing has substantial thermal-energy requirements in wet processing and finishing. Important heat-consuming operations include desizing, scouring, bleaching, dyeing, washing, drying, finishing, steam ironing and hot-water generation. Thermal energy is commonly supplied by coal, biomass, natural gas, furnace oil, LPG or electricity, depending on the process and location.

Solar Heat for Industrial Processes (SHIP) can provide a portion of this demand. Solar heat can be integrated directly into process equipment, through hot-water systems, as boiler-feedwater preheating, through thermal-oil circuits or through solar steam generation. MNRE identifies textiles among Indian industrial sectors with good potential for CST deployment.

2. Typical Thermal Applications

Table 1: Textile sector applications, indicative temperature range and typical heat medium

Textile application	Indicative temperature	Typical heat medium
Washing / rinsing	40 - 90°C	Hot water
Scouring / desizing	70 - 100°C	Hot water / steam
Bleaching	80 - 110°C	Hot water / steam
Dyeing	80 - 140°C	Hot water / steam
Drying	80 - 160°C	Hot air / steam / thermal oil
Finishing	80 - 180°C	Hot air / thermal oil / steam
Steam ironing / pressing	120 - 180°C	Steam
Boiler feedwater preheating	60 - 120°C	Hot water / suitable HTF

3. Solar Thermal Technology Options

The appropriate technology should be selected based on required process temperature, heat-load profile, available area, solar resource and integration point.

Table 2: Solar thermal technology options, indicative applications and temperature range

Solar thermal technology		Indicative application	Temperature range
Non-concentrating solar thermal	Flat Plate Collector (FPC)	Low-temperature washing and hot water	30 - 80°C
	Evacuated Tube Collector (ETC)	Hot water, washing and preheating	40 - 100°C
Non-imaging concentrating	CPC/evacuated-tube CPC/xCPC	Low/medium-temperature hot water and process heat	60 - 120°C
Concentrating Solar Thermal	Scheffler / parabolic dish	Steam, washing, ironing and process heating	100 - 250°C
	Parabolic Trough Collector (PTC)	Medium-temperature process heat, thermal oil and steam	100 - 250°C
	Linear Fresnel Reflector (LFR)	Steam and medium-temperature process heat	100 - 250°C
	Higher-temperature CST systems	Selected specialised finishing/drying applications	Up to 400°C

Thermal storage can improve the utilisation of solar heat where the solar resource and process demand do not coincide. For textile processing applications below 120°C, hot-water storage can be a relatively simple option.

Potential storage options include:

- Hot-water tank: Low-temperature processes
- Pressurised water: Processes above 100°C
- Thermal-oil storage: Medium-temperature applications
- Phase-change materials: Specific temperature ranges
- Molten salt: Higher-temperature applications

4. How Solar Heat Can Be Integrated

A key principle in industrial solar thermal design is to identify the most technically and economically suitable integration point rather than simply connecting the solar field to the main boiler. IEA SHC specifically highlights process integration and selection of the appropriate integration concept as a critical part of SHIP project design.

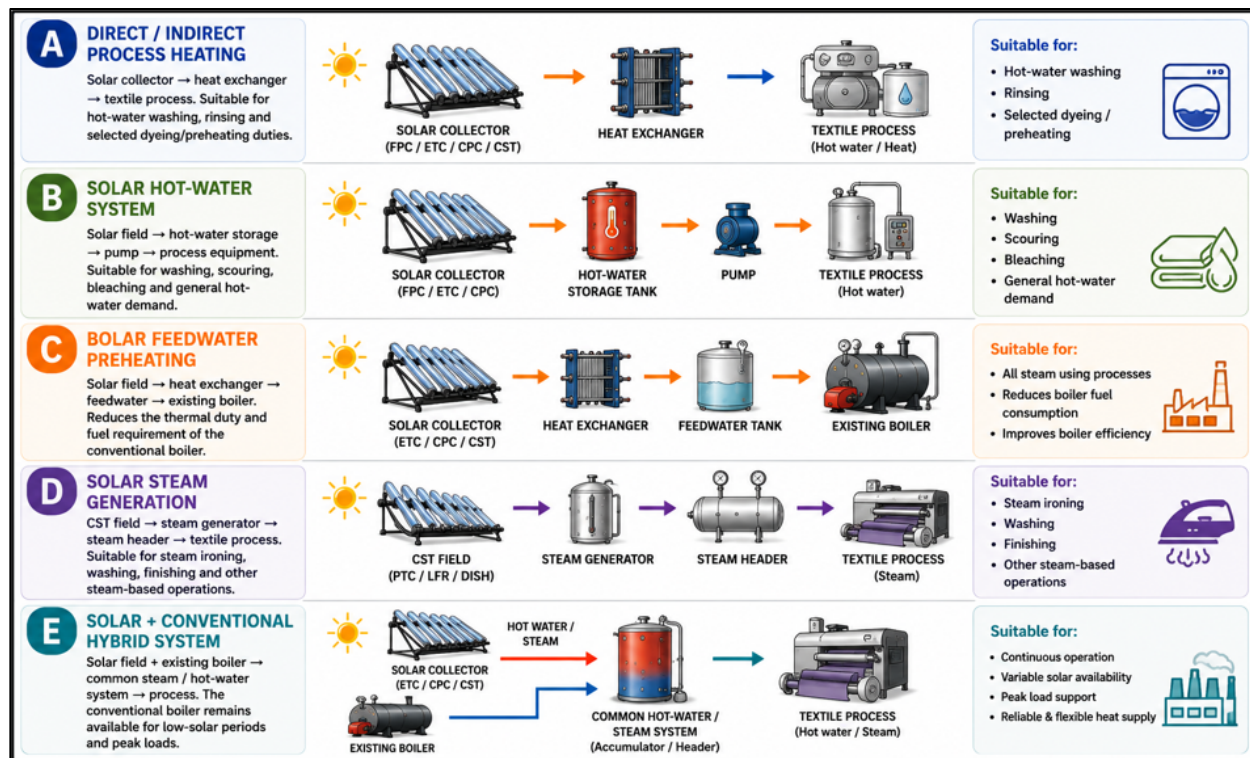


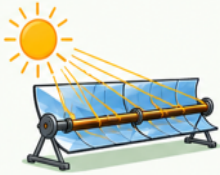
Figure 1: Illustration of solar heat integration to textile industries

5. Key Benefits for Textile Processing MSMEs

Solar thermal systems can potentially supply a significant share of suitable textile process-heat demand where solar resource, process temperature, operating schedule and collector area are well matched. As a preliminary screening range, a solar contribution of approximately 20–50% of suitable process heat may be considered; actual solar fraction and fuel displacement should be established through project-specific hourly heat-load and solar-yield analysis. Key economic indicators include annual solar heat delivered, fuel displaced, annual cost savings, O&M costs, LCOH, NPV, IRR and payback period.

Table below presents key benefits for textile sector MSMEs.

Table 3: Key benefits for textile sector MSMEs

 ENERGY	 Reduces consumption of biomass, LPG, diesel, furnace oil or natural gas.  Reduces boiler fuel requirement.  Provides renewable thermal energy for daytime production.
 ECONOMIC	 Reduces exposure to fuel-price fluctuations.  Can reduce long-term thermal-energy costs.  Can extend the useful role of existing boiler infrastructure.
 ENVIRONMENTAL	 Reduces fossil-fuel consumption and associated GHG emissions.  Can reduce local air-pollutant emissions where fossil or poorly controlled biomass combustion is displaced.
 OPERATIONAL	 Can be integrated with existing boilers.  Thermal storage can improve solar utilisation.  Hybrid operation maintains process reliability.

6. Indian Case Example

Navkar Textiles, Jodhpur, Rajasthan, installed a Scheffler-dish CST system for steam used in cloth washing/cleaning and related processing. It is a useful example of solar heat integrated with an existing textile utility operation. The 2016 UNDP/MNRE Sun Focus case study reports these project parameters and states that solar concentrators were intended to avoid firewood use for cloth washing/cleaning. The reported fuel and economic figures should be treated as project-reported values rather than generic benchmarks.

Parameter	Reported project information
Project	Scheffler-dish CST system at Navkar Textiles
Location	Jodhpur, Rajasthan
Industry	Textile processing
Year of installation	2016
Technology	Scheffler parabolic-dish concentrators
Number of dishes	12
Aperture area	16 m ² per dish; total 192 m ²
Steam delivery	~150°C and ~3 bar
Application	Steam washing/cleaning and textile processing
Pre-solar fuel	Firewood
Reported annual firewood use before solar	~660 tonnes/year
Reported annual firewood cost before solar	INR ₹2.6 million/year

Parameter	Reported project information
Reported solar-system cost	INR ₹3.6 million
UNDP support	INR 0.518 million
Fuel saving	660 tonnes of firewood per year
CO₂ emission avoided	1153 tCO ₂ /year (considering IPCC default emission factor of 112 kg CO ₂ /GJ and net calorific value 15.6 GJ/tonne for wood)

7. Sources and References

- 1) MNRE, Concentrated Solar Thermal – CST for Heat Generation.
- 2) UNDP/MNRE Sun Focus, October–December 2016, 'CST Plant for Cloth Processing at Navkar Textiles'.
- 3) MRS Energy & Sustainability review, 2016 — Purple Creations, Maharashtra.
- 4) IEA SHC Task 49 / Task 64 resources on Solar Heat for Industrial Processes (SHIP).