Biomass energy uses: an experience and application of alternative energy technologies in Nepal

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Energy scenario in Nepal

Nepal is a mountainous country and its energy situation has been characterized by a very low energy consumption per capita of 15 GJ. Only four other countries in the world have per capita energy consumption lower than Nepal [1]. The total energy consumption of Nepal was estimated to be 270 million GJ in 1994/95 and has an average 2.4 percent increment. More than 90 percent of total energy use comes from biomass which is used for domestic sector and the commercial and other sectors utilize remaining 10 percent. Biomass is primarily used as fuel for cooking, space heating and cooking animal feeds as well as animal fodder. The share of fuelwood, agricultural resides and animal dung accounts respectively 79, 4 and 7 percent [2]. The forestry sector master plan has revealed that there is a gradual increase in fuelwood consumption. There was 11.3 million tons of fuelwood consumed in 1985/86 and this figure has been increased to 14.1 millions tons in 1995/96 [1]. The agricultural residues (paddy, maize and wheat residues and jute stick) estimates approximately 11.2 million tons per annum, however no data are available on quantity of its uses. Most of the agricultural residues are used in very crude form and burnt in ineffective stoves, efficiency less than 11 percent. The animal dung, a third major source of biomass energy after fuelwood and agriculture residue, has been estimated to be 11 million tons dry weight from 3 million cattle [3]. Nepal has huge hydropower (HP) potential, 83000 MW from 6000 rivers and rivulets flowing from north to south. Although, the hydropower development has begun from early nineties, the development could not be made as required. As of today only 359 MW hydropower has been installed from 15 plants, too low in a period of 90 years [4]. The electricity contributes to only 1 percent of the total energy consumption and only 3 percent has been used for domestic sector of rural part where more than 88 percent of the total population resides. The share of petroleum fuel and coal used for domestic and commercial sector is minimal and has been estimated to be 8.6 and 1.4 percent respectively. Nepal has zero production of petroleum fuel [5]. This scenario of laggard development of hydropower and zero existing situations of imported petroleum fuels compel the situation for biomass consumption increment to meet the growing need of energy.

Consequences of present trend of energy uses

The present scenario of energy uses in Nepal depicts an unsustainable picture. Heavy dependence on fuelwood coupled with the high population growth rate (2.54 percent) is exerting a continuous pressure on forests, which has caused the rate of forestation is less than the rate of felling. The existing annual rate of deforestation accounts to be 1.7 percent posing a great threat to the environment. The dwindling of forest has direct impacts on fragile mountain ecosystem, which has created landslide, erosion, loss of bio-diversity and climate change and led to enhance poverty. Further, uncontrolled burning of agricultural residues and animal dung have brought about indoor air pollution and deficiency on manure, which has impact on the agricultural productivity as well as soil quality. In addition to the biophysical impacts, a study carried out by REDP on 2000 showed that it has created a social burden on more than 78 percent of the rural women and children causing drudgery and extra work in rural part in Nepal [6]. Further, dung burning has reduced the organic manure input to the fields, which is very vital to agricultural productivity in the economically poor farmers to supplement the nutrients by fertilizers.

Application of alternative energy technologies

The increased demand of accessible energy, which is forest base, could be met either by reducing consumption, over-cutting the accessible forests or increasing the use of agricultural residues and animal dung. But by increasing the tree felling and increasing burning of agricultural residues and dung would not make the energy supply sustainable rather it increases the ecological vulnerability. The possibilities of

reducing the use of forest base energy could be brought by introducing energy efficient technologies and application of alternative energy sources (with an application of alternative energy technology) which would support for the long term sustainable supply of biomass energy and help enhance the ecological balance. Alternative Energy Technologies (AETs) in the context of Nepal are related to micro hydropower, biomass energy (biogas, briquettes, improved cooking stoves), solar energies, wind-energy, etc. Given the economic situation and settlement pattern of the rural communities, the application of AETs related to the biomass have been more successful as compared to the hydropower, solar and wind power which simply needs a diversification and less economic involvement. The application of biogas and improved cooking stoves (ICS) are the biomass based two AETs to combat problem to a major extent and would make the fragile mountain ecosystem managed and reduce drudgery of women and children. Government of Nepal has very recently recognized the importance of ATEs to make the biomass energy sustainable and minimize the consequences. The role and importance of biomass energy has been reflected from the eighth five-year plan (1992-1997) and has been prioritized in ninth five-year plan (1997-2002) [7]. To support this, Government of Nepal has initiated subsidy policy in the promotion of biogas technology and other alternative energy technologies but still lacks its effective implementation.

Application of biogas and improved cooking stoves

Biogas technology has proved itself to be one of the most promising and sustainable sources of alternative energy in Nepal. It has prevented direct burning of agricultural products and has helped generate biogas for household cooking and lighting. There are more than 71,490 biogas plants have been installed through different organizations including Rural Energy Development Program (REDP), Biogas Support Program (BSP) and other donor-supported organization. In Nepal 1.3 million households are potential for biogas and could release burning of biomass (dung, crop and tree residues) for use as fertilizer in addition to the other benefits of using biogas [8]. Similarly, ICS has been promoted in the rural part of Nepal, which has helped in reducing the fuelwood by at least 25 percent and indoor air pollution by about 80 percent. As of today 115,000 ICS have been already installed [9].

A REDP study on the application of biogas and ICS for forest saving shows that from biogas about 14268 tons of biomass per year has been saved which is equivalent to 8917 ha of forest and from ICS 420 tons of biomass per year equivalent to 262 ha of forest area. Which is a remarkable saving and increase in trees and forest area [9]. The study further identified that the biogas and ICS have multiple benefits, it has reduced the pressure on the forest, improved the health of women and children and saved women working time. Its use has been successful in the rural part of Nepal despite some cultural barriers. Both biogas and ICS are important AETs for sustainable supply of biomass energy in the country like Nepal.

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