

## **EN 671: Solar Energy Conversion Technology**

### **Participatory evaluation and Term Project (weightage: 20%)**

#### **Guidelines:**

Each group should consist of a maximum of 5 students. Each group has to prepare a poster presentation.

**Date of presentation: 29<sup>th</sup> April 2020**

#### **List of projects**

#### **Design based projects:**

1. Design a system for desalination of water for drinking purpose using suitable Solar thermal collector for schools in rural areas of Assam. Analyse the economic feasibility of the system.
2. Design a solar refrigeration system for 1 ton of refrigeration. List all the possible merits and demerits of the system.
3. Design a Solar energy based dryer for turmeric drying. List its possible reasons for failure/not being able to meet the requirements properly.
4. Design a Wind-Solar energy hybrid system for sustainable power supply to a small community of 50 families. Study the economic feasibility of the system.
5. Design a Solar powered cold-storage system for de-centralized storage of vegetables applicable for rural India. List its possible reasons for failure/not being able to meet the requirements properly.
6. Design a Solar-powered vaccine refrigerator, which can be used by healthcare workers in remote areas and critical medication can be administered to those who need it.
7. Design a solar powered automatic irrigation system for the agricultural field to meet the demand for optimum water requirement of the crop.
8. Design a sun tracking PV system for maximum conversion of solar energy. List its possible reasons for failure/not being able to meet the requirements properly.
9. Design a solar street light system with auto intensity for the campus of IITG. Also, make an economic analysis of the system.
10. Design a 1 KW solar chimney tower system. List its merits as well as demerits.
11. Design a 20KW Solar-biomass hybrid gasifier system; Make a theoretical analysis of both loaded and unloaded condition.
12. Design a 100kg/day capacity Solar Tunnel Dryer for paddy suitable for the North-Eastern region of India. Study the economic feasibility of the system as well.
13. Design a 100 kW stand-alone Solar-powered system. Study the cost analysis of the system.
14. Design a 100 kW Solar grid connected PV system. List its possible reasons for failure/not being able to meet the requirements properly.
15. Design a solar electric bicycle. Study the merits and demerits of the designed bicycle over the conventional electric bicycle.
16. Design a passive solar building system specifically for the campus of IITG. List its possible reasons for failure/not being able to meet the requirements properly.
17. Design an FPC for maintaining the optimum temperature for maximum biogas production. Capacity: 2m<sup>3</sup>/day capacity generated through anaerobic digestion technology.

18. Design a Solar cooker suitable for community use for 1000 persons per day. List its possible reasons for failure/not being able to meet the requirements properly.
19. Make a design on a solar-powered E-rickshaw and make a theoretical assessment on its performance and also draw an economic assessment by taking the present E-rickshaws into comparison.
20. Design a Solar PV based milk chiller for a dairy farm of capacity 1000 litre/day suitable for Assam. Study the economic feasibility of the system.
21. Design and optimize a Solar PVT based electricity generation as well as water heating system. List its possible reasons for failure/not being able to meet the requirements properly.
22. Design a space heating system unit for a home in Shillong using Solar energy. List its possible reasons for failure/not being able to meet the requirements properly.
23. Design a 2 KW floating solar power plant. List its possible reasons for failure/not being able to meet the requirements properly.
24. Design a Solar-Biomass based cook-stove; List its merits as well as demerits.
25. Design a Solar pond suitable for operating a vapour absorption refrigeration system. List its possible reasons for failure/not being able to meet the requirements properly.

### **Developmental projects:**

26. Develop energy metrics analysis of a 10 kWp Solar power plant.
27. Utilization of Micro Grid distribution system for a village in Assam.
28. Develop a model for a Solar energy based vacuum cleaner, to create a partial vacuum in order to suck the dirt and dust particles.
29. Develop a simulation depicting how the geometry of a Solar Greenhouse/Tunnel dryer affects the performance of the dryer as a whole. Also, show how the geometry can be optimized for achieving the best performance.
30. Study the effect of dust on PV performance in Guwahati city using a self-developed model and compare the results with available literature.
31. Develop and model a Tri-functional solar photovoltaic-thermal solar collector for the suitable location of India.
32. Develop a correlation for predicting hourly global, beam and diffuse radiation under cloudless skies for the state of Assam (In particular Guwahati city). You may take help of ASHRAE mode for base line model development. Average of 55 years' meteorological data will be given to you for the analysis.
33. Develop a working model of Solar energy based robots.

### **Theoretical projects:**

34. Prepare a theoretical study of the solar distillation system mentioning the economic assessment of the system and recent advancement in this field with future prediction.
35. Write a detailed report on Solar powered vehicles and sustainability, clearly mentioning relevant statistical data, a comprehensive historical review and future predictions.
36. Write a detailed report on energy storage and sustainability, clearly mentioning relevant statistical data, a comprehensive historical review and future predictions.
37. Prepare a detailed case study on concentrated solar power technology, clearly mentioning all relevant statistical data.
38. Prepare a detail report on Solar power plants in India and predict the future possibility of solar plants in India with relevant statistical data.
39. Give a brief write up about Solar Radiation with a very brief historical review.
40. Give a brief write up about Organic solar cell and its performance with a comprehensive historical review and future predictions.
41. Describe the different technologies based on new materials for the manufacturing of thin film solar cells; a comprehensive historical review along with an explanation on a detailed economic assessment (with statistics) and future predictions.

42. Give a brief write up about artificial photosynthesis with a comprehensive historical review and future predictions.
43. Prepare a detailed report on Different materials used for the production of the PV cell, the recent advancements in this field and the future prediction.
44. Prepare a brief report on module reliability & performance of the solar PV system, clearly mentioning relevant statistical data, a comprehensive historical review and future predictions.
45. Give in details the materials and technology used for the production of flexible solar cells; clearly mentioning relevant statistical data, a comprehensive historical review and future predictions.
46. Prepare a detailed report on the technologies available for solar cell manufacturing mentioning comparative historical review and future predictions.
47. Write a detailed report on thermodynamic management of a Solar PVT system, clearly mentioning relevant statistical data, a comprehensive historical review and future predictions.
48. Write a detailed report on economics and sensitivity analysis of a Solar PVT system, clearly mentioning relevant statistical data, a comprehensive historical review and future predictions.
49. Prepare a detailed review report on the ecology and economics of PV system mentioning the future prospects of PV technology.
50. Give an elaborate description of the various kinds of solar collectors and solar concentrators in commercial use at present. Based on factors like climatic conditions, load capacity, efficiency, concentration ratio, etc. comment on which type would be most suitable and for what application for small scale entrepreneurs in India, along with an explanation on your comment based on a detailed theoretical & economic assessment (with statistics).
51. Write a detailed report on the scope of a Megawatt-scale Solar power PV plant in the NE region of India, clearly mentioning relevant statistical data, a comprehensive historical review and future predictions.
52. Write a detailed report on the use of Solar energy in agriculture, clearly mentioning relevant statistical data, a comprehensive historical review and future predictions; its drawbacks and prospects.
53. Prepare a comparative study of Life Cycle Assessment for different PV & PVT technologies and detail your own conclusions based on the comparative study.
54. Write a detailed report on Solar energy and Gasification hybrid energy system clearly mentioning relevant statistical data, a comprehensive historical review and future predictions.
55. Write a detailed report on the prospects of a Distributed grid for Renewable energy system, clearly mentioning relevant statistical data, a comprehensive historical review and future predictions.
56. Prepare a detailed review of various national and international solar energy policies mentioning the drawbacks and prospects of each policy.
57. Elaborate on the various prospects of powering the Bell-Metal industry of North-Eastern India through Solar energy. Also, make a practical assessment on which option is the best and why.
58. Prepare a detailed report on Solar Fuels: Electrolysis of water /Photo electrochemical (PEC) water splitting and make a detailed economic assessment of the same.
59. Prepare a detailed report on Economic and Environmental Performances of Small-Scale Rural PV Solar Projects, clearly mentioning relevant statistical data, a comprehensive historical review and future predictions.
60. Draw a descriptive comparison of Solar energy and Fossil Fuel based energy. Make a trade-off section statistically elaborating on their merits and demerits with a vision of 20 years into the future.

61. Prepare a detailed review on Indian government initiation and implementation on solar energy projects with relevant statistical data and analyze future prospects of India in the field of solar energy.
62. Write a detailed review of the various batteries used in solar PV system from early stage to recent advancements and the future scope of the technology.
63. Prepare a detailed report on the assessment of district wise potential for solar thermal energy system installation for the state of Assam, clearly mentioning relevant statistical data, a comprehensive historical review and future predictions.
64. Prepare a detailed report on the assessment of district wise potential for solar PV system installation for the state of Assam, clearly mentioning relevant statistical data, a comprehensive historical review and future predictions.

### **Assessment:**

- Model demonstration / simulation/ modelling/depth of analysis
- Report writing (should include Abstract, Introduction, literature review, methodology, results and discussion, conclusion, references, nomenclature and abbreviation)
- Poster Presentation