Active Use of Energy harvesting concepts: Plan for Future Energy Management and efficiency:

Use of energy efficient electric appliances

We may replace incandescent bulbs with compact fluorescents (CFLs), which will use less energy and last much longer, cutting down electricity bills dramatically. Energy efficient electric appliances use two to 10 times less electricity for the same functionality and are mostly higher quality products that last longer than the less efficient ones.More precisely, efficient appliances saves lots of energy and money. **L**aptops instead of a desktop is suggested, as it consumes five times less electricity. In case of a desktop,an LCD screen is more preffered.We may enable the power management function on our computer, the screensaver does not save energy. Switching off a computer extends its lifetime, contrary to some misconceptions. Minimising printing and printing on both sides of the paper is better. Laser printers use more electricity than inkjet printers.

Some of the important noteworthy research works for Renewable Energy, solar energy usage, energy storage and production of higher energy efficient devices are as follows:

- **Grid-Connected/Stand-Alone Power Electronic Converter Control** : In the growing electricity supply industry and open access market for electricity worldwide, renewable energy sources (RES) are getting added into the electric grid system. Power electronic systems (PES) are the crucial interfacing devices which matches output voltage, perform DC to AC (or AC to DC) conversion, control power quality and power flow, and have high efficiency on 10% to 100% power range. The objective of the research is to develop simulations and experimental set-ups for interfaces for RES with grid connected PES control using intelligent and advanced digital signal processing techniques. A significant emphasis is placed on the cost-effective utilization of this energy resource to simultaneously achieve a quality and reliable power supply.
- **Energy Storage** : One of the major thrust areas for research in IIT Mandi is to develop storage devices for large quantities of electricity generated from renewable energy sources such as solar or wind power. The storage of electrical energy is also required for devices rangeing from a cellular phone to highly compact electronic devices implanted in a body to electric vehicles. Within this context, research has been initiated here to develop high energy density capacitors using functional oxide materials. The research involves (a) materials development (selection of materials and bulk processing), (b) studying the structure property relationship of the materials by using various electrical and structural characterization techniques, (c) fabricateingdevices in the form of films or multilayered structures. Various structural and thermodynamic aspects are considered to understand and optimize the device physics of these. The measurements include dielectric permittivity, energy storage density and leakage currents etc. The structural study involves characterization using TEM, SEM and X-ray diffraction techniques.
- **Improving Efficiency of Plastic Solar Cells** : Polymer solar cells have attracted much scientific attention in spite of poor power conversion efficiency because of the possibility of fabricating large area devices by solution-processing onto flexible and lightweight plastic substrates. The main research goals include development of novel conjugated polymers, new device architecture and morphology optimization for the betterment of the device efficiency. Design and synthesis of conjugated polymers having low band gap and high hole mobility will be undertaken. Electrical parameters of the solar cells will be measured preceded by fabrication of devices using synthesized polymers. Study of time evolution of charge carriers employing

steady state and time-resolved spectroscopic techniques will help to understand the role of nanomorphology on the device efficiency.