

Solar Thermal Energy

Introduction to Solar Thermal Energy and Solar radiation Fundamentals

Overview of renewable energy sources, Importance of solar energy in the context of renewable energy, Solar thermal vs. photovoltaic systems, Solar radiation and its measurement, Solar geometry and angles, Insolation and solar irradiance

Solar Liquid and Air Heating System

Classification of solar thermal collector, Flat plate collector – Liquid and air heating - Evacuated tubular collectors - Overall heat loss coefficient, heat capacity effect - Thermal analysis. Design of solar water heating systems, with natural and pump circulation. Solar dryers and applications. Thermal energy storage systems.

Solar thermal power plants

Parabolic trough system, distributed collector, hybrid solar-gas power plants, solar pond based electric-power plant, central tower receiver power plant, Concept of solar temperature and its significance, calculation of instantaneous heat gain through building envelope. Solar thermo-mechanical refrigeration system – Carnot refrigeration cycle

Solar Thermal Applications

Solar systems for process heat production - Solar cooking – Performance and testing of solar cookers. Seawater desalination – Methods, solar still and performance calculations. Solar pond, Solar greenhouse, Space heating and cooling using solar energy

Integration and Hybrid Systems and Emerging Trends and Future Prospects

Integration of solar thermal systems with existing energy systems, Hybrid systems: solar-thermal combined with biomass, geothermal, etc., Economic and environmental consideration, Advanced solar thermal technologies: nanofluids, high-temperature materials, Solar thermal in urban environments, Policy and regulatory aspects of solar thermal energy