

Solex

1. Problem Statement

Construct an apparatus which uses only solar energy (possibly a solar concentrator, with a line focus or a point focus design) and performs the following tasks:

1. Heats flowing air of specific flow rate at atmospheric pressure to maximum possible temperature.
2. Heats flowing water to deliver maximum possible heat duty.

2. 1 Machine Specifications

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1. The apparatus should consist of a heat exchange unit (possibly as simple as a metallic tube) which allows both air (at atmospheric pressure) and water to flow through it and also allows heat exchange between the apparatus and flowing air or water.
2. It is suggested that the aperture area be within the range of 0.75 m^2 and 1.77 m^2 (Aperture area is as defined in 3.1.6).
3. A pipe of inner diameter 8mm and outer diameter 14mm will be provided at the venue for both water and air flow. The pipe provided will be approximately 1.5 m above the floor surface. It is advisable that participants use a flexible inlet pipe with appropriate dimensions to fit in the above mentioned pipe. Apparatus should be equipped with an outlet pipe so that flowing water can be collected in container kept on the ground.
4. Water should not accumulate or stagnate at any given instant inside the apparatus. Any apparatus found violating this rule will be disqualified.
5. It is recommended that apparatus should be equipped with a mechanism (manual or autonomous) which aids in setting up the apparatus to maximum possible exposure.
6. It should be noted that participants are not allowed to manually adjust their apparatus once the competition is declared to have started. However any autonomous system can continue to adjust the apparatus for maximum exposure.

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Apparatus will be judged on objective as well as subjective basis.

3.1 Judging Criteria

3.1 Objective Judging

Elimination Round

1. Ten teams will compete simultaneously in each elimination round.
2. Teams will be given a time of 30 minutes each for direct exposure to solar radiation.
3. Participants should adjust their apparatus so as to get maximum possible exposure. It should be noted that participants are not allowed to manually adjust their apparatus once start of the competition is declared.
4. At the end of 30 minutes, air of 100 liters per minute flow rate will be passed through the heat exchanger for 1 minute and the temperature of the air will be measured at the center of the outlet of the apparatus.
5. The teams will be ranked on the basis of **temperature reached of the air per unit aperture area per average direct insolation** of the device.
6. Direct insolation is the solar radiation that is transmitted directly through the atmosphere to the earth's surface without interacting with atmospheric components. It shall be calculated using an intensity meter.
7. Average Direct insolation shall be the mean of Direct insolation values calculated after every minute for the 30 minutes that each apparatus would be exposed to direct sunlight.
8. Aperture area is defined as the maximum projected area of the apparatus \square outermost dimensions in the direction of sun-rays at the time of competition.
9. **The teams will have to mention the aperture area of their apparatus in the abstract itself together with the process through which they have arrived at such a result.** The same would be checked by the organizers at the time of competition itself.
10. The top 10 teams from the elimination round will be chosen for the final round.

Final Round

1. This round measures heat duty per unit aperture area per average direct insolation of the apparatus.
2. Average Direct insolation shall be the mean of Direct insolation values calculated after every minute for the 20 minutes that each apparatus would be exposed to direct sunlight.
3. A pipe of inner diameter 8mm and outer diameter 14mm will be provided at the venue for both water and air flow. The pipe provided will be approximately 1.5 m above the floor surface. It is advisable that participants use a flexible inlet pipe with appropriate dimensions to fit in the above mentioned pipe. Apparatus should be equipped with an outlet pipe so that flowing water can be collected in container kept on the ground.
4. Teams have to focus their device to optimum solar exposure before start of the round. They are not allowed to make any adjustments once the start of the competition is declared.
5. A time period of 20 minutes will be provided for exposure to sun rays.
6. At the end of time period of 20 minutes participants need to open valve for water inlet and shall be given a maximum of 1 minute time to set the flow rate which they feel is optimum for their apparatus. Note that participants are not allowed to readjust flow rate or anyhow change it once set.
7. Initially 10 liters of water will be allowed to pass through the apparatus, after which heat duty of apparatus will be measured.

8. Heat duty = Temperature rise x Flow rate.

Temperature Rise = Temperature of water flowing from outlet of apparatus - Temperature of water provided at inlet.

Flow rate = weight of water flowing through outlet pipe in a time period of 1 minute.

9. Apparatus with maximum **Heat duty per unit aperture area per average direct insolation** will score maximum points in objective judging criteria.
(Aperture area is as defined in 3.1.6)

3.2 Subjective Judging

Only teams those qualify for final round under objective judging will be judged subjectively.

Subjective judging will be based on following criteria:

Concept: The technical details involved in the device with proper reasoning as to why such a design is conceptualized; should be explained. Mathematical formulation should be used wherever it is necessary and appropriate.

Aperture area: Participants need to mention the aperture area and the process through they arrived at the mentioned result.

Fabrication process: Participants need to explain materials used for fabrication of apparatus and reasons for selecting that particular material. Aspects like long lastingness, availability and costs should be thought of.

Outstanding quality: This includes any outstanding quality of the device (e.g. in terms of its installation, effectiveness, cost, ease of mass production etc.), if any.

Team that scores maximum combined points from objective and subjective judging will be declared as winner.

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4. Rules

4.1 General Rules

1. The teams must adhere to the spirit of healthy competition. The teams must not damage the opponent's machine in any way. Judges reserve the right to disqualify any team indulging in misbehavior.
- 2. Any team that is not ready at the time specified will be scratched from the competition automatically.**
3. The machine would be checked for its safety before the event and would be discarded if found unsafe for other participants and spectators.
- 4. The organizers reserve all rights to change any or all of the above rules as they deem fit. Change in any rule will be highlighted on the website and notified to the registered participants.**

4.2 Team Specifications

A team can consist of maximum 3 members. Students from different educational institutes can form a team.

4.3 Eligibility

All students with a valid ID card of their respective educational institutes are eligible to participate in SolEx at Techfest 2008.

4.4 Certificate Policy

1. Certificates of Excellence will be given to all the winners.
2. Certificates of Participation will be given to all the teams that are able to qualify for the final round.

4.5 Registration

Registrations are closed.

4.6 Accommodation

Accommodation registrations for SolEx have ended.

4.7 Accommodation Criterion

- Participants are required to submit an abstract containing a brief idea of:
 1. The design of reflector incorporated and the reason behind it.
 2. The various parts of the apparatus together with the material used.

Only a brief idea of the above is required, not the details. The abstract should be concise and to the point and should not exceed **one A4 sheet** of text typed with Times New Roman font of size 12 in 'doc' or 'pdf' format.

- **Note that abstract submission is only for teams who wish accommodation during Techfest2008 at IIT Bombay.** Abstracts are not required for participants who can arrange accommodation themselves.
- The abstracts are to be sent to the address solex@techfest.org.

4.8 Important Dates

25th December 2007: Last date to submit abstract to get accommodation at IIT Bombay during Techfest 2008.

25th December 2007: Last date for submission of online accommodation form for participants who require accommodation at IIT Bombay during Techfest2008.

10th January 2008: Last date of registration for participants who do not require accommodation during Techfest2008.

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