Wood as a Source of Energy in Pakistan (Current Situation and Future Prospects)

K.M. Siddiqui, *Director General, Pakistan Forest Institute, Peshawar.*

Abstract

There is high dependence on fuelwood for domestic energy in Pakistan and a majority of population especially in the rural areas depends upon it. The estimates of annual demand are very high and most of it is met from tree grown on farmlands and waste lands; government forests contributing only a small proportion of wood energy. The price of fuelwood has risen continuously over the years due ot acute scarcity of the resource. This situation is expected to continue in near future. In order to plan for future fuelwood supplies, data base should be developed through periodic surveys throughout the country. Further, there may be increasing pressure in coming years for conservative use of fuelwood through adoption of ecient cookstoves and its replacement with more ecient and economic fuels to improve environment.

Introduction

Wood is the oldest fuel known to man. Since times immemorial it has been meeting energy needs for such domestic activities as cooking of food and space heating. Until the middle of the ninteenth century, wood was the sole or principal source of domestic and industrial energy all the world over. However, the use of wood as fuel has been steadily replaced by cheaper, more ecient and more convenient sources of energy such as fossil fuels and electricity in the developed countries. In developing countries the process of replacement of fuelwood is still in initial stages and wood continues to be the dominant fuel for domestic cooking and heating. According to FAO estimates about 80% of wood removed all over the world is used as fuel in developing countries and a large majority of rural people and urban poor depends upon it for providing domestic energy. After 1973 energy crisis, there was considerable international concern about the plight of these people and shortages of fuelwood were high-lighted. Almost all developing countries started programmes of energy plantations with the assistance of foreign donor agencies which are continued to-date.

Pakistan has very small forest resource as forests cover only about 4.8% of its total land area and only about one half of these forests are productive in which timber and fuelwood can be harvested on sustained basis. Although foresters' community has been advocating development and extension of forestry in the country since independence to meet growing needs of fuelwood and timber, still, nothing substantial was done in this regards till late seventies. Initial planning for establishment of energy plantations on the farmers' lands through farm/social forestry programmes was done in early eighties and a number of projects were launched by the federal and provincial forest departments in mid eighties to promote tree growth on private lands for meeting fuelwood needs of the people.

Data Base Development

At present reliable country-wide data on production and consumption of fuelwood is lacking. Wood is produced on state-owned forests, private farmlands and waste lands. No data are available for wood production on farmlands and waste lands which are estimated to meet 90% of the total requirements of fuelwood. The records on production of fuelwood on state-owned forests are also very sketchy. A substantial quantity of fuelwood is collected by forest right holders which goes un-recorded. Similarly biomass generated during harvesting operations is also consumed as fuel but it is not recorded. It is generally believed that reported production from state forests is only a fraction of their total production.

In the past some attempts were made to collect this information. The Housing Census of 1980 showed that 70% households in Pakistan use wood as the principal fuel for domestic cooking. The household distribution according to fuel used for cooking in urban and rural areas is as follows:

Cooking fuel	*Urban Areas (%)*	*Rural Areas (%)*
Wood	55	76
Coal	1	—
Kerosine oil	16	1
Gas	17	—
Electricity	—	—
Cow dung and crop residues	11	23
	100	100

Earlier, the Directorate General of New and Renewable Energy Resources conducted a survey in 1974-75 to estimate the fuelwood consumption in the country. This survey reported total consumption in the country at 10.9 million tonnes and per capita consumption at 156 kg of fuelwood. Another study was conducted by the same agency in 1983-84. It found per capita consumption of firewood at 114 kg in urban areas and 142 kg in the rural areas of irrigated plains, 147 kg in sub-mountainous (rural) and 447 kg in hill tracts, A number of surveys on fuelwood supply and demand were also conducted by the Pakistan Forest Institute in recent years. In one of such survey the per capita consumption in barani areas was found to be 321 kg. The details of other surveys are given below:

(i.) Household energy survey:

This survey was conducted in Kohat district of NWFP and in Rawalpindi, Sialkot and Khushab districts in the Punjab province in 1988-89. The data showed that 64.4% of the house hold energy was obtained from fuelwood, 0.6% from liquified petroleum gas, 0.4% from kerosine and 34.0% from dung. Only 53% of the total fuelwood demand was met from trees growing on farm lands while the designated forest areas provided remaining 47% of the requirement of the study area. It was also found that about 12% of the income was spent on fuel consumption. Per capita consumption of fuelwood was found to be 0.4 m^3 in this survey. It also showed the following fuel consumption pattern on household basis:

Fuelwood	40.3%
Fuelwood and dung	35.3%
Dung only	8.0%
Kerosine	1.9%
L P G	1.9%
Mixed fuel	12.6%

(ii.) Farm land tree growth survey:

An inventory of tree growth on farmlands of Pakistan is being carried out under a special project. It consists of determination of number of trees growing on the farmland and their species and size classification as well as total wood growing stock and its annual removals. The data would provide reliable estimates of wood supply and demand situation in different regions of Pakistan upon the completion of the survey in 3 years time. However, for the present, the data for Peshawar region and Sialkot and D.I. Khan districts are presented in Table 1 for comparison of wood supply and demand situation in them.

Peshawar valley consists of Peshawar and Mardan civil divisions and has a very high population density as compared to Sialkot and D.I. Khan districts. The cultivated area in Peshawar valley is smaller than that in Sialkot, but, it has a large number of trees growing on the farmlands. However, all three areas exhibit large wood deficits; D.I Khan district showing least deficit because of its low population density, and large cultivated area, which is mostly barani with small number of trees on unit area basis of the farmlands. Further, in a region like Peshawar if some wood is exported to other regions for the manufacture of industrial products e.g. sports goods, matches and plywood , then a large quantity of fuelwood has also to be brought into this region to meet fuelwood requirement of the local people as shown in the table 2.

Table 1.
Yearly wood balance for selected districts areas

Demand	Peshawar Valley	Sialkot	D.I. Khan
Projected population 1990 (000)	4948	3537	829
Per capita fuelwood consumption (m^3)	0.337	0.217	0.296
Total fuelwood consumption (000 m^3)	1667	768	245
Timber consumption @ (0.025 m^3)/capita (000 m^3)	124	88	21
Total timber and fuelwood consumption (000 m^3)	1791	856	266
Supply			
Estimated growing stock/ha (m^3)	6.6	2.9	4.4
Cultivated area (000 ha)	398	442	301
Total growing stock (000 m^3)	2627	1282	1324
Number of trees/ha	66	18	18
Number of trees felled per ha	15	N.A.	1
Estimated volume felled/ha	3.0	N.A.	0.41
Total volume removed (000 m^3)	1194	128*	123
BALANCE (000 M^3)	—597	(—) 728	(—) 143

* Estimated at 10% of the growing stock

Table 2.
Outflow and inflow of wood in Peshawar valley.

Year	Outflow m^3	Inflow m^3
1985	23,752	64,998
1986	21,107	121,365
1987	24,844	85,140
1988	20,335	128,304
1989	19,340	95,976

Outflow figures include Willows, Mulberry and Shisham wood, besides poplar wood.

Current situation

There is no doubt that the dependence on fuelwood for domestic cooking and heating is quite high in Pakistan, especially in rural areas. About 70 million people partially or wholly depend upon fuelwood for their domestic energy needs. The per capita domestic energy needs vary with climatic conditions, income level, cooking habits, availability of fuels, and other social and cultural factors. According to a World Bank Survey, the average per capita domestic energy requirements in Pakistan are equal to 0.4 m^3 of firewood corresponding to 4 million kilo jouls of energy. On this basis, for an estimated population of 107.04 million in 1988-89, the total domestic energy requirement works out to be equivalent to 42.8 million m^3 of fuelwood which corresponds to 428 million million kilo jouls. However, on account of acute scarcity of fuelwood, it caters for only 50% of the total requirements and the rest 50% are met by alternative fuels. The fuel consumption pattern is shown in Table 3 below.

Table 3
Fuelwood consumption pattern in Pakistan, 1988-89.

Fuel type	Unit	Quantity	Fuelwood equivalent (Million m^3	% of total
Fossil fuels				
Natural Gas	Million cft	51,278	5.24	12.2
Kerosene	tonnes	971,037	4.37	10.2
Coal	tonnes	14,900	0.03	0.1
				22.5
Non-commercial				
Fuelwood	Million m^3	21,408	21.48	50.0
Animal and agriculture waste	—	—	11.77	27.5
			42.89	100.0

1 million cft of natural gas = 102.2 m^3 of fuelwood

1 tonne of kerosene oil = 4.5 m^3 of fuelwood

It will be seen from the above data that non-commercial fuels cater to 77.5% of the requirements and the commercial fuels for the balance 22.5%. Amongst non-commercial fuels, fuelwood accounts for 50% of the requirements. Further, in 1988-89, Pakistan consumed 971,037 tonnes of kerosene oil in household sector. Of this, 614,028 tonnes were imported at a total cost of Rs. 1848.7 million.

Country-wide Fuelwood Supplies and Demand

There are two main sources of fuelwood supplies in the country viz, state-controlled forests and the farmlands. State forests, which cover only 4.8% (4.176 million ha) of the total land area, produce a limited quantity of firewood. The recorded production of firewood from these forests in 1988-89 was only 0.3 million m^3. However, people living around forested areas have rights to collect dead and fallen trees as well as the bio-mass generated during conversion process for use as fuelwood. It is estimated that 10% of the total fuelwood consumed is supplied by state controlled forests and the rest 90% by the farm lands. Thus in 1988-89 state controlled forests supplied about 2.1 million m^3 of fuelwood and the farmlands 19.3 million m^3.

At the current rate of population growth of 3%, it is expected to increase from 107.00 million in 1988-89 to 148.2 million in year 2000. Further, assuming that the

per capita consumption of fuelwood remains steady at 0.2 m^3, total consumption of fuelwood in 2000 is projected at 29.6 million m^3. If the supplies remain at their present level of 21.4 million m^3, the gap between demand and supply in year 2000 will be of the order of 8.2 million m^3.

Fuelwood Prices and Scarcity

Because of the existence of a large subsistence and non-monetized sector, fuelwood has been and continues to be mostly a non-traded commodity in rural areas of Pakistan. Only a fraction of fuelwood supplies passes through market channels. However, with rapid growth in population, the pressure on fuelwood resources has been mounting. As a result, the scarcity of fuelwood has been accentuating leading to sharp increase in its prices.

The retail price of fuelwood has increased in real terms at the rate of 1.2% per annum between 1956-57 and 1988-89. This brings out the fact that in relation to other commodities fuelwood has become a more scarce and valuable commodity in 1988-89 than in 1956-57. The increase in the scarcity of fuelwood has adversely affected the welfare of the urban poor. They are forced either to cut down on the consumption of fuelwood or divert expenditure from other items to fuelwood. In either case, it has negative effect on their well-being.

In rural areas where it is a non-tradeable commodity its scarcity is leading to accelerated depletion of the tree and vegetation resource. Trees are cut far in excess of replanting causing depletion of the resource. In some hilly catchment areas, the land has been cleared of all vegetation. The social cost of removal of trees for firewood is very heavy. It results in soil erosion which speeds up siltation of river dams and also adversely affects the productivity of the agricultural lands in the catchments. The living environment has also greatly deteriorated.

Wood Energy Prospects

Wood is most likely to continue to play a significant role in meeting domestic energy needs of the people in the foreseeable future. The future demand for wood will depend among other things on size of population, preferences of people, income levels, price of wood viz-a-viz price of the substitutes and efficiency in use of wood. With increase in income level people may shift from wood to other more convenient fuels. The scarcity of wood may force people to use it more efficiently. As a result, per capita consumption of wood may decline. But the rapid growth in population will offset these tendencies and wood consumption in absolute terms will expand.

As earlier stated, on the basis of assumption of steady level of per capita consumption of 0.2 m^3, the fuelwood consumption will increase to 29.6 million m^3 in year 2000 A.D. Even if 10% decline in per capita consumption is assumed, the total fuelwood demand will be in the order of 26.7 million m^3. However, wood substitution and conservation are likely to take place in urban areas only and no marked changes in fuel consumption pattern in rural areas are expected.

The future supplies of wood will largely depend upon the magnitude of investment made in the fuelwood production. With presently known technology it is possible to produce 15-30 m^3 of wood per ha per year depending upon species and soil productivity. Land is available in sufficient quantity and the only constraint is the water. About 10 million ha of cultivable land are lying waste. In moist zone fuelwood plantations can be established favourably. In that case the constraint is the availablity of funds for investment. Given sufficient funds, fuelwood production can be increased substantially. Massive scope exists for expanding tree growth on farmlands in the barani areas.

Wood has the potential to produce electricity and liquid fuels and thus replace commercial fuels. Technical knowhow is available to run power stations on wood to produce electricity. Similarly wood can be converted into liquid fuels to run vehicles. Wood can also be upgraded as a fuel and some of the industries can be operated with it. The economic feasibility of these opportunities is not yet fully established. But the possibility cannot be ruled out in the long run.

Future Strategy

In order to meet the projected increase in demand for fuelwood it is essential to evolve an effective strategy for wood energy development. The main elements of this strategy will be the following.

- Improvement in productivity of existing forests
- Creation of new fuelwood resources
- Conservation in fuelwood consumption

The improvement in the productivity of existing forests would ameliorate the shortages of fuelwood in those areas only which are in their immediate vicinity without making any significant impact on national situation. On the other hand, creation of new fuelwood resources through social/farm forestry programmes would be quite helpful in this regards. Further, although

number of attempts were made in the past to conserve fuelwood consumption through introduction of efficient cookstoves, still, no headway could be made due to technical and social-economic aspects of the problem.

Environmental Aspects

There is a world-wide concern about increasing production of carbon dioxide gas by burning of fuelwood and fossil fuels for energy and its impact on the environmental warming by its greenhouse effect. About 40% of carbon dioxide entering the atmosphere comes from the burning of fuelwood for domestic energy and of forests for clearing land for agriculture in the developing countries. Therefore, presently, there is less emphasis on fuelwood production and more on forest conservation by the international organizations. In Pakistan with small forests area, many forested areas are threatened with extinction within next decade or two due to heavy pressure of fuelwood collection by people living in their vicinity. Under the circumstances, inspite of fact that fuelwood would continue to be in high demand as a principal source of domestic energy, increasing attention will have to be paid in the coming years to its conservative use through efficient cook stoves, its substitution with more efficient and economic fuels, and the promotion of forests and tree cover all over the country.

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