

Abstract

Access to electricity in the rural areas remains to be a great challenge in India. According to 2011 census, the rural electrification in India was only 43.2%. Due to the high cost of transmission and distribution, low load density and the high cost of a centralized management system for small loads make supply of grid power unattractive for remote places. However, access to electricity is a vital programme for improving the socio-economic conditions of the rural areas. It also promotes livelihood security by providing electricity as an input for productive uses in agriculture and rural industries, and helps to improve the quality of life. This study is focused on renewable energy base system for access to electricity for Jhawani, a rural un-electrified village of Assam as off-grid base systems. It is found from the load survey provides that the average load demand per day per household varies from 0.2 to 0.5 kW. The daily peak load for the village based on the average demand of each household are 19.3 kW, 21 kW, 24 kW and 41 kW. It is also found that photovoltaic system and biomass gasification based electricity generation will be most suitable for providing electricity in this village. In this study, HOMER simulation tool have been used to optimize the different resource share based on cost of energy. This simulation tool is a powerful tool for designing and analyzing hybrid power systems either grid connected or off-grid environments. In this study, the levelized cost of energy has been calculated for different load capacity. The study also addresses sensitivity analysis of the critical parameters like biomass price, biomass to producer gas ratio, capital cost variation. The data used for the analysis is arrived at from case studies on various distributed power generation systems. It has found from the analysis that the levelized cost of energy for a 25 kW biomass based gasification system varies from US\$0.270 /kWh to US\$0.329 /kWh as the price of biomass changes from US\$40/tones to US\$80/tones. As the capital cost of gasification system increases by 20%, the cost of energy changes to US\$0.276 /kWh from its base price. The simulation also reveals that as the producer gas output increases from 2.5 kg per kg of biomass to 2.8 kg per kg of biomass, the levelized cost of energy decreases from US\$0.270 /kWh to US\$0.263 /kWh. This study provides various scenarios of sharing of the renewable energy resources and cost of energy for different load pattern. This study is useful to predict the capacity of various renewable energy systems, sharing of these energy resources and the levelized cost of energy. This study is also useful to understand the economic feasibility of decentralized off-grid renewable energy system as a source of quality power supply in remote un-electrified village.