

Pattern Of Energy Consumption And Its Impacts On Economic Development Of Nepal

Shoora Beer Paudyal*

INTRODUCTION

Nepal is a small country with 147,181 sq. km. area inhabited by more than 23 million people. As per UN criteria, it is least developed country with per capita income of 210 US \$ in 1997. One of the lowest literacy rates is also another evidence for its underdevelopment as it accounts 41 percent for male and 14 percent for female in 1995 (WDR 1998/99). The life expectancy for male and female accounts for 57 years in 1996. Another criteria for development is per capita use of commercial energy which is extremely low in Nepal among other developing countries which accounts for 33 Kgs. in 1995 against 67 Kgs. Bangladesh, 260 Kgs. India, 243 Kgs. of oil equivalent Pakistan, 136 Kgs. Sri Lanka in 1995 (WDR 1998/99). The latter criteria and its relationship with the economic growth is the subject of this paper. This paper thus, intends to analyze the present dimension of energy problems, possible solutions and its impacts on economic growth of Nepal.

POWER POTENTIALITIES AND PROBLEMS

The availability of adequate inexpensive supply of energy has an important role to play in the process of economic growth of a country. Nepal is well endowed with biomass and hydro power resources. Hydro electricity production potentiality is estimated at 83 thousand MW, of which only 42 thousand MW is economically viable (NPC 1992). So far only 0.6 percent of economically potential power has successfully been generated in the country. Kosi, Gandaki, Karnali, Arun and Marsyandi have huge power development potentiality and prospects of running many mega projects in these rivers are extremely high. But these resources are currently left unharnessed due to shortages of capital and technical manpower on the one hand. On the other, a major constraint that emerged recently is lack of national consensus about the water resource development among various political parties. As Nepal's internal demand for electricity limits to 350 MW, she has to fetch external market for the rest of her power that she intends to produce in the country. However, international market for Nepal's hydro power essentially falls into

* Mr. Paudyal is lecturer, the Centre for Economic Development and Administration, Tribhuvan University, Kathmandu.

monopsony market category, in which India is the single buyer. As a rule of this market, the bargaining strength of seller is extremely weak. One of the major reasons why the development of hydropower in the country lagged behind is controversies about this very type of market Nepal faced. Nepal, therefore, emphasized time and again about the involvement of Bangladesh along with Nepal and India in the development projects of water resources in the region. If India could be convinced, Nepal might have better position in sharing the benefits that accrue from the water resources development projects. Besides, Nepal is said to be comparatively rich in micro hydro power, which is defined as electrical generation capacity up to 100 kw. (NPC 1994). Admist the huge potentiality of hydro power development Nepal, at present, suffers from the substantial energy shortage in the face of growing demand for it on the one hand and on the other, consumers have been suffering from price hike of power.

Table 1
Structure Of Energy Consumption

(000 ton of oil equivalent)

Energy Type	1985/86	1990/91	1994/95	1995/96	1996/97
Traditional Total	5393.2	5773.5	5937.0	6096.0	6224.1
Fuel wood	4304.0	4569.8	5324.4	5467.3	5582.2
Agriculture Residue	619.7	666.7	227.8	233.9	238.8
Animal Waste	469.5	537.0	384.8	394.8	403.1
Commercial Total	233.9	344.7	552.9	665.8	743.0
Coal	31.5	39.3	66.6	72.4	160.0
Petro Products	171.9	251.8	410.3	513.0	515.0
Electricity	30.5	49.1	65.5	69.9	68.0
Others	-	4.5	10.5	10.	0.0
Total	5627.1	6118.2	6489.9	6761.8	6967.1

Source: CBS, *Statistical Pocket Book Nepal, 1998.*

Table 1 shows that energy consumption is largely dominated by traditional energy such as fuel wood, agricultural residue and animal waste. This sector comprises more than 90 percent of the total energy consumption in the country for most of the years during 1985/86 to 1996/97. This implies that only 10 percent and less demand is met by commercial energy. Of the traditional energy fuel wood in 1985/86 occupied 79.8 percent, which in 1990/91 declined slightly to 79.1 percent of the total energy consumption in the country. This percentage share rose again to 89.7 in 1996/97 revealing that dependency on the fuel wood has not decreased ever since. This is also demonstrated by the growth rates of fuel wood which accounted for 2.4 percent against growth rate of

traditional energy which grew at 1.3 percent during 1985/86 to 1996/97 period. This is so because of the fact that alternative energy supplied in the economy are either expensive or have yet to develop in the rural areas which can match to the needs and income level of the people. Secondly, fuel wood is supplied free of price, although they have to devote lot of time to collect fuel wood. Since there is evidence of heavy disguised unemployment in the rural and agricultural sector such time seems to claim little value, because marginal productivity of such labour is either zero or even negative. The other traditional energy such as agricultural residue and animal wastes can be used instead of firewood but they are more pollutant. Further, these practices have massive adverse effects on fertility of agricultural land due to deficiency in organic manure and soil nutrients. Besides commercial energy like kerosene can be used by the semi urban people and increasing use of such energy can further deteriorate the balance of payment of the country. Electricity is an important energy among commercial energy since it is home made. However, electricity consumption grew at only 7.6 percent per annum against 10.5 percent of the growth rate of petro products during 1989/90 to 1996/97. Electricity from micro hydro can be alternative energy so as to reduce heavy dependency on fuel wood in the urban and semi urban areas, so that cutting more trees for the purpose of fuel wood could be reduced. However, current position of electricity is extremely poor. It is shown in Table 1 that percentage share of electricity in the total energy consumption of Nepal is less than one percent and its percentage share in commercial energy accounted for 9.1 percent in 1996/97.

Table 2
Electricity Consumption And Production 1993/94-1996/97

Consumption Type	1970/71	1975/78	1980/81	1985/86	1990/91	1995/96	1996/97
Total Electricity Power Consumption (MWH)					834025	1172373	1235730
Domestic Consumption	43867	76717	111047	172092	261399	333704	352234
Industrial Consumption	725	1487	2850	121530	206881	358443	376465
Commercial Consumption	30	103	84	19359	36640	62482	67400
Others	432	677	308	10314	99260	106899	114284
Total	45054	78984	114289	323595	604180	861528	910383
Loss					229845	310845	325347
Total Production (MWH)					868880	1192293	1206325
Hydro Generation					867872	1153620	1166596
Diesel Generation					818	38673	39729
Others (solar, wind)					190	-	-

Source: CBS, *Statistical Pocket Book Nepal*, 1984, 1990, 1994, 1996 and 1998.

Table 2 presents electricity generation totalled 1.206 million MWH, while 1.235 million MWH were consumed in the country in 1996/97 showing that 29.405 thousand MWH deficit in electricity balance sheet. However, it has shown the surpluses for the years 1995/96 and 1990/91. The production side shows that hydro electricity generation is the major type of electricity produced in the country, accounting for more than 95 percent. The rest five percent and less are generated through diesel plants. On the consumption side domestic consumption occupies a lion's share in the total consumption of the electricity. As shown in Table 2, domestic consumption of electricity accounted for more than 97 percent from 1970/71 to 1980/81, only in 1985/86 it declined to 53.2 and further to 43.3 in 1990/91 and to 38.7 in 1996/97. Nepal met some of its demand from imports of electricity and exported some of power to India. Besides, it imported largely petro-products and coals from abroad.

Table 3
Domestic Sector Energy Consumption
(000 ton of oil equivalent)

Energy Type	1991/92	1993/94	1994/95	1995/96	1996/97
Traditional Total	5764.5	5812.0	5819.6	5970.5	6095.9
Fuel wood	4540.0	4316.2	5211.9	5347.0	5459.3
Agriculture Residue	679.5	960.7	222.9	228.7	233.5
Animal Waste	545.0	535.1	384.8	394.8	403.1
Commercial Total	88.5	127.3	135.2	189.6	171.3
Coal	0.0	0.3	0.3	0.4	0.8
Petro Products	65.5	103.8	108.8	161.1	144.2
Electricity	23.0	23.2	26.1	28.1	26.3
Total	5853.0	5939.3	5954.8	6160.1	6267.2

Source: CBS, *Statistical Pocket Book Nepal*, 1998.

Table 3 shows that traditional energy has dominance in domestic sector of Nepal accounting for 97 percent to 99 percent of total energy consumption in the country during 1990/91 to 1996/97. The simple reason behind this is that rural areas dominates the economy and only energy so far available in these areas is traditional fuel. This trend seems to be continue to the years to come. The major contributors in the traditional energy is fuel wood which comprised of 74 percent to about 90 percent of the total traditional energy consumption in 1993/94 and 1996/97 respectively. Besides, agricultural residue and animal waste are traditional energy used in rural Nepal. The former is consumed both in rural areas of

hills and tarai while the latter is used largely in tarai. Table 5 also highlights this fact.

Table 4
Industrial Sector Energy Consumption
(000 ton of oil equivalent)

Energy Type	1991/92	1993/94	1994/95	1995/96	1996/97
Traditional Total	58.6	171.8	81.7	87.4	89.2
Fuel wood	52.3	164.8	77.	82.5	84.2
Agriculture Residue	6.3	7.0	4.6	4.9	5.0
Animal Waste	0.0	0.0	0.0	-	-
Commercial Total	81.3	119.5	126.7	210.8	307.8
Coal	42.1	54.5	59.2	61.0	134.8
Petro Products	8.8	29.1	29.3	109.3	144.2
Electricity	21.0	25.7	27.7	30.0	28.8
Others	9.4	10.2	10.5	10.5	0.0
Total	139.9	261.3	208.4	298.2	397.0

Source: CBS, *Statistical Pocket Book Nepal*, 1998.

Energy consumption in industrial sector, which is conventionally regarded as an indicator of economic development, is presented in Table 4. The share of commercial energy in this sector accounted for 41 percent in 1993/94 to 77 percent in 1996/97. However, further diagnosis shows that about 91 percent of commercial energy used by this sector comprises imported petro-products and coal. This implies that only 9 percent demand is met by electricity and other commercial energy sources. This shows that industrial development in Nepal is highly dependent on imported fuel and therefore, influenced by ups and downs in the fuel prices in the international market.

Higher percentage weighted on fuel wood is further presented by Table 5. Accordingly, per capita annual rural household fuel consumption accounted for 708 Kgs. in mountain and 689 Kgs. in tarai. The fuel wood alone accounted for 640 Kgs. and 479 Kgs. in mountain and tarai respectively. This further reveals that fuel wood is equally important energy for all rural people. The consumption of fuel wood, however, is slightly lower in the case of tarai compared to mountain, which is understandable that animal wastes like cow dung are used in tarai Nepal.

Table 5
Per capita Annual Rural Household Fuel Consumption
 (in Kgs.)

Energy Type	Nepal
Mountain Total	708
Fuel wood	640
Agriculture Residue	96
Dung	0
Tarai Total	689
Fuel wood	479
Agriculture Residue	63
Dung	171

Source: WECS, *Perspective Energy Plan, Supporting Doc 2, 1995.*

The projected Table 6 shows that the supply of biomass fuel will be totalled 12144 thousands kg. in 2000/01 and 15507 thousands kg. in 2010/11. But the fuel wood production was estimated at about 7.5 million tons in 1992/93 of which 5 million tons were obtained from the forest and the rest from on farm and other sources (NPC 1994). The energy needs of the country will approximately double by that time indicating higher energy deficits. The deficits will be met by cutting additional trees from the forrest.. As the access to fuel wood become difficult, people are compeled to increase the use of agricultural residue and dung which in turn reduces the supply of natural agricultural manure and nutrients. That will lead further reduction in agricultural production in the country. Due to deforestation more top soil will be washed off by flood, which further contributes in reducing agricultural productivity and environment degradation. This eventually will lead the economy to the further deteriorating situation in the country. This remained one of the reason why agricultural production could not be increased in the past too.

Table 6
Projected Biomass Fuel Supply

(in 000 Kgs.)

Source	Year 2000-01	Year 2010-11
Fuel Wood	9221	12212
Natural Forest	3756	4285
Shrub Lands	351	402
Plantation	1420	2657
Tree Farms	3694	4868
Dung	1310	1390
Agriculture Residue	1613	1905
Total	12144	15507

Source: WECS, *Perspective Energy Plan, Supporting Doc 2, 1995.*

ENERGY AND THE ECONOMY

World Bank describes that the links between energy and the rest of economy are strong and intimate. Because investments in energy compete with those in other sectors for scarce resources on the one hand. And on the other, decisions on them cannot be taken without considering how they interrelate with policies and trends elsewhere in the economy (WB 1985). It is both output and input, output of the investments in energy sector is an important input for other sectors of the economy and one has, therefore, to make investments in energy development to develop other sectors of the economy.

The relationship between economic growth measured in term of GDP is crystal clear since the production is the function of land, labour, capital, entrepreneur and largely of technological change which in turn substantially depends on the use of commercial energy. Because an increase in productivity depends on technological change which necessarily demands substantial amount of commercial energy in use. The average annual growth of GNP was 2.3 percent during 1974/75 to 1996/97 period at constant prices of 1974/75 and the population growth rate was 2.32 percent for the same period. The same growth rates of GNP and population in the country obviously indicates that living standard of people remained almost stagnant during the same period. The experiences show that low standard of living of the people and low level consumption of commercial energy live together since low purchasing power of people does hardly allow them to switch off their consumption from traditional to commercial energy. It is hence, there is two way traffic since GDP growth cannot be accomplished without technological change which requires increasing use of energy. For

this reason an increase in such energy is associated with GDP growth without which living standard of people can increase hardly. On the other, only with an increase in per capita income domestic sector can increase the demand for commercial energy. It is thus with industrialization in the country, the per capita consumption of commercial energy increases. It indicates transformation of an economy from agriculture to other sectors. Even in agricultural sector traditional farming system can be transformed into modern farming system using power tillers and other equipments. All these transformations in an economy demand the more and more use of commercial energy instead of traditional energy. As aforesaid, the demand for commercial energy is largely linked with increase in income of households because of the fact that such energy are expensive for domestic use. In the initial stage, the consumption of energy, therefore, increases with the increase in income. The low per capita consumption of commercial energy in Nepal presented above clearly reveals that the country has yet to transform its economy.

The increase in commercial energy use has many implications for a country like Nepal. One of such implications is preservation and renewal of biomass energy sources such as forest. The deforestation and desertification in the country at large reduce the supply of biomass energy which remained traditionally major energy consumed in the country. Since the hydro power is both expensive and in short supply, which is well understandable that why electricity is less consumed by common people, and petro-products are imported expensive energy, majority people have to depend on the traditional energy like fuel wood for their domestic use. Moreover, even cottage and rural industries also have to depend on traditional fuel. Therefore, any efforts to accelerate economic growth of the country should take care of sustainable development of such biomass energy. In this light rapid degradation of forest and depletion of environment in the country should be the major concern to the planners.

Imported petro-products can be burden for balance of payment since it takes large amount of foreign currency earned from export trade. In 1888/89 the percentage share of Nepal's import of mineral fuel and lubricants on total export value was 26 percent while this percentage share has gone up to 28 percent in 1995/96. This shows that larger component of export earnings used to be spent for import of petro-products in the country.

All the gender issues that raised in the energy sector are closely associated with the failure of understanding this relationship by the society. It is all women in a family who take the responsibility of cooking, washing, and cleaning job. Therefore, a woman is the sole manager and

user of the energy in the rural areas. It is she who has to collect fuel energy for household. Generally, most of her time is spent in collecting energy for cooking. The farther the energy collecting place from the village, the greater is the time spend on it. The greater the time spent by women in collecting energy the less time is left for productive works.

The economic growth of the country is also positively associated with the health of people. The ways how people use energy affect largely the health of people in the country. Smoke from the stove can cause the health problem to women and other family members. The traditional stove in the house consume more fuel and time and emit more smoke. It is for this reason that about half of the country's labour force is engaged for household works and thereby lessening speed of economic growth. The solution of energy problem is itself essential for economic growth as it increases the supply of labour force for productive works by two reasons: one is through increase in labour force and another is through improvement in the health of women and other family members.

CONCLUSION

Economic growth and development in the past were largely influenced by the consumption of commercial energy in Nepal. However, such consumption were constrained by the price and supply of energy in the economy which substantially adversely affected the productivity and growth of Nepalese economy. It is evident from the oil price rise of 1970s which had brought substantial negative impact to many economies based on imported oil. Developing poor economies like Nepal were among the hard hit. International market price for many commodities had gone up and even chemical fertilizer become expensive which, in turn, had reduced the agricultural production in Nepal and other economies. In short, Nepal experiences the rise in cost of production withing the country with the increase in oil price in the international market. The ways out from such situation can only be the development of the hydro power in the country and replacement of petro-products by electricity in the industrial and commercial sector. Besides, micro hydro power development strategy can be applied especially in rural Nepal. Given the sparsely scattered settlement in rural Nepal micro hydro power development seems appropriate. The former would lead to more favourable balance of payments since development of the hydro power would reduce the import of petro-products. The latter would lead to the reduction of deforestation. This will raise the agricultural productivity gthrough conservation of soil. In addition, such supply of electricity can be used for raising the income of the rural farmers through pumping irrigation water, drying crops and grinding grains.

The domestic sector in the urban sector purchases electricity and demand for it can be increased but, the present predominance of traditional fuel in the years to come seems to be continued given the household settlement and income level of the rural people. It is thus proper management of forest resource occupies an important place in solving the energy needs of rural people, and thereby contributing national economy. Ninth Plan estimate shows that annual fuel wood consumption will be about 1.47 tons crore during plan period. Of which about 51 percent and about 20 percent are expected to come from forest resource and agriculture sector respectively. (NPC 1998). This also shows that importance of fuel wood energy in Nepalese economy.

In short, appropriate strategy of the power development in Nepal is mixed of both traditional and commercial energy. To meet the increased demand for fuel wood from rural areas, more plantation of trees and conservation of the forest should be encouraged. Besides, commercial energy like micro hydro should be developed to meet the rural demand for energy. But to meet demand of industrial sector the development of hydro power is only choice so far.

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