MARKETING OF WOOD FUELS IN PESHAWAR CITY

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INTRODUCTION

In most Asian countries, the rural population mainly depends upon non-commercial fuels to meet its domestic energy needs. They do not purchase any fuel from the market as fuelwood is a non-tradeable commodity in rural areas. The land owners obtain its supplies from their farmlands and other people collect it as a free good from the wastelands and public forests. But the situation in urban areas is altogether different. Here people purchase all fuels from the market to meet their domestic energy needs. They mostly use commercial fuels such as natural gas, kerosine oil and liquified petroleum gas (LPG). Those who use fuelwood and charcoal, they also purchase it from the market. Thus in strict commercial sense a market for woodfuels exists only in urban areas. Each urban center has a number of firewood sales depots which sell fuelwood to the consumers. In some cases the firewood sales depots also sell charcoal.

A number of people are employed in marketing of woodfuels as wholesalers, retailers and ordinary workers. Although marketing of woodfuels in urban areas is an activity of sizeable proportion, very little information is available about it. Perhaps it is attributable to the fact that woodfuels fall in the informal sector of the economy. Because of numerous difficulties in collection of data from informal sector, the statistical organizations usually do not cover it. However, the data on woodfuel markets has assumed added importance in recent years in the wake of implementation of large scale social forestry programmes. As a result of these programmes,

fuelwood production has increased substantially in rural areas. Some areas have even become surplus in fuelwood production. Future planning of these programmes must take into account changes in the urban fuelwood markets. Price and consumption trends in fuelwood and charcoal in urban markets have crucial implications for fuelwood production programmes. A declining consumption trend does not augur well for these programmes. The success of these programmes depends to a large extent on the retention and expansion of the urban woodfuel markets. Taking cognizance of the importance of information on woodfuel markets, the Regional Wood Energy Development Programme for Asia Pacific Region of FAO, initiated a series of micro-level studies in major urban centers of Asia Pacific Region. As a part of this series, a study on marketing of woodfuels in Peshawar city of Pakistan was undertaken. This study focuses on total size of fuel market, fuel consumption pattern, market demand for woodfuels, marketing channels, infrastructure and operating environment of woodfuel marketing.

National Energy Situation

The main characteristic features of national energy situation in Pakistan are:

- Low per capita energy consumption; in 1990-91 the per capita energy consumption was 11.45 million kj.

- Rapid growth in national energy consumption; it increased by 68% during eighties and reached the level

29.2 million TOEs in 1990-91; annual growth rate 4.3%.

- Increasing reliance on commercial fuels, share of commercial fuels has increased from 62% in 1980-81 to 74% in 1990-91.

- Heavy reliance on imports; imports of oil and petroleum products was 8.4 million tonnes on 1990-91 costing 37 billion rupees.

- Declining role of woodfuels which accounted for 15% of national energy consumption in 1990-91, against 21.6% in 1980-81.

Woodfuels find their use mainly in household sector to meet domestic energy needs for cooking and heating. Its consumption was estimated at 16.8 million m³ in 1980-81 which increased by 16% to 19.4 million m³ in 1999091 reflecting a growth rate of 1.5% per annum. In contrast the consumption of gas of kerosine oil in household energy sector increased at an annual rate of 14.2% and 5.5% respectively during the same period. Gas and kerosene are mainly used in urban areas, and are replacing woodfuel in them. However, increase in fuelwood consumption is taking place in rural areas. In urban areas, the demand for wood is either static or declining. Ideally, in the present situation, woodfuels can replace gas and kerosene. It can release gas for more productive alternative uses and do away with imports of kerosene costing about 3.3 billion rupees per annum which will lessen the burden on balance of payments.

Plan of Work

In order to carry out the study, recourse had to be placed mainly on primary data collection because requisite data were not available from secondary sources. On the demand side, to collect data on fuel consumption and fuel consumption pattern in the household sector, a sample survey of randomly selected households was undertaken. This survey focused on collection of data about household size, income level and fuel consumption pattern. Another sample survey was designed to collect information on fuel consumption pattern in commercial establishments. On the supply side, a sample survey was conducted of firewood sales depots to collect information on prices, sales and marketing outlook. The information on fuelwood inflow through railways was collected from the Railways department. The data on inflow of fuelwood through road transport were collected from the Forest Check Posts located on various entry points to the city. The data on city population was collected from different census reports. The data were processed at computer using Lotus 1-2-3 package. The analysis mainly focused on descriptive statistics. However, where necessary certain hypotheses were also tested and a model involving relationship of per capita energy consumption to household size, income level of household, and fuel type used was also developed.

Historical Perspective

Wood and charcoal have been traditional fuels for cooking of food and heating of rooms in winter in Peshawar city. In the early fifties these were the only fuels used by the Peshawarities. The commercial establishments such as restaurants, bakeries and ovens and traditional "Kebab" shops also used woodfuels. The situation began to change in sixties when kerosene stoves were introduced and people began to switch over to them. The displacement of traditional woodfuels received further impetus in mid-seventies when natural gas was supplied to the city. As a result of

these changes, the woodfuels have yielded to the more convenient commercial fuels. The supply of gas has especially quickened the replacement of woodfuels. A large number of households as well as commercial establishments have switched over to gas.

The survey of households in Peshawar city carried out in 1992 for the present study reveals the following pattern.

Cooking fuel	% of households in Peshawar city
Wood	13.4
Charcoal	-
Kerosene	33.8
Liquified petroleum gas	7.8
Gas	38.7
Dung	6.3
Total:	100.00

The dependence on kerosene and gas has evidently increased over last 3 decades. One reason, inter alia, for this trend is the comparative 'cheapness' of kerosene and gas. The prices of kerosene and gas are controlled by the Government whereas firewood prices are determined by the open market.

Factors affecting choice of fuel type

The choice of fuel type used by a household is mostly influenced by income level of household. Households with high income level use either gas or liquified petroleum gas.

The percentage of gas using households in this group is 86% and another 12% households use liquified petroleum gas. In the middle income level group, the percentage of households using gas drops to 76%, and those using kerosene increases to 15% and of fuelwood to 4%. In the lower income group,the percentage of households using gas drops to 40% and of kerosene users increases to 30%,and of fuelwood users to 16%. The relationship is brought out in the following table.

Table 1. Household income level and choice of fuel type.

Fuel type for cooking	High income households (%)	Middle income households (%)	Low income households (%)
Wood	-	4	16
Charcoal	-	-	2
Kerosene	2	15	30
Liquified Petroleum gas	12	3	2
Gas	86	76	40
Dung	-	2	10
Total:	100	100	100

Per capita energy consumption in household sector

The annual per capita energy consumption in household sector of Peshawar city (excluding electricity) is estimated at 4.578 million kj (95% confidence limits 4.090 - 5.066 million kj). However, it varies significantly with the level of household income, household size, fuel type used for cooking, and the availability of gas in the

locality. Further, there is a moderate association between the annual per capita energy consumption and the level of household income. The households with high level of income tend to have higher annual per capita energy consumption compared to households with medium and low level of income. It is perhaps due to income effect i.e. consumers with higher income tend to consume relatively more of each of the commodities. The relationship is depicted in the following table.

Table 2. Household income level and annual per capita energy consumption

Income level	Average annual per capita energy consumption (million kj)
High	7.918
Medium	4.831
Low	4.163

As might be expected, the household size and annual per capita energy consumption are negatively correlated. The association is moderate (cramer's v = 0.19). It is attributable to economies of scale. The relationship is given in the following table.

Table 3. Household size and annual per capita energy consumption

Household size	Average annual per capita energy consumption (million kj)
1-3	8.121
4-6	6.133
7-9	5.475
10-12	4.231
13 +	4.166

Influence of fuel type

There is strong association between annual per capita energy consumption and the fuel used for cooking of food (cramer's V = 0.42). Households which use gas tend to have larger per capita consumption and the households using dung tend to have the smallest per capita consumption. The following table shows the relationship.

Table 4. Fuel type and annual per capita energy consumption

Fuel type	Average annual per capita energy consumption (million kj)
Gas	5.876
Wood	5.367
Kerosene	4.098
LPG	1.777
Dung	0.990

A multiple linear regression model was built up to relate annual per capita energy consumption to variables affecting it. The model is:

$$Y = 4960 + 1409 G + 1.402 E - 385 H - 901 K.$$

Where Y is per capita annual energy consumption in thousand kj, G is availability of gas in locality, E is total household expenditure

on fuel, H is the household size and K is the income level of the household. Three income levels were identified. High (1) if the household owns car, medium (2) if household owns TV set and refrigerator, and low (3) all other cases. The co-efficient of determination (R^2) is 0.655 which indicates that 65% variation in per capita energy consumption is accounted for by variation in these variables. Model is highly significant. The model bring out that other things being equal, per capita energy consumption is greater by 1409 thousand kj in localities with gas supply. An increase of one rupee in household expenditure on fuel results in increase of 1.402 thousand kj in per capita energy consumption. On the other hand, an increase of one member in household leads to a decline of 385 thousand kj in per capita energy consumption. Compared to high income households, per capita energy consumption is less by 901 thousand kj in medium income households and compared to medium income households, it is less by 901 thousand kj in low income households.

Household fuel expenditure

The average annual household fuel expenditure (excluding electricity) works out to 3526 rupees. However, it varies with the type of fuel used by the household. It is shown in the following table.

Table 5. Annual household fuel expenditure

Fuel type used	Annual household fuel expenditure	
	Rs.	US $
Wood	4636	185
Kerosine oil	4065	163
LPG	1198	48
Gas	3591	144
Dung	755	30
Weighted average	3526	141

1 US $ = 25 Pak rupees

Composition of energy consumption in household sector

Total consumption of delivered energy in the household sector (excluding electricity) in Peshawar city is estimated at 105,000 TOEs. This estimate is based on the proportion of city population using a given fuel material and the average per capita consumption of energy of that segment of population. Both the statistics

i.e. proportion of population and the average per capita consumption of delivered energy were derived from the sample survey of households. The following table gives the break up.

Table 6. Estimated annual consumption of delivered energy in households of Peshawar city

Fuel type	% of population using the fuel type (%)	Estimated population using the fuel in 1991 (000)	Average per capita consumption (million kj)	Total consumption (TOEs)[a]	% of each fuel type in total consumption (%)
Wood	13.4	136	5.367	16,456	15.7
Kerosene	33.8	343	4.098	31,899	30.4
LPG	7.8	79	1.777	3,160	3.0
Gas	38.7	392	5.876	52,136	49.6
Dung	6.3	64	0.990	1,408	1.3
Total	100	1014	4.578[b]	105,059	100

a 1 TOE = 44.2 million kj
b Weighted average

It is evident from the above data that kerosene and gas are the pre-dominant fuels used by the people of Peshawar city. These two fuels together account for 80% of total estimated consumption. Woodfuels account for 15.7% of total consumption. The remaining 4% is accounted for by LPG and cow dung. It may be emphasized here that consumption is in terms of delivered energy.

Since burning efficiency of different fuels varies between 0.2 and 0.7 the net energy consumption will be less than the delivered energy. The ratio of net energy to delivered energy for different fuels is different, therefore different fuels cannot be equated with each other on the basis of delivered energy. The quantities consumed of different fuels in conventional units are shown below:

Table 7. Quantities consumed of different fuels in conventional units

Fuel type	Unit	Quantity
Woodfuels	Tonnes	40,874
Kerosene	Tonnes	31,090
LGP	Tonnes	2,923
Gas	Million cft	2,228
Dung	Tonnes	7,129

Comparative prices of different fuels

The price of different fuels consumed by household sector shows that in terms of delivered energy, gas is the cheapest fuel and kerosine oil is the most expensive. This is brought out in the following table.

Table 8. Price of different fuels

Fuel type	Unit	Calrofic value kj/unit	Price Rs./ unit	Rs./million kj
Wood	Kg	17,800	1.37	76.95
Kerosene	Litre	38,338	3.78	98.58
LPG	Kg	47,811	4.36	91.21
Gas	m³	36,507	1.33	36.21
Dung	Kg	8,731	0.50	57.26

These price comparisons are, however, illusory because they do not take into account the burning efficiency of different fuels. For instance, the data in the table indicate that kerosene is more expensive than firewood. But the burning efficiency of kerosine oil is 3 times greater than fuelwood. Accordingly on the basis of net energy availability, kerosene is far cheaper than wood fuels. Similar is the case with LPG. Gas appears to be much cheaper than kerosene and firewood. However, this price does not include the capital cost portion of gas connection. There is a general feeling that the present price structure is encouraging substitution of fuelwood with gas and kerosene.

Future trend in market demand for woodfuels

The future trend in market demand for woodfuels in Peshawar city market will depend, inter alia, on rate of growth in city population, growth rate in gas connections, future structure of fuel prices, pattern of income distribution and availability of kerosene and LPG. It is extremely hazardous to make any forecast about these parameters. Past trends may not continue in the future. They are a poor guide in this respect. Moreover, in the absence of time series data, no econometric model can be built up. As an educated guess, it may be asserted that future demand for wood fuels will decline or remain static at best.

Energy consumption in commercial sector

The commercial sector also consumes a considerable amount of energy. The main establishments which use woodfuels or their substitutes (excluding electricity) are the following:

- Restaurants
- Tea bars
- Ovens
- Tikka shops
- Bakeries
- Barber shops

- Others

The others are milk shops, 'kebab' shops, sweet shops and 'pakora' shops. Except barber shops, all other establishments use energy fuels for cooking of food or making of tea. Barber shops use fuels for water heating in winter.

In the sampled area of 4 wards of Peshawar city out of total of 45 wards, there were 224 commercial units.

Of 224 commercial units in sampled area, 22% used wood, 5% charcoal, 8% kerosene and the rest 65% gas. The annual energy consumption of these units totalled 9 39.4

TOEs of which 54% was accounted for by ovens and 79% by gas. The wood accounted for only 17%.

The estimated population of sampled area is 106,000. This gives the per capita energy consumption in commercial sector at 0.0091 TOE or 0.404 million kj. On this basis, energy consumption in commercial sector of Peshawar city with estimated population of 10,14,000 works out to 9,227 TOEs. Assuming that composition of energy consumption in Peshawar city is the same as in sampled area, the distribution of energy consumption by fuel types is as shown in Table 9.

Table 9. Energy consumption by fuel type in commercial sector of Peshawar city

Fuel type	Energy consumption (TOEs)	Energy consumption in conventional units
Wood	1587	3725.00 tonnes
Charcoal	83	186.00 tonnes
Kerosene	286	280.00 tonnes
Gas	7271	311.00 million cft
Total	9227	-

Woodfuel consumption in Government sector

The Government sector consisting of civil and military establishments also consumes a considerable amount of energy fuels. It is mainly used for room heating in winter. Charcoal is the main fuel used. Enquiries made from the charcoal dealers reveal that about 2 - 3 thousand tonnes of charcoal is used in the Government sector annually.

Total market demand for woodfuels

The total annual demand for woodfuels in Peshawar city market is estimated at 44,600 tonnes of fuelwood and 3,500 tonnes of charcoal. Its sector-wise distribution is shown in the following table.

Table 10. Market demand for woodfuels by sector in Peshawar city

(Tonnes)

Woodfuel type	Households sector	Commercial sector	Government sector	Total
Wood	40874	3725	-	44599
Charcoal	300	186	3000	3486

Woodfuel supplies

The trade in woodfuels is roughly worth Rs.78 million (3.1 million US $) in Peshawar city market. The Peshawarities spend about 61 million rupees on fuelwood and Rs.17 million on charcoal annually.

The city has always depended for its fuelwood supplies on the mountaineous and sub-mountainours natural forests in adjoining tribal areas. The farmlands in the rural areas adjacent to Peshawar city also carry considerable tree growth and make a significant contribution to city's fuelwood supplies. The remaining short fall, if any, is met through imports from the Punjab province. As regards charcoal supplies, the city depends largely on imports from the Punjab province.

Table 11.   Distribution of fuelwood and charcoal supplies by source into Peshawar city in 1991

Sl. No.	Source	Firewood including wood waste	%	Charcoal	%
1.	Supplies from trial areas	22,370	50.2	-	-
2.	Imports from Punjab	7,230	16.2	3.500	100
3.	Local supply	15,000	33.6	-	-
	Total:	44,600	100	3.500	100

It is evident from the above data that Peshawar city market obtains 50% supplies of firewood from natural forests in tribal areas, 16% through imports from Punjab, and the remaining 34% from local sources. The firewood supplies from tribal areas consist of Oak, Kao (*Olea cuspidata*) and Phulai (*Acacia modesta*) whereas imports from Punjab mainly consist of Babul (*Acacia nilotica*) and Shisham (*Dalbergia sissoo*).

Basic Marketing Factors

The marketing system of woodfuels in Peshawar city market has evolved over a long period of time. Although working primarily in informal sector, it is well organized and performs the marketing functions in a reasonably efficient manner. The main ingredients of the marketing system are: the product, physical distribution system, marketing channels, price structure and the information system.

As against firewood, charcoal is a manufactured item. It has all the these mentioned attributes except that its stock turn over rate is relatively higher as it does not require any drying before its use.

Quality of product

Households and other consumers demand firewood not for its own sake but for the sake of its heat value. Therefore, the quality of the product is to be adjudged by its heat value. The calorific value of oven - dry wood is about 20,000 kj per kg. The chemical composition of woody substances is almost the same, therefore, there is little variation in the calorific value of different species of wood. Each kilogram of wood, regardless of species yields more or less the same amount of heat.

Marketing Channel

The role of middlemen is all the more important in the marketing of wood and charcoal for a number of factors. It operates in the informal sector where organized institutions like banks play little role. The number of producers is too large and each produces only a small amount. Production takes place in remote areas which are geographically far away from the consumption centres. The consumers are too large in number and are spread over large area. The product is purchased frequently and on regular basis. It necessitates wider distribution which is simply not possible without middlemen.

Prices

The firewood prices are affected by a large number of factors. Among these are; species, size of billets, rate of inflation production point and its distance from roadside, mode of transportation, freight charges, profit margins of whole salers and retailers. On the whole it is

the interaction of forces of supply and demand which determine the prices.

Charcoal prices

Charcoal is imported entirely from Punjab. The manufacturing cost of charcoal amounts to Rs.3300 per tonne. The manufacturer sells it at Rs.3600 per tonne. His mark up is about 9%. The transportation cost from point of production to Peshawar city averages Rs.500 per tonne. Thus wholesaler's cost price works out to Rs.4100. He sells to retailers at Rs.4400 per tonne. The retailer sells to the consumer at Rs.5/kg or Rs.5000/tonne. These prices relate to the first half of 1992.

Price trends

The prices received by the producer and the prices paid by the consumer have exhibited strongly upward trend in the eighties. The prices realized at auctions for shisham firewood at Changa Manga of middle class have increased at the rate of 6.6% per annum, of thick 10.4% and of selected at 9.5% per annum. The same trend is discernible in retail prices at Peshawar city. The prices of kikar firewood and of charcoal in the last 10 years gone up from Rs.27.10 in 1980-81 to Rs.47.94 per 40 kg in 1989-90. It shows annual growth rate of 6.5 percent. Likewise the price of charcoal has risen from Rs.75.73 in 1980-81 to 133.48 per 40 kg in 1989-90, showing annual growth rate of 6.6 percent. Inflation during 1990-91 and 1991-92 has been high and as a result prices in these years have risen much more rapidly.

CONCLUSIONS

Peshawar City with an estimated population of 10,14,000 is a big market for wood fuels. The choice of cooking fuel by a household is influenced by level of income,

availability of gas in the locality, education level of household head and occupation of household head. The use of wood as cooking fuel is positively associated with non-availability of gas in the locality, low level of household income, illiterate household heads, and households heads with labour as occupation. The household size has no influence on choice of cooking fuel.

In Peshawar City about 38% of households use gas for cooking, 33% use kerosene, 13% use wood, 8% use LP6, and 6% use cow dung. The per capita energy consumption is positively correlated with income level. High income group has per capita energy consumption 7.9 million kj compared to 4.1 million kj for low income group. Due to economics of scale, the per capita energy consumption is inversely related with household size. Households in size group 1-3, have per capita energy consumption of 8.1 million kj compared to 4.1 for households with 13 or more members and 4.2 million kj for households in size group 9-12.

There is strong association between per capita energy consumption level and fuel type used for cooking. Households using gas have per capita energy consumption of 5.9 million kj. followed by wood 5.4 million kj, kerosene 4.1 million kj, LP6 1.8 million kj and dung 0.9 million kj. Per capita energy consumption is 25% greater in localities with gas supply compared to other localities.

Total energy consumption for cooking and heating in households of Peshawar City is estimated at 105,000 TOES, of which wood contributes 16,476 TOES or 16% of total consumption. In conventional units wood consumption is 40,874 tonnes in households. The commercial establishments consume about 3725 tonnes of fuelwood. Thus total fuelwood consumption in Peshawar City works out to be

44,600 tonnes. Charcoal consumption is estimated at 3500 tonnes, of which 3000 tonnes is used in Government establishment 300 tonnes in households and 200 tonnes in commercial sector.

Woodfuels trade in Peshawar City is worth 78 million rupees. Wood supplies come from natural forests in tribal areas (50%), imports from Punjab (16%) and local production (34%). Local production includes wood waste generated at saw mills operating in hardwoods. The entire supplied of charcoal come from Punjab.

Main wood species are kao (*Olea cuspidata*) Phulai (*Acacia modesta*), Oak (*Qurcus*), Kikar (*Acacia nilotica*) and Shisham (*Dalbergia sissoo*). The first 3 species come from tribal areas, and the later from Punjab and local areas.

Fuelwood is a highly differentiated product. It is differentiated on the basis of species, size class, and moisture content. Middlemen i.e. local assemblers and retailers play important role in moving product from producer to the consumer. Prices of fuelwood have resen at the rate of 6.6% during 1980-90. It is in line with the rate of inflation.

Information on price trends, consumption trends and supplies trends need to be compiled on regular basis for the benefit, of traders. Woodfuels face price competition from gas and kerosene in Peshawar market. If prices of gas and kerosene stay low, demand for woodfuels will gradually peter out. Promotional measures are needed for retention and expansion of the market.

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