

Technical Specifications

"Design, Fabrication, Erection and Commissioning of LFR Thermal Receiver System and Integration with Biomass Boiler, Steam Turbine cum Generator, Desalination Unit, Space Cooling and Cooking"

I. Project Information

This project is part of the prestigious initiative for development and setup of indigenous Solar thermal power and process plant at Pathashaala, Vallipuram Tamil Nadu. Setup of this indigenous Solar Thermal Power Plant would require design, development and supply of various CSP components.

This tender calls for selecting reputed Indian firms which have a proven track record in the design, engineering, fabrication, erection and commissioning of LFR solar thermal direct superheated steam generating system with the required auxiliary process equipment (pumps, valves, steam drum, pipes). The vendor should be capable of integrating all the major components and sub-systems with control systems for automated operation of the plant.

The vendor is expected to deliver the LFR evaporator and superheater with necessary auxiliary equipments.

II. Project Location

This project will be implemented at Pathashaala campus, The Chennai Education Centre, Pathasalai Street, Vallipuram, Thirukazhukundram Taluk, Kancheepuram District. Annual average DNI at the site can be considered as 4.33 kWh /m²/day. Latitude and longitude of the location are 12.57°N, and 79.98°E.



ALL DIMENSIONS ARE IN m

Figure 1: Aerial view of site for LFR and other components installed at the site

III. Intent of the Project:

The intent of the project is to generate electricity by driving a steam turbine using direct superheated steam from Linear Fresnel Reflector (LFR) based concentrated solar thermal technology. The waste heat from the turbine exhaust is utilised for various process heat applications to increase the thermal efficiency of the plant. A biomass fired boiler will be used as a backup for low or non-sunshine periods.

The major system components and their specifications are given in the following table.

Table 1: Major system components and their specifications

S. No	Description	Quantity	Unit
1	Direct superheated steam generating LFR Solar energy collector		
1.1	LFR Solar energy collector area	2156	m ²
1.2	Design Pressure	40	bar
1.3	Design Temperature	400	deg C
1.4	Design thermal power output corresponding to a DNI value of 800 W/m ²	700	kW _{th}
2	MCR of Steam turbine generator*	100	kWe
3	Biomass Boiler*	700	kW_{th}
4	Cooling system*	5	TR
5	Cooking system*	500	People / day
6	Desalination System*	5	m³/day
* These components are not in the scope of bidder All the technical parameters are indicative value, vendor has to design and specify in their offer.			

The process flow diagram of the proposed system is given below

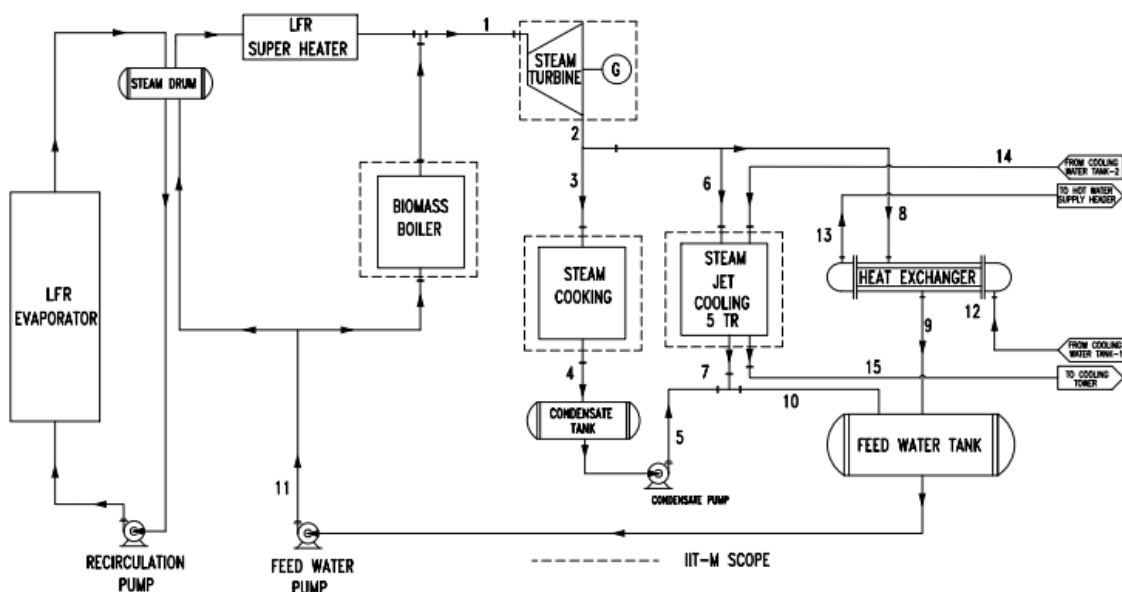


Figure 2: Indicative process flow diagram of LFR solar steam generating system and power block

Table2: Indicative process flow parameters

Stream Number	Pressure (bar-a)	Temperature (°C)	Maximum Flow (TPH)	Medium
1	40	400	1	Superheated steam
2	3	203	1	Superheated steam
3	3	203	0.742	Superheated steam
4	1	95	0.742	Condensate
5	1	95	0.742	Condensate
6	3	133	0.126	Saturated steam
7	1	60	0.126	Condensate
8	3	203	1	Superheated steam
9	1	95	1	Condensate
10	1	90	0.868	Condensate
11	45	90	1	DM Water
14	2.5	32	11.1	DM Water
15	1.5	40	11.1	DM Water

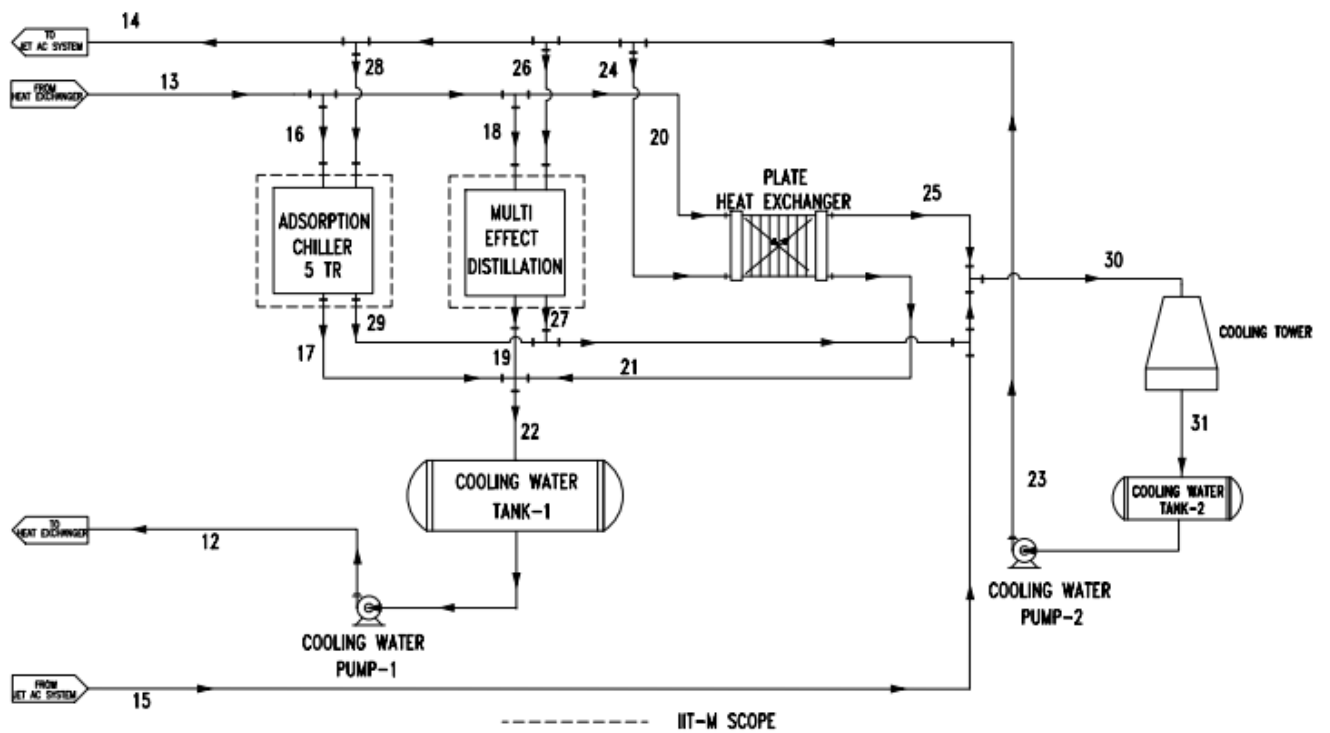


Figure 3: Indicative process flow diagram of cooling system ,desalination system and other auxiliaries

Table 3: Indicative process flow parameters

Stream ID	Pressure (bar-a)	Temperature (°C)	Maximum Flow (TPH)	Medium
12	3	74	37.9	DM Water
13	2.5	90	37.9	DM Water
16	2.5	90	5.58	DM Water
17	2	84	5.58	DM Water
18	1.5	90	1.94	DM Water
19	1	62	1.94	DM Water
20	1.5	90	30	DM Water
21	1	74	30	DM Water
22	1	74	37.9	DM Water
23	3	32	102	Raw Water
24	2.5	32	73	Raw Water
25	2	38	73	Raw Water
26	2	32	8.5	Raw Water
27	1.5	37	8.5	Raw Water
28	2	32	9.7	Raw Water
29	1.5	37	9.7	Raw Water
30	1.25	38	102	Raw Water
31	1	32	102	Raw Water

Note: Process parameters shown are indicative and bidder shall work out actual parameters prior to equipment design and parameters shall be finalized in consultation with IITM based on other integration equipment requirements.

IV. General Requirements for LFR System & Integration with other systems

a) LFR System:

- The collector area of the LFR including evaporator and super heater shall not be less than 2156 m². Evacuated absorber tubes for evaporator and super heater sections are under the scope of supply of the bidder. Primary mirrors for LFR system will be supplied by IITMadras.
- Primary mirror curvature and secondary reflector shall be optimized for maximum intercept factor.
- Design report for pressure vessels, general arrangement of LFR and accessories, IBR calculation report shall be submitted to IIT-Madras for approval prior to fabrication.
- Piping and other pressure parts required for commissioning of LFR system shall be designed per IBR standards and shall be IBR certified.
- LFR tracking system should be fully automatic.
- Bidder shall supply, erect and commission a PLC based Control & Instrumentation system for accessories and associated equipment.
- Expansion loops, condensate drain and steam trap have to be provided along the length for steam lines.

b) Integration with Sub systems:

- Bidder is responsible for design, erection of pipe lines connecting LFR and other subsystems. Bidder shall decide the location for LFR system and other sub systems based on site visit and interaction with other vendors/IIT-Madras.
- Bidder is responsible for installation of pipe supports, insulation and erection for pipe lines required for integration. The length and routing for external piping shall be decided by the bidder during site visit.
- Desalination system process flow pipe routing and external pipe routing for chilled water piping from cooling system to utility point, shall be decided during site visit.

c) Electrical, Control and Instrumentation

- Bidder shall supply, erect and commission a PLC based Control and electrical system with accessories, auxiliaries, associated equipment for safe, efficient and reliable operation of the plant. It shall also be responsibility of bidder to ensure the control system is capable to handle instruments and control elements required for automation of integrated operation of the system.
- Instruments for measuring temperature, pressure and mass flow rate should be provided at required locations as part of system integration. Level transmitter must be provided as required. Suitable valves and control valves must be installed.
- The goods supplied and works executed shall confirm to the standards mentioned in the technical specification.

V. Exclusions:

- Supply of solar grade primary mirror for LFR evaporator and super heater.
- Supply of steam turbine cum generator.
- Supply of biomass boiler, desalination system, chilled water cooling system.
- All statutory approvals and clearances except IBR.

VI. Inspection / Testing / Acceptance Tests

- IITM will provide technical guidance and direction for the LFR system in view of the research nature of the project and the pioneering efforts needed. The bidder should supply the drawings with supporting data and design calculations and obtain concurrence from IITM before fabricating the components so that IITM technical expertise will be reflected in the design and manufacture.
- IIT reserves the right to inspect, or to have their authorized representative inspect the project at any time during their construction, erection and commissioning to ensure their compliance with the specification.

VII. Drawing & Documents

The following set of documents shall be supplied along with equipment:

- Bought out items Data Sheets and Test certificates
- Raw material test certificate for metallic components
- As built drawings and overall General arrangement layout
- Handling procedures if applicable

VIII. Standards

- All the material and components shall comply with appropriate national and international standards.
- All pressure parts and external piping works shall conform to the latest editions of American National Standard Code for Pressure Piping, Power Piping, ANSI B 31.1, ANSI B16.11, and Pressure Vessel Codes and other applicable ASME, ANSI and state standards.