



Solar Thermal Solutions for FMCG Sector



1. Industry Overview

Fast-moving consumer goods (FMCG) manufacturing includes food and beverages, personal care, home care, packaged consumer products and associated packaging operations. Many plants have recurring thermal loads for process water, cleaning-in-place (CIP), washing, pasteurisation, cooking, blanching, sterilisation, drying, evaporation, hot-air generation and boiler services. Thermal energy may be supplied by natural gas, LPG, diesel, furnace oil, biomass, electricity or steam.

Solar Heat for Industrial Processes (SHIP) can provide a portion of suitable low- and medium-temperature demand. The FMCG sector uses the same SHIP framework which include direct process integration, hot-water systems, boiler-feedwater preheating, thermal-oil circuits and solar steam generation. Actual suitability depends on process temperature, load profile, solar resource, available area and integration constraints.

2. Typical Thermal Applications

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

FMCG application	Indicative temperature	Typical heat medium
CIP / cleaning / sanitation	50–90°C	Hot water / steam
Bottle / container washing	50–90°C	Hot water / steam
Food washing / blanching	60–100°C	Hot water / steam
Pasteurisation / product preheating	60–100°C	Hot water / steam
Cooking / process heating	80–150°C	Hot water / steam / HTF
Sterilisation / retort support	100–140°C	Steam / pressurised water
Drying / hot-air generation	80–180°C	Hot air / steam / thermal oil
Evaporation / concentration	80–150°C	Steam / HTF
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 hot water, washing and cleaning	30 - 80°C
	Evacuated Tube Collector (ETC)	Hot water, CIP and preheating	40 - 100°C
Non-imaging concentrating	CPC/evacuated-tube CPC/xCPC	Low/medium-temperature process heat	60 - 120°C
Concentrating Solar Thermal	Scheffler / parabolic dish	Steam, cooking and selected process heating	100 - 250°C
	Parabolic Trough Collector (PTC)	Thermal oil, steam and medium-temperature heat	100 - 250°C
	Linear Fresnel Reflector (LFR)	Steam and medium-temperature process heat	100 - 250°C
	Higher-temperature CST systems	Selected specialised drying/process duties	Up to 400°C

Thermal storage can improve the utilisation of solar heat where the solar resource and process demand do not coincide.

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.

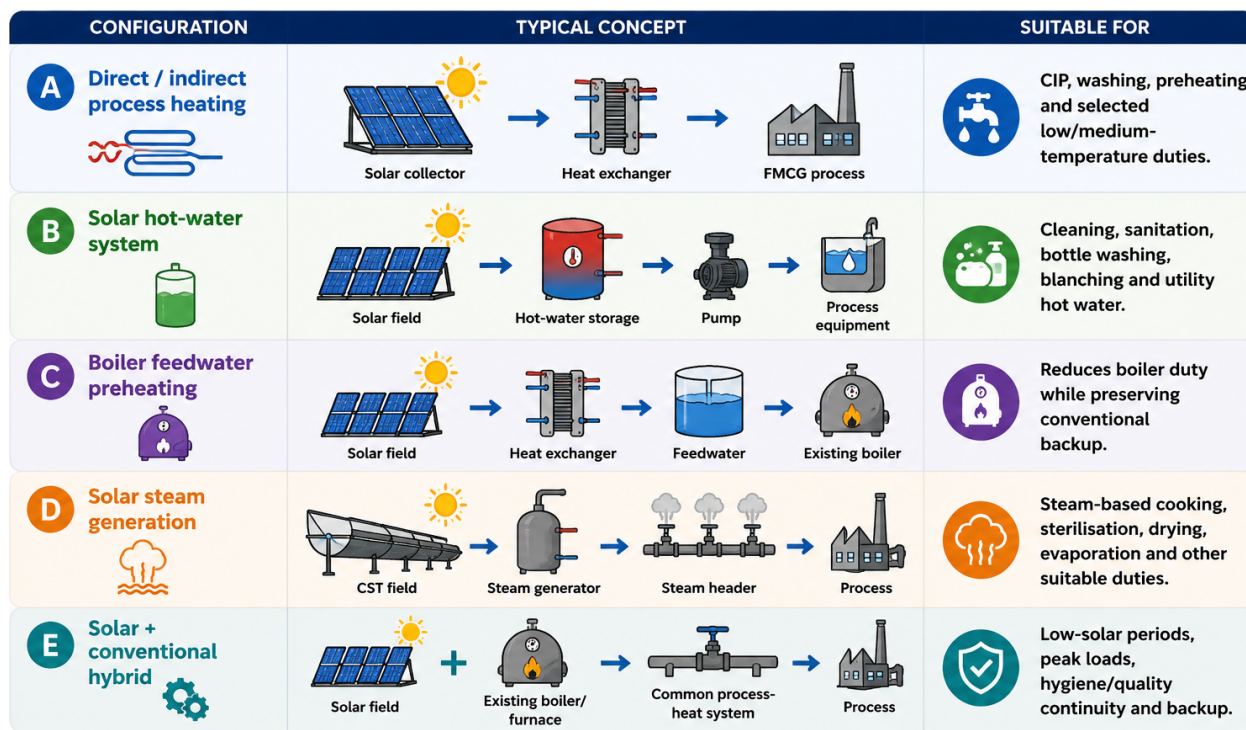


Figure 1: Illustration of solar heat integration to FMCG industries

5. Key Benefits for FMCG MSMEs

As a preliminary screening range, a solar contribution of approximately 20–50% of suitable process heat may be considered where solar resource, process temperature, operating schedule and collector area are well matched. This is not a performance guarantee; 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 FMCG sector MSMEs.

Table 3: Key benefits for FMCG sector MSMEs

BENEFIT		KEY BENEFITS	
	ENERGY Use clean energy. Improve efficiency.	- Reduces consumption of natural gas, LPG, diesel, furnace oil, biomass or electricity for suitable thermal loads; - Reduces boiler duty and provides renewable daytime process heat.	 LESS FUEL LOWER BOILER DUTY RENEWABLE HEAT
	ECONOMIC Lower costs. Stronger business.	- Reduces exposure to fuel-price fluctuations; - Can reduce long-term thermal-energy costs and specific energy consumption.	 LOWER COSTS BETTER SAVINGS MORE COMPETITIVE
	ENVIRONMENTAL Cleaner operations. Better planet.	- Reduces fossil-fuel use and associated GHG emissions; - Can reduce local air pollutants where combustion is displaced.	 LOWER EMISSIONS CLEANER AIR SUSTAINABLE FUTURE
	OPERATIONAL Flexible. Reliable.	- Can be integrated with existing boilers and process equipment; - Storage can improve utilisation; - Hybrid operation preserves reliability.	 EASY INTEGRATION BETTER UTILISATION RELIABLE OPERATIONS
	PRODUCT / QUALITY Consistent quality. Satisfied customers.	Controlled preheating can support stable process conditions while conventional heating remains available for final temperature lift and validated continuity.	 STABLE PROCESS CONSISTENT QUALITY HIGHER RELIABILITY

6. Indian Case Example

Hindustan Unilever's Kandla plant provides a relevant Indian FMCG example of solar thermal integration for process-water heating. A UNDP/MNRE Sun Focus case study reports that the plant replaced diesel-based process-water heating with a Compound Parabolic Concentrator (CPC) system. The system was designed to heat 20 kL of water during one shift, from about 30°C to 85°C, corresponding to approximately 11 lakh kcal of useful heat per shift.

Parameter	Reported project information
Company / sector	Hindustan Unilever Ltd. / FMCG
Location	Kandla, Gujarat
Solar technology	Compound Parabolic Concentrator (CPC)
Number of collectors	160
Total aperture area	480 m ²
Process-water demand	20 kL per shift
Water temperature rise	30°C → 85°C
Designed useful heat	≈11 lakh kcal per shift

Parameter	Reported project information
Primary solar circuit	Cold-water storage → pumping → CPC arrays → hot-water tank
Conventional system before solar	Diesel-based process-water heating
Reported project rationale	Reduce diesel use/cost and environmental impact
Reported project economics	Published case material states payback within 4 years; project-specific

7. Sources and References

- 1) IEA SHC Task 49 / Task 64 resources on Solar Heat for Industrial Processes (SHIP).
- 2) UNDP/MNRE, Sun Focus, July–September 2016, case study: Compound Parabolic Concentrators Used for Industrial Process Heating in Kandla.
- 3) Hindustan Unilever Annual Report 2016–17 — confirmation of solar thermal plants at Amli and Kandla for process-water heating.