



Solar Thermal Solutions for Plywood Sector



1. Industry Overview

Plywood manufacturing is a thermal-energy-intensive process involving veneer drying, wood seasoning, adhesive bonding and hot pressing. In Indian plywood clusters, steam boilers and thermic-fluid heaters are commonly used for drying, while hot presses require controlled heating for resin activation and bonding.

Solar Heat for Industrial Processes (SHIP) can therefore be applied most effectively as a preheating or hybrid source: solar air heating for seasoning/drying, solar hot water for selected utility duties, boiler-feedwater preheating, and CST/HTF systems for selected medium-temperature loads. MNRE notes that CST can decarbonize industrial process heat, although plywood is not specifically listed among the sectors in its current CST sector list; project suitability should therefore be assessed on the actual process heat requirement rather than sector label alone.

2. Typical Thermal Applications

Table 1: Plywood Industry applications, indicative temperature range and typical heat medium

Plywood industry application	Indicative temperature	Typical heat medium
Log / veneer preheating and conditioning	40–80°C	Hot air / hot water
Seasoning / timber drying	60–125°C	Hot air / steam
Veneer drying / stenter / impregnator	80–130°C	Hot air / steam
Glue / resin preparation and conditioning	30–80°C	Hot water
Hot pressing / bonding	107–165°C	Steam / thermal oil / hot plates
Laminating / overlay pressing	100–180°C	Thermal oil / steam / electric
Boiler feedwater preheating	60–120°C	Hot water / suitable HTF
Condensate / return-water preheating	50–120°C	Hot water / HTF

Table 2: Solar Heat opportunities in Plywood Industries

Process	Solar opportunity	Priority
Timber / veneer pre-drying	Solar air heater reduces moisture before conventional dryer	High
Seasoning chamber	Solar hot air or solar-heated water/air loop; hybrid operation	High
Veneer stenter / dryer	Solar air preheating or solar hot-water/steam support	High
Boiler feedwater	Solar heat exchanger upstream of boiler	High
Condensate return	Solar-assisted return-water preheating where appropriate	Medium
Glue / resin preparation	Low-temperature solar hot water	Medium
Hot pressing	CST/thermal-oil support at 107–165°C where stable load exists	Medium
Laminating / overlay pressing	Medium-temperature solar HTF support	Medium

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 3: 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 / conditioning	30 - 80°C
	Evacuated Tube Collector (ETC)	Hot water and preheating	40 - 100°C
Non-imaging concentrating	CPC/evacuated-tube CPC/xCPC	Veneer/wood pre-drying and seasoning-air preheating	60 - 120°C
Concentrating Solar Thermal	Scheffler / parabolic dish	Medium-temperature process water / air	100 - 250°C
	Parabolic Trough Collector (PTC)	Steam and selected process heat	100 - 250°C
	Linear Fresnel Reflector (LFR)	Thermal oil, hot press support and process heat	100 - 250°C
	Higher-temperature CST systems	Steam / medium-temperature process heat	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.

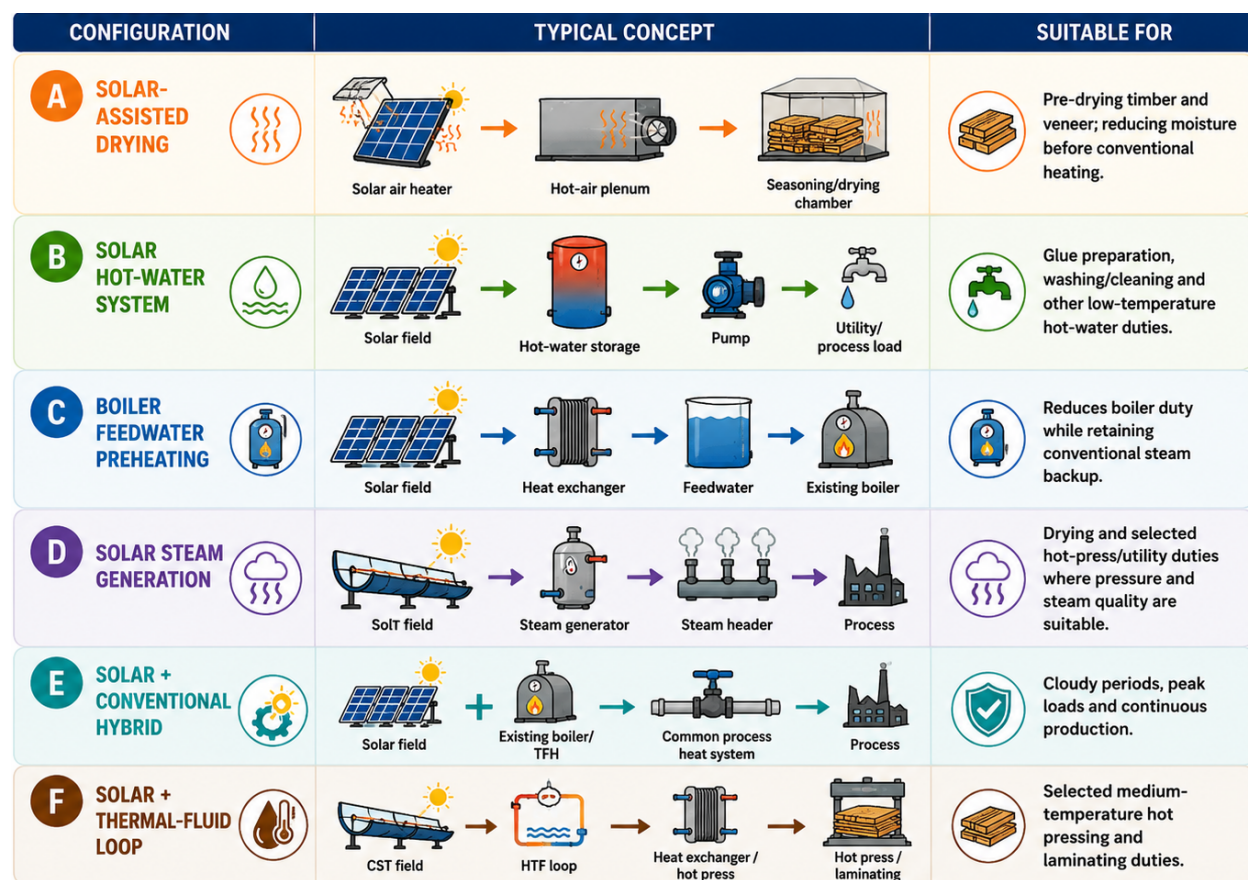


Figure 1: Illustration of solar heat integration to plywood industries

5. Key Benefits for Plywood MSMEs

Solar thermal systems can potentially supply a significant share of heat demand in plywood industries where solar resource, process temperature, operating schedule and collector area are well matched. For small plywood units, the most attractive initial application is normally solar-

assisted drying because the solar system can reduce the moisture load presented to the conventional dryer. TERI's Yamuna Nagar cluster assessment estimated that solar air heating could reduce wood-plank moisture from about 50% to 35% before conventional drying, with a reported annual sawdust saving of about 63 tonnes and monetary saving of about ₹1.27 lakh/year for a typical unit. These are historical cluster-specific estimates and should not be treated as current benchmarks. 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 plywood sector MSMEs.

Table 4: Key benefits for plywood sector MSMEs

BENEFIT	KEY BENEFITS		
 ENERGY Use clean energy. Improve efficiency.	Reduces conventional thermal duty for drying; reduces boiler/TFH loading; supplies renewable daytime process heat.		LESS FUEL USE LOWER BOILER/TFH DUTY 
 ECONOMIC Better savings. Stronger business.	Can reduce biomass/fuel consumption and drying-energy cost; can improve dryer utilisation and reduce drying time where solar preheating is well integrated.		LOWER ENERGY COSTS BETTER DRYER UTILISATION SHORTER DRYING TIME 
 ENVIRONMENTAL Cleaner operations. Better planet.	Reduces combustion demand and associated emissions; can reduce local pollutants where fuel-fired heat is displaced.		LOWER EMISSIONS CLEANER AIR SUSTAINABLE FUTURE 
 OPERATIONAL Flexible. Reliable.	Can be integrated upstream of existing dryers, boilers and TFHs; conventional equipment remains available for cloudy periods and peak loads.		EASY INTEGRATION RELIABLE BACKUP CONTINUOUS PRODUCTION 
 PRODUCT QUALITY Consistent quality. Satisfied customers.	Controlled pre-drying can improve moisture uniformity and reduce exposure to uncontrolled ambient drying; final moisture remains controlled by the conventional dryer.		BETTER MOISTURE UNIFORMITY HIGHER QUALITY CONSISTENT OUTPUT 

6. Indian Case Example

The Yamuna Nagar cluster is one of India's major plywood manufacturing centres. TERI's 2016 energy profile reported approximately 300 plywood units, 356 peeling units and 40 sawmills in the cluster, with plywood production estimated at about 3 million ft²/day. The study found that approximately 97% of unit-level energy consumption was thermal, supplied primarily by sawdust.

Parameter	Reported project information
Location	Yamuna Nagar, Haryana
Plywood units	~300
Typical plywood-unit production capacity	~10,000 ft ² /day
Typical plywood-unit sawdust use	~1,382 t/year

Parameter	Reported project information
Typical plywood-unit electricity use	~171,160 kWh/year
Typical total energy	~457 toe/year
Typical annual energy bill	~₹4.3 million/year (study-period value)
Drying load	Wood planks from ~50% moisture to ~3–5%; seasoning chamber heating about 5–6 days in the described practice
Hot press	~107–165°C; press time typically 2–7 min
Boiler	Common capacity ~3 tph; steam pressure ~100–130 psi; reported efficiency ~55%
Solar pre-drying opportunity	Flat-plate solar air heating; pre-moisture removal from ~50% to ~35%
Reported solar-drying saving	~63 t/year sawdust; ~₹1.27 lakh/year for a typical unit

7. Sources and References

- 1) IEA SHC Task 49 / Task 64 resources on Solar Heat for Industrial Processes (SHIP).
- 2) TERI (2016), Energy Profile: Yamuna Nagar Plywood Industry Cluster — process description, energy consumption and solar-drying opportunity.
- 3) MNRE, Concentrated Solar Thermal — overview of CST for industrial heat generation and current Indian CST technology categories.
- 4) Suresh, N.S. & Rao, B.S., 'Solar energy for process heating: A case study of select Indian industries', Journal of Cleaner Production — methodology for integrating solar thermal collectors for Indian industrial process heating in the 50–250°C range.