

## Abstract

Energy consumption and carbon emissions due to space heating and cooling load which accounts a substantial share of total energy consumption in buildings have become a serious concern. Hence, energy efficient building design has become a necessity for optimum energy performance of the building. Building energy demand is increasing rapidly with the increase of population growth and for improved indoor thermal environment conditions. Thermal performance study has become an important aspect to understand the energy consumption and scope for energy conservation in buildings. In this study, estimation of energy consumption and environmental monitoring of buildings is done with the help of degree-day method. Degree-days are a versatile climatic indicator that can be used in estimating the heating and cooling energy demand of buildings. Heating degree-days (HDD) and cooling degree-days (CDD) are calculated for various base temperatures by using daily maximum and daily minimum temperature data for Tezpur (warm and humid climatic zone), Shillong (cold and cloudy climatic zone) and Imphal (cool and humid climatic zone) of North-East India. Five years duration temperature data for above three locations are collected from Regional Meteorological Centre, Guwahati. ASHRAE formula, UKMO equations and Schoenau-Kehrig methods are used for the degree-day calculations. It has been found that degree-day values obtained from the above methods vary in the respective zones and also from zone to zone. Generalized relations by using multiple linear regression technique are developed to calculate the degree-days for all the climatic zones of the region. The findings of the study suggest a strong relationship between mean temperatures and degree-days. This generalized relation can be used to calculate degree-days of locations, for which daily temperature data may not be available. Thermal performance analysis has been carried out for a vernacular building in Tezpur. The objective of the simulations is to improve the indoor thermal environment. Solar energy modular simulation tool TRNSYS 16 is used to carry out the simulations of the building. Building model is generated in TRNSYS and design optimization has been done by carrying out parametric simulations for different scenario such as wall thermo-physical properties and thickness, orientation, and insulation thickness on ceilings. The optimum thermal performance has been achieved by integrating the optimum building design parameters.