

**The Potential of land belong to the farmer for biomass energy supply:  
System Approach in household level, Chi watershed, the Case of Khon  
Kaen Province.**

**Abstract**

It is generally believed that the role of biomass energy will diminish and even disappear as rural communities become more urbanized. However, there is some evidence that biomass energy consumption is still significant even in urban area. This study aimed to investigate the extent to which biomass energy still plays an important role as a source of energy for household consumption in communities at varying levels of urbanization. The objectives were (1) to compare utilization of energy (biomass and non-biomass) among communities at different levels of urbanization in terms of absolute quantity, relative share and functional roles, (2) to identify factors causing the differences in utilization of energy (biomass and non-biomass) among households in communities at different levels of urbanization, (3) to elucidate the causes for the differences in utilization of energy (biomass and non-biomass) among communities at different levels of urbanization, and (4) to identify the sources of biomass energy utilized by households in the communities at different level of urbanization.

The study was conducted in three villages in Khon Kaen province in Northeast Thailand that were selected to represent the rural, suburban and urban communities. Data were collected on household use of energy using a formal questionnaire survey with field observation, field measurement and in-depth interview. Random samples of 50 percent of households in the rural and suburban communities and all households in the urban community were selected for study. The numbers of sample households were 130, 93 and 65 for the rural, suburban and urban communities, respectively.

The results showed that on average total household energy consumption increased slightly with urbanization while both the absolute quantity and the relative share of biomass energy used declined with greater urbanization. The absolute quantity of total energy consumed was 46,042 Megajoules per household per year (MJ/hh/yr) in the rural

community, 52,465 MJ/hh/yr in the suburban community and 55,076 MJ/hh/yr in the urban community. Biomass energy provided 21,691, 18,557 and 5,433 MJ/hh/yr in the rural, suburban and urban communities, respectively, with its relative share declining from 47.1 % in the rural community to 34.5 % in the suburban one and to only 9.9 % in the urban community. Both firewood and charcoal were used primarily for cooking with a small amount used for home industry, while LPG and electricity were used entirely for living, and gasoline was mostly used for transportation with a small amount used for agriculture. Occupation, size of household, size of cultivated land and income level were found to influence household energy consumption, although these factors are so closely interrelated that their effects are confounded. Occupation appeared to be the dominant factor that could explain the differences in pattern of energy uses among households. The households with regular income and the business owners, which also tend to have higher incomes and follow more urbanized life styles, used less biomass than the agricultural and irregular income households, whereas the agricultural households have larger household sizes, larger land areas and lower incomes, and also follow a rural lifestyle, used more biomass energy for living than non-biomass energy. The irregular income households, which were the poorest and could not afford the modern life style, also depended very much on biomass energy for their living, even though they have only small areas of land from which to collect it.

The differences in household energy use among the three communities reflect their different levels of urbanization and the dominant occupations of households in these three communities. In the rural community most (94 %) of households were agricultural households, who use a greater share of biomass energy, whereas the majority of households in the urban community were regular income households (49 %) and owners of businesses (26 %), who use more modern energy and much less biomass energy. The composition of occupations of households in the suburban community was more like the rural community than the urban one with agricultural households and irregular income households, which continue to follow a rural life style and use mostly biomass as the source of energy for their living, accounting for 85 % of households.

Households acquire fuelwood for biomass energy by collecting it, purchasing it, or both collecting and purchasing it. Most urban people lack sufficient land to grow their own wood so either have to collect it from public land or unused lots of neighbors or

purchase firewood and charcoal from rural producers at a cheap price. Rural and suburban villagers can either grow fuelwood on their own land or, if their houses are located close to the forest, are able to freely collect dead branches there but are prohibited by law from cutting down living trees. Most agricultural households collected biomass fuel only from their own land (62.7 %), whereas households with irregular incomes obtained firewood from several different sources, including public land (27.1 %), their own land (16.7 %) or both public land and their own land (16.7 %). In the rural and suburban communities, most households appeared to encounter no difficulty in producing sufficient biomass energy to meet their needs since the annual consumption of fuelwood of a typical household could be met by the annual growth increment of 68 Eucalyptus trees for a rural household and only 59 trees for a suburban household.

The case studies of biomass energy acquisition by selected households provided some confirmation of this conclusion by showing that many rural households have already planted trees and managed them to provide biomass energy to meet their own needs, while some of them even had a surplus that could be supplied to their relatives or neighbors. They also indicated that many people prefer to continue using cheap and readily available biomass energy for their living activities rather than switching to LPG. Moreover, if their production of biofuels is sufficient to meet household needs, they can save the money they have to expend to purchase energy used for cooking fuel.

Since in Northeast Thailand biomass energy will continue for the foreseeable future to play an important role in the energy economies of many households, it is recommended that, in developing alternative energy sources to cope with the diminishing supply and high price of fossil fuel, the government should pay more attention to biomass as a source of energy for household consumption. Further research, however, is needed to investigate whether the supply of biomass for household uses can be managed in a sustainable manner without further destruction of the forest.

**Keywords :** Energy consumption, Biomass energy, Fuelwood acquisition, tree management, Rural-urban continuum