ABSTRACT

Global atmospheric concentrations of carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) have increased markedly as a result of human activities since 1750 and have far exceeded pre-industrial values. The effects of global warming are climate change, rising of mean sea level, change in rainfall pattern which results in floods, droughts, the melting of glaciers and the spread of infectious diseases. In order to save Earth, United Nations Framework Convention for Climate Change (UNFCCC) was signed in 1992 and the third Conference of Parties (COP) meeting signed the Kyoto Protocol, which makes it binding on the developed countries to achieve an agreed level of emission reduction by at least 5.2% below 1990 levels in the commitment period 2008 to 2012. It may be required for India also to reduce emission of greenhouse gases (GHG) under this protocol. Hence, all the industrial sectors have to reduce the emissions by applying different mitigation options like fuel switching, energy efficient technologies and renewable energy technologies.

In India, it was estimated that small and medium scale industries contribute to 65% of the total industrial pollution. There is an increasing awareness of emission control requirements among the large scale industrial units and they have already initiated measures for improvement in energy

efficiency and pollution reduction. They also have the facility for importing the know-how for advanced processes and equipments. However, small and medium scale industries face constraints due to the lack of know-how on technologies, non-availability of finance and lack of trained manpower. Hence, it has become necessary to identify the energy efficient technologies for improving the performance of these units, which will reduce emissions and also improve the efficiency. It is also very important that these technologies should be capable of reducing the cost of production so that small and medium industries can easily adopt these technologies.

The main objective of this research work is to estimate the CO_2 emission reduction for a cluster of garments manufacturing units in Tirupur, a South Indian city, which can be extended to the other small and medium scale industries clusters in India, if needed. This requires estimation of CO_2 emission in the year 1990 from this textile cluster, as well as the present level, to meet the Kyoto Protocol requirements.

Details of historical energy consumption and garments production in 173 factories in the small and medium scale industries cluster in Tirupur were collected. These data were used to verify the collected secondary data from other sources. Also, energy audits were conducted in 56 units in the Tirupur cluster. From the garments production and consumption details of diesel, firewood and fuel oil, specific fuel and energy consumption data were calculated. The consumption trends of various energy sources in the Tirupur

sub-sectors were estimated based on the weighted average specific consumption and garments production. Similarly, from the specific CO_2 emission data, cluster CO_2 emission was estimated based on the Intergovernmental Panel on Climate Change (IPCC) 2006 guidelines.

The demand forecasting can be estimated using many methodologies. In this study, forecasting was carried out using three methods, namely trend analysis, regressing various parameters which affect energy consumption and artificial neural network. Though factors like production output, per capita fabric consumption, export, investment, labour cost, energy cost, capacity utilization, productivity and profit influence the cluster energy consumption, only three important and significant factors were chosen for this regression analysis and the factors considered are garments production, per capita cotton fabric consumption and export.

Tirupur garments manufacturing cluster depends on electricity, firewood, diesel, and fuel oil for its energy needs. Firewood is an inefficient fuel and replacing it with efficient fuels like coal and natural gas will result in considerable reduction in fuel consumption and emission of CO_2. These replacement scenarios were studied and the possible reduction in CO_2 emission was estimated.

Based on the collected data and energy audit studies, many efficient and environmentally sound technologies were identified. The mitigation potential was estimated on the implementation of these technologies. It is also

important to evaluate economic viability of these identified technologies for adaption. A simple payback analysis was carried out for the identified technologies and the results have been presented.

Resource availability studies were conducted to estimate the energy generation potentials from the Solar, wind and biomass in Tirupur district. To estimate the power generation potential from wind mills, data were collected from two wind mills of capacity 500 kilowatt (kW) each located in Tirupur region. Monthly data were collected from January 2005 to December 2008. Biomass availability was estimated by conducting survey in three village panchayats in Tirupur region. Experimental studies were conducted on biomass gasifier to produce electricity for cluster and also to ascertain the specific fuel consumption for the locally available biomass in the Tirupur district. CO_2 reduction potentials by utilizing the biomass, wind and solar energy resources were also estimated. Finally, the mitigation scenarios of CO_2 by implementing different technologies and renewable options were presented.