

Summary and Conclusions

Fuelwood is the major source of energy in the study area. It is considered a free source of energy by villagers, although they spend an average of 4 to 6 hours each day to collect it from the forest. The estimation of biomass requirements for the surveyed villages indicated that a substantial increase in the forest area would be required if the biomass demand is to be met through the forests alone. Under these circumstances, efforts are needed to develop innovations to reduce the consumption of fuelwood and to promote the use of alternative sources of fuel for cooking and space heating. Electricity is widely used for lighting. Villagers do not consider electricity to be an important energy source for space heating and cooking but view it as a convenient energy source for industrial use and for lifting water. Considering the vast hydroelectric potential of the State and the expansion of transmission lines, electricity holds the promise of playing an important role in meeting the energy demand. It is worthwhile considering that the fuelwood consumption rate is directly correlated with altitude. Therefore, the saving in biomass would be greater if villages in the higher altitude range are made targets of alternative fuel technology on a priority basis.

The survey of selected villages showed that cooking and space heating shared the bulk of energy consumption. All buildings in the area are very poorly insulated. As a result, they are unable to retain heat. The '*chullas*' (cooking stoves) and '*tandoors*' (furnace to heat the room) currently in use are fuel inefficient. This calls for improvements in the design of buildings and the promotion of improved and energy-efficient stoves.

Sunshine hours vary across villages depending upon the location of the settlement and the surrounding topography. Due to atmospheric factors, effective sunshine hours are approximately 60 per cent of the total possible incidence. Hence, solar-powered equipment such as water heaters, cookers, and photo-voltaic cells may not be very popular in the area. In addition, the incidence of hailstorm is quite high and can adversely affect solar-powered equipment.

The kinetic energy of water is used in the area to run water and sawmills. The local technology for harnessing water power can be improved through technological innovations.

Biogas plants are unlikely to be popular in the district because the biological waste of cattle is not significant and is difficult to collect. So far, a total of 404 biogas plants of varying sizes (2m² to 5m³) have been installed in the district in villages below the altitude of 1,500 m. Since the majority of villages lie above this range of altitude, biogas plants do not seem to be a feasible alternative in the district.

Although there are significant potentials for saving energy and materials through improvements in the designs of residential buildings and community facilities, this is an area which requires a sustained effort over a long period of time to motivate and change the attitude of the people. It was observed that the people were responsive to the adoption of energy-efficient building construction techniques. There is a great need to popularise such techniques that use indigenous materials.