

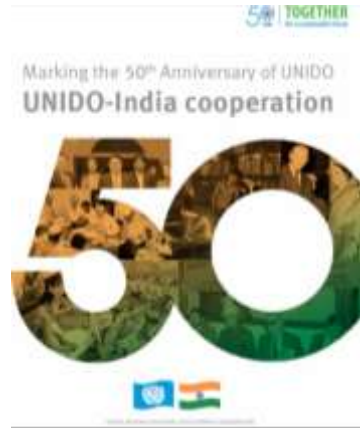


Concentrating Solar Thermal (CST) Technologies for Process Heat Applications in Industries

MNRE-GEF-UNIDO Project
Promoting business models for increasing penetration and
scaling up of solar energy

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UNIDO

UNIDO in India



➤ **Technical cooperation services since 1966**


➤ **2013-2017 Country Programme**

- Green industrial development
- Inclusive economic development
- South-South industrial cooperation
- Operationalized 24 projects with total budget of USD 87 million

➤ **2018-2022 Country Programming Framework**

- Productive and resilient MSMEs
- Solutions for climate, resources and environment
- Inclusive and responsible value chains and business
- Strategic policy for industrial transformation





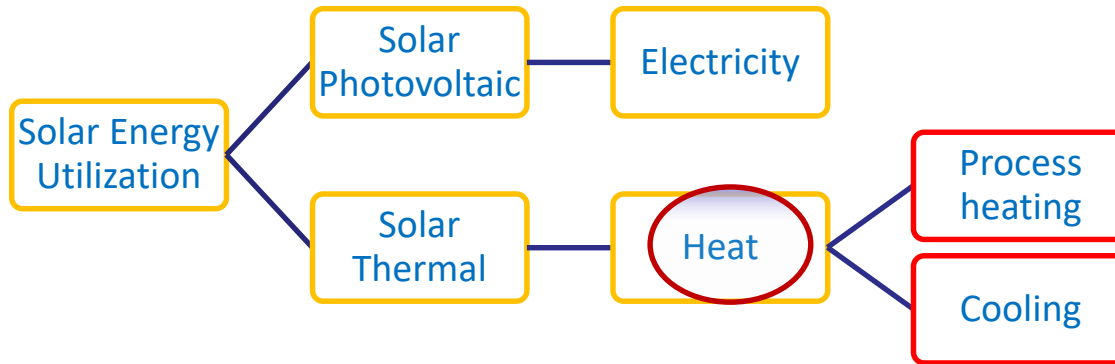
"It shall be the duty of every citizen of India to protect and improve the natural environment including forests, lakes, rivers and wild life and to have compassion for living creatures."

ARTICLE 51-A (G), Constitution of India

India on the move

- India is committed to invest in tackling climate change while addressing poverty, food security and access to healthcare and education.
- The country's action plan also prioritises efforts to build resilience to climate change impacts, and gives a broad indication of the amount of financing necessary to reach its goals.
- Committed to reduce its emissions intensity per unit GDP by 33 to 35 per cent below 2005 by 2030. Create an additional carbon sink of 2.5 to 3 billion tonnes of CO₂ through additional tree cover.
- India's NDC targets installing 175 gigawatts (GW) of renewable energy capacity by 2022. (100 GW has been allocated to solar and 60 GW to wind).
- With rising share of Renewable Energy & launch of Saubhagya Scheme to provide last mile connectivity to rural households – addition in transmission infrastructure becomes an imperative for the country.
- It has set a new target to increase its share of non-fossil fuel-based energy from 30% today to about 40% by 2030. Off-Grid solar power is growing at a fast pace in India. In the first half of 2018, India accounted for 44 per cent of global off-grid product sales, with sales of 1.3 million products.

Emerging Concentrating Solar Thermal Technologies (CSTs)



- Solar heat at medium & high temperatures uses concentrating solar collectors such as parabolic trough or dish collectors or a Linear Fresnel system.
- CSTs can concentrate solar radiation using mirrors/lenses to produce heat for various applications (up to 400 °C).
- Most of these devices need automatic tracking so as to focus Sun rays on to a receiver all the time.



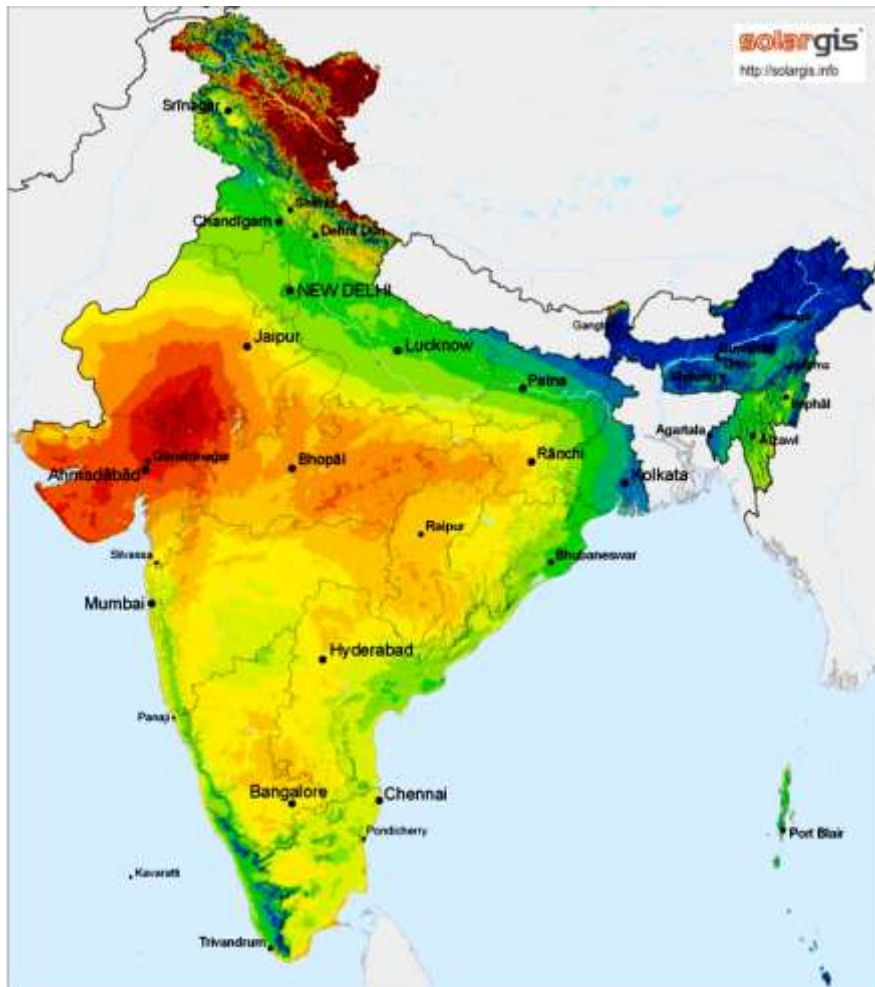
Fuels Saving using CST

100 m² CST system can save the following fuels per year ;



Note : Cost for 100 m² system is in the range of 15 – 25 lakh

Radiation Suitability for Concentrating Solar Thermal (CST) technologies



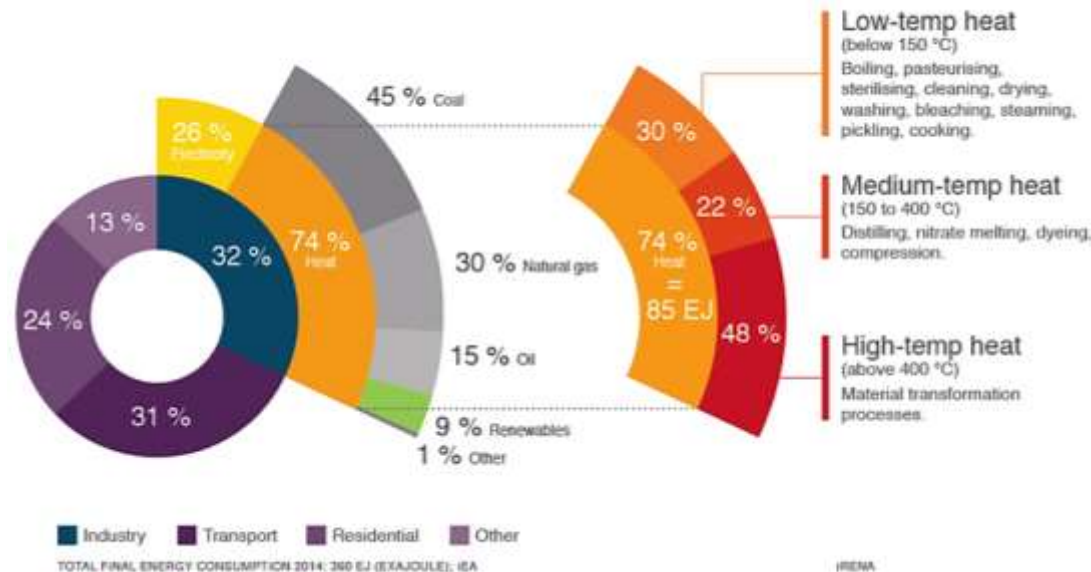
- ✓ India has good climatic conditions to operate CST systems in direct competition to fossil fuels.
- ✓ Large number of potential customers - industrial units in many sectors.
- ✓ Applications: Process heat and steam, cooling, water desalination, hybridisation with biomass or biogas, electricity generation.
- ✓ Key criteria for the economical usage of solar thermal booster is a solar radiation DNI >1700 kWh/m² and possibly the availability of flat land or roof area.

Average annual sum (2005-2010)



Background

- ✓ Industries use 32% of India's total energy consumption.
- ✓ A small part of energy demand is met by electricity, rest by coal, biomass, oil products and gas, indicating that a large amount of energy in the industrial sectors is used to provide thermal energy/heat.
- ✓ Industrial heat is characterized by a wide diversity with respect to temperature levels, pressures and production processes to meet the many different industrial process demands.
- ✓ Energy demand of the Industrial sector accounted for 42% of the imported crude oil in 2014-15 (189.43 mil. tonnes), out of which around 30 mil. tonnes provided thermal energy at temperatures below 250 °C.
- ✓ **Solar technologies can produce a range of temperatures, between 50°C and 400°C, which can be used in a variety of these thermal applications.**





**Chitle Dairy, Sangli
(338 m²; Milk Pasteurization)**



**Paraboloid Dishes at Synthokem
Pharmaceutical, Hyderabad
(540 m²; Process Heating)**



**Parabolic Trough Collectors
at Honeywell Technology
Solutions, Hyderabad
(820 m²; Cooling)**



**Non- imaging Collectors at
Neel Metal, Gurgaon
(612 m²; Process Heating)**

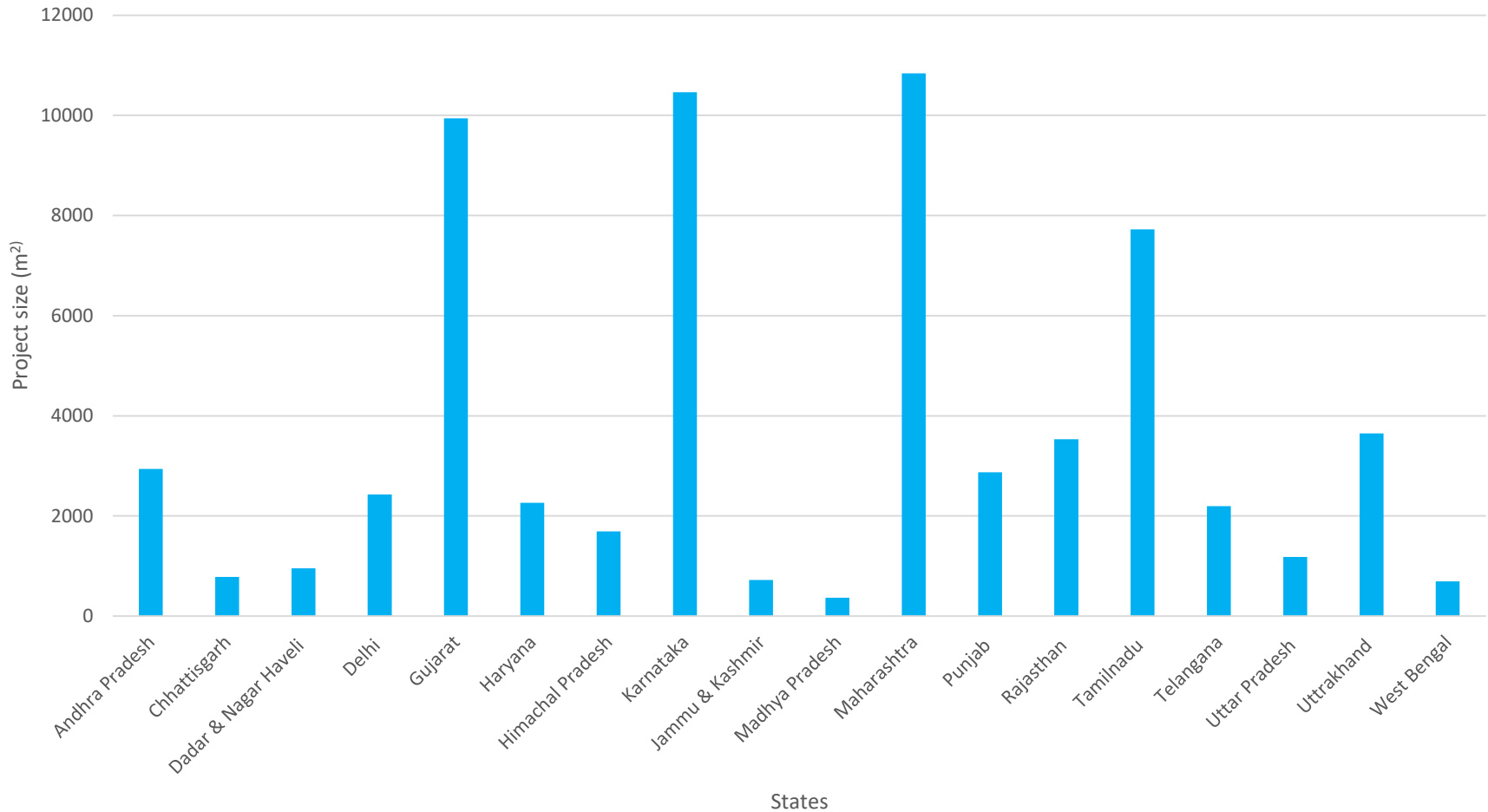


**Parabolic Trough Collectors
at Siddhartha Surgical, Vadodara
(263 m²; Process Heating)**

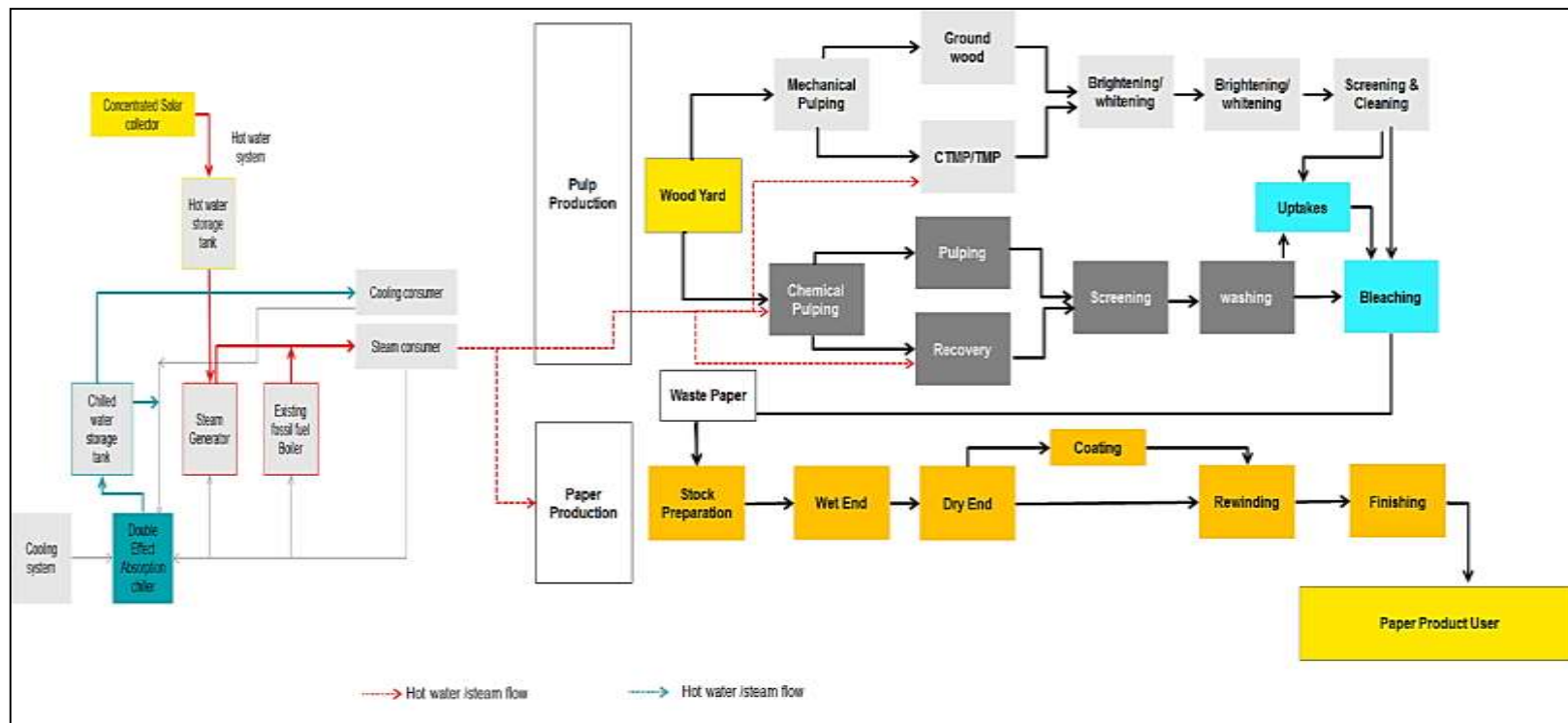


State –wise Installation of CST projects in India

(as on 31.12.2018)



Processes	Temperature(°C)	
Kraft Pulping (cooking temperature)	170 - 175°C	
pulping of rice straw, wheat straw, grasses jute sticks (Cooking temp)	135-140 C.	
Refining mechanical pulping CTMP (hard wood -chemical soak)	75-80°C	
Refining (thermo-mechanical pulping)	steam	110 - 20°C
	refining	100 -130°C
Recovery of Black liquor		
Conversion of calcium carbonate to calcium oxide	100 - 200°C	
Black liquor evaporation	150 - 250°C	
Causticizing	100°C	



CST System installed at BS Paper Mills Ludhiana



System Type

Scheffler Dishes (10 x 16 m²)

Year of Installation/ Supplier

2011/ Taylormade Solar Soltions Pvt. Ltd.

System Cost/ CFA

Rs 28.75 lakh. Rs 8.01 lakh

Operation & Savings

The system is used 8 hours per day, 300 days in a year to replace wood used in the boiler.

Operating temp.: 90 – 98 °C.

Stem generation: 10 kg/hr

About 70 kg of wood is saved per hour during the system operation.

IRR & Payback: 24.18%; 3 years 3 months

(15.16%; 5 years 3 months without subsidy)

National Scheme for CST

Off-Grid and Decentralized Solar Thermal Technologies for Community Cooking, Process Heat and Cooling Applications in Industrial, Institutional or a Commercial Establishments

Objectives

- To promote off-grid applications of Concentrating Solar Technology (CST) systems for meeting the targets set in the National Solar Mission.
- To provide support to CST manufacturers/suppliers and potential beneficiaries, within the framework of boundary conditions and in a flexible demand driven mode.
- To create awareness through capacity building and demonstrate effective and innovative use of CST systems.
- To create a paradigm shift needed for commoditization of off-grid decentralized solar thermal applications and create suitable business models.
- To reduce use of fossil fuels and thereby reducing GHG emission to the atmosphere.

Central Financial Assistance available for CST projects

Solar Collector Type	Benchmark Cost (INR per m ²)
Concentrator System with Manual tracking	7 000
Solar Collector Systems for Direct Heating & drying and Non imaging/ Compound Parabolic Concentrators (NIC/CPC)	12 000
CSTs with single axis tracking (including Scheffler Dishes)	15 000
CSTs with single axis tracking, Solar Grade Mirror/ Reflector & Evacuated tube collectors	18 000
CSTs with double axis tracking	20 000

- **20% of the bench mark cost or actual cost (whichever is less) to all beneficiaries in all states.**
- **40% of the bench mark cost or actual cost (whichever is less) to Non-profit making bodies and institutions in special category states, viz., NE states, Sikkim, J&K, Himachal Pradesh, Uttarakhand and islands.**
- **Accelerated depreciation (AD) benefits to profit making bodies.**

Innovations through the UNIDO Project

- ✓ Introduced the first ever dedicated loan scheme for CST – Promotes large-scale projects due to availability of funds.
- ✓ First project to support manufacturing in the CST sector.
- ✓ Promotion of system integrators for proper Integration of CST system with an existing industrial process and its optimization.
- ✓ Support to diversified application of CST in unexplored sectors such as Oil refining, Effluent treatment etc.
- ✓ Specialized Trainings –two-pronged approach for trainings in CST sector, one focused singularly on targeted design of CST systems for Indian conditions and one for installation, operation and maintenance of CST systems.
- ✓ On-going R&D work on thermal storage solutions.

Financing Arrangement under UNIDO project

- ✓ The beneficiary's or project developer's contribution would be 25%.
- ✓ Subsidy of 20% would be provided by MNRE.
- ✓ Bridge loan against subsidy and at normal interest rate would be available.
- ✓ Loan for the remaining amount would be provided at an interest subvention of 5%. The funds under the UNIDO project would be used for subvention of the interest rate.
- ✓ Support is available also for improving the manufacturing of CST system/components besides technical support.

Benefits of the Scheme

Soft Loan for the Project

- ✓ 75% of the project cost could be considered upfront for the provision of loan & bridge loan.

Single Window for Multiple Funding

- ✓ Both the loan and MNRE subsidy would be bundled in form a financial package by IREDA. One application is required for loan, subsidy and interest subvention under this scheme.

Simpler Processing and Documentation

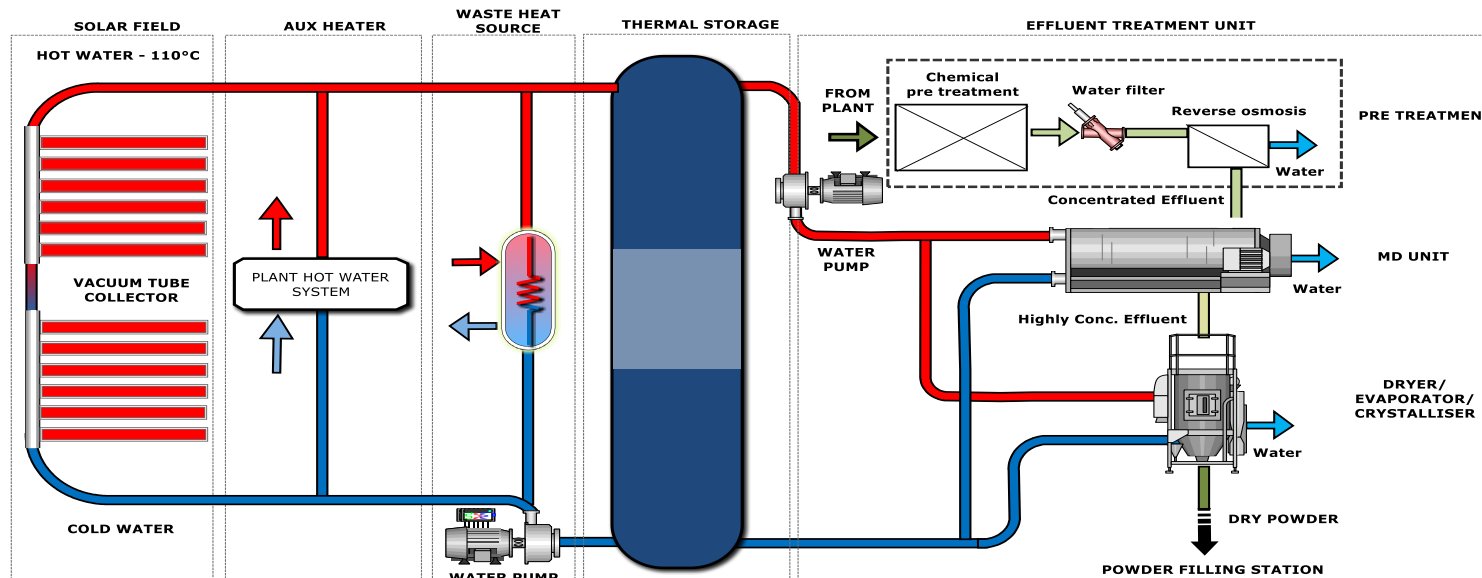
- ✓ Composite loan application form for Soft Loan and Bridge Loan.

Increased Availability of Finance and Faster Disbursal of subsidy

- ✓ Effective and fast method for lowering capital cost of project, and reducing the burden of working capital.

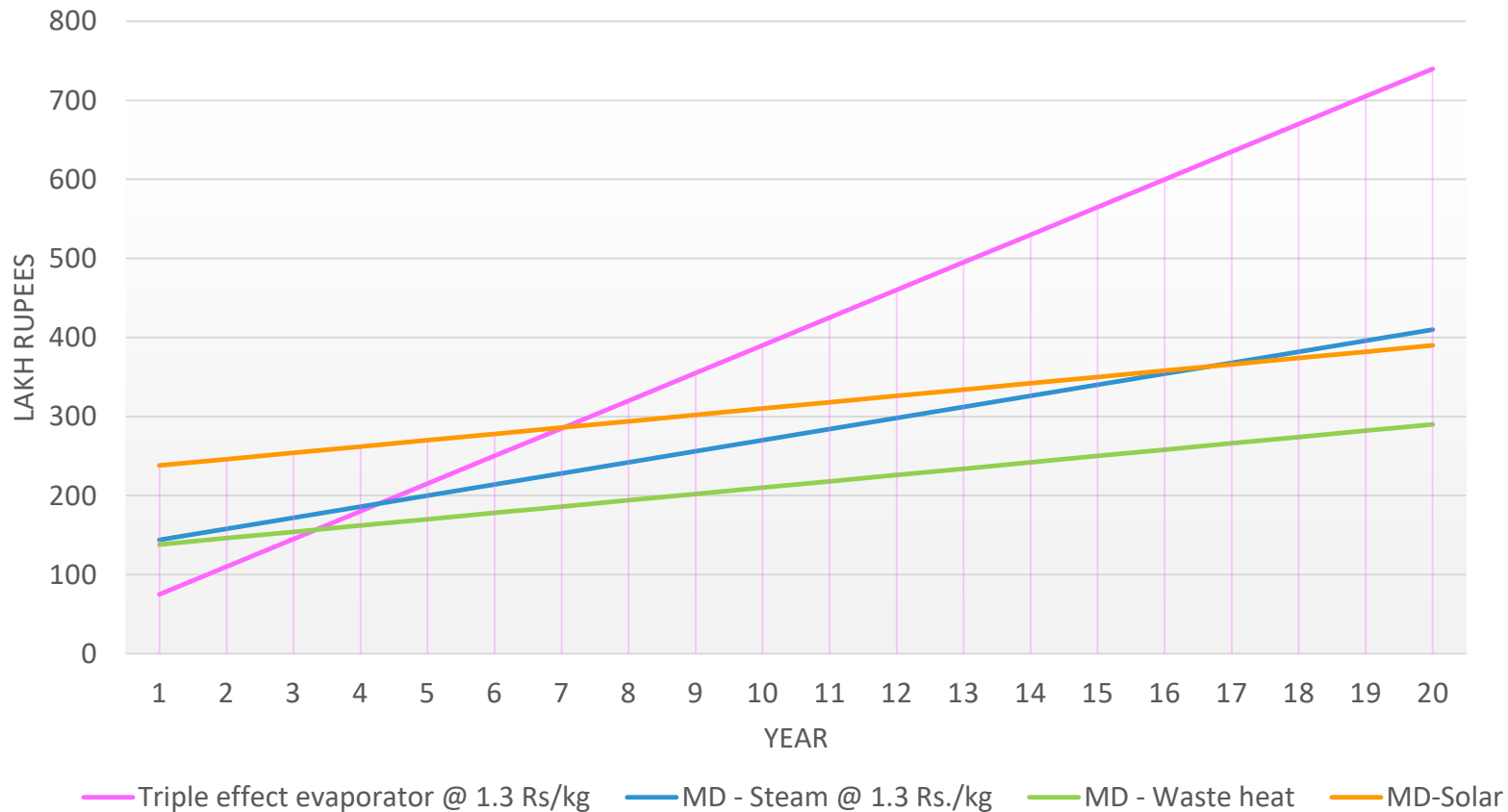
Solar Powered Zero Liquid Discharge (SPZLD)

- The system consists of a solar Compound Parabolic Concentrator (CPC) system which provides heat to power the concentrating and drying processes.
- Membrane Distillation (MD) system, is a thermal process that concentrates the effluent by removing and recovering distilled water.
- As the water recovered is effectively 100% pure it can be directly reused in the process. The remaining concentrate can then be routed to an evaporator system and be converted to a dry powder, resulting in Zero Liquid Discharge (ZLD) of waste.
- As the input feed effluent coming from different industrial processes vary, it first needs to be treated to make it ready for the SPZLD system, which is done by performing some pre treatment processes based on effluent composition.



Cost Comparison

Cost of ownership (excl. interest) 10 m³/day system over 20 years



Cost Comparison

Thank you !

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