6. Characteristics of Energy Consumption by the Manufacturing Sector

This section will discuss the characteristics of energy consumption by 38 establishments on the basis of census data. The results reported are per establishment. An establishment consists of many firms.

Mean Energy Prices and Energy Budget Shares

Table 4 below presents the mean values of each energy price and energy type budget share, based on 38 manufacturing establishments, as reported in CME 1986-87.

The average unit price of energy borne by firms in the manufacturing establishment are presented in Table 4. The energy price standard deviations reported in Table 4 indicate that unit energy prices do vary across different industries. Under assumptions of perfect competition, prices across industries are expected to be the same. However, the variability can arise due to various factors. The variability, however, must be of a nature that prices are not influenced by internal decisions of the industry (i.e., price elasticity of demand for factors must be perfectly inelastic to individual firms). Price variability in perfectly competitive factor markets is caused by localised markets for relatively immobile factors, institutional factors, variable transportation distances, and non-homogeneous factors of production. To the extent that these influences are beyond the control of the firm, input prices are exogenous. Thus, all industries are price takers in the factor markets and hence the variability observed in the prices is not surprising.

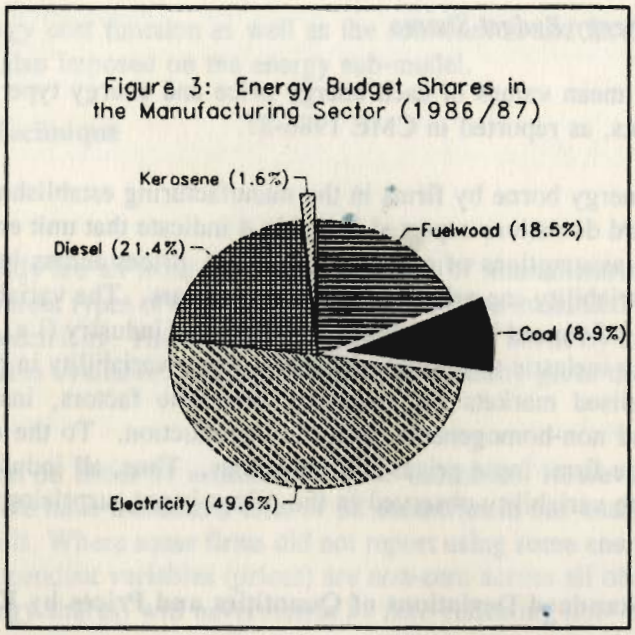
Table 4: Means and Standard Deviations of Quantities and Prices by Energy Types (1986/87)

Energy Type	Mean	Standard Deviation	Minimum	Maximum	Coefficient of Variation (%)
Wood price (Rs/kg)	0.49	0.11	0.29	0.93	22.45
Coal price (Rs/kg)	1.71	0.56	1.43	2.61	45.88
Electricity price (Rs/Kwhr)	1.03	0.16	0.75	1.40	15.53
Kerosene price (Rs/lit)	5.83	0.75	0.00	8.32	12.86
Diesel price (Rs/lit)	7.34	1.23	0.00	9.85	16.76
Wood quantity ('00'kg)	15695	30105	0.00	13061	191.81
Coal quantity ('00'kg)	2934	8566	0.00	48361	291.95
Electricity ('000'kwhr)	3004	5606	5.00	31907	186.62
Kerosene (Lit)	4583	5683	0.00	20919	124.00
Diesel (Lit) 171221	273245	0.00	103970	159.59	

Source: Census of Manufacturing, Central Bureau of Statistics, 1986/87

The coefficient of variation of unit energy prices reported in Table 4 indicates that coal prices, followed by wood prices, show the greatest variation. The remaining three energy prices vary to a lesser extent. The greater variation in the wood price relative to the other energy types may be indicative of segmented wood markets across industries, and this results in large price variations. The observed variation in coal price reflects the differences in the quality of coal that is imported into the country among other conditions.

Table 5 (Figure 3) provides the mean energy budget and budget shares per establishment. An average establishment spent about Rs 5,354,000 per year on energy in 1986/87. It must be noted that each establishment has many firms and the results reported in the tables are per establishment or industry and not per firm. However, the large standard deviation associated with the total energy expenditure implies that substantial variability exists across the industries regarding their energy budgets. Electricity is by far the chief energy source. The average electricity bill was found to be almost half the total energy bill. The relatively (in relation to the mean) small standard deviation also indicates that variability in the electricity bill was far less than observed for the total energy bill. Electricity is relatively the most efficient type of energy among the five types considered, in terms of cost per B.T.U., and it is also a non-polluting energy type.



Following electricity, diesel accounted for nearly half the remaining energy bill after subtracting the electricity bill. The mean budget share for diesel was found to be about 21 per cent. The variability in diesel shares across the industries was greater than that observed for electricity. Wood is the third most important source of energy in the manufacturing sector of Nepal with an average budget share of about 19 per cent. Variations in wood budget shares across industries were more pronounced than in the case of other two energy types already discussed. Coal ranked fourth and kerosene ranked fifth in importance.

Diesel, kerosene, and coal are imported energy types which require foreign exchange. These imported energy types accounted for about 30 per cent of the energy bill. It is quite possible that in the future these imported types of energy will be replaced by electricity, which will not only save foreign exchange but also generate income and employment as well as abate environmental pollution. The relatively huge budget share of wood energy also has grave consequences for the environment as deforestation has already become a serious problem in Nepal.

Table 5: Mean Energy Cost and Energy Type Shares for the Manufacturing Establishment of Nepal (1986/87)

	Mean	Standard Deviation	Minimum	Maximum
Total Energy Budget ('000'Rs)	5354.3	7430.5	41	38124
Wood share	0.185	0.253	0	0.878
Coal share	0.089	0.163	0	0.552
Electricity share	0.496	0.297	0	1.000
Kerosene share	0.015	0.028	0	0.105
Diesel share	0.214	0.212	0	0.666

Source: Census of Manufacturing, Central Bureau of Statistics, 1986/87

Structure of Energy Input Across NSIC Groups

The 1986/87 Manufacturing Census provides a detailed breakdown of input and output of different types of industries classified according to the Nepal Industrial Standard Classification (NISC). The number of

industrial establishments and their percentage distribution by type of industrial grouping are reported in Table 6. For the purpose of analyses, a further aggregation of the industries is conducted on the basis of the NISC. Out of a total of 2,714 establishments, about one-third of the industries are food and food processing industries. Wood and wood products account for the second largest number of establishments (23.3 %), followed by chemical and mineral products (Table 6).

Average Price of Energy

Establishment or industry specific prices of energy have been computed and are provided in Table 7. The average price of wood borne by the firm varies from Rs 0.44 per kg for chemical and mineral-based industries to Rs 0.61/kg for textile, with an average price of Rs 0.50/kg for the industry as a whole. The variation in wood price is found to be minimal for each group of industries as indicated by their respective standard deviation. The average price of coal borne by metal and capital-based industries was relatively higher compared to the other industrial groups. There was less variation in electricity price across the industries. It is interesting to note that, although the average price of kerosene faced by the chemical/mineral and metal based industries was found to be relatively higher compared to the other industrial groups, the price variation within the former group (chemical & metal-based industries) was minimal, relative to the latter. A similar pattern can be observed in regard to the diesel price. It should be noted that the variation in diesel price among food and beverage industries is much more pronounced compared to the chemical and metal/capital based industries as indicated by their standard deviation.

Energy Input Utilisation Pattern

Table 7 shows the average quantity of different types of energy input used by type of industries along with their standard deviations. A close examination of the table reveals a wide variation in the composition of energy utilisation by type of industries. Wood was by far the most important energy input for the carpet and rug industries. The annual wood consumption of these industries in 1986/87 amounted to 64,642 quintals. The beverage industry ranked second in terms of wood consumption although variation in wood use by this industry was much larger than in other types of industry. The large volume of wood required by these industries, especially the carpet industry (mostly located in the Kathmandu Valley), has a grave impact on the environment. Chemical and mineral based industries were the major users of coal and electricity whereas kerosene was mostly used by the beverage industry. Wood and metal based industries consumed a larger volume of diesel compared to the other industries. The details are provided in Table 7. Electricity use across industries was also varied. The paper, chemical, and rubber industries were the prime users and the smallest users were the beverage and tobacco industries.

Budget Share

The energy budget shares by group of industries are given in Table 8. As discussed earlier, the carpet industry relies heavily on wood which is the major source of energy input. About 86 per cent of the total energy cost of this industry was accounted for by wood alone. The contribution of wood to total energy cost was also found to be the highest (60%) for beverage industries. Electricity ranked first in terms of total energy cost for food processing, wood, textiles, and chemical and mineral-based industries. The share of kerosene in total energy cost was generally less than two per cent for the entire establishment. Similarly, coal was found to be the second major source of energy for metal and capital goods' industries, accounting for about 19 per cent of the total energy cost. It should be noted that the last column of the preceding table also provides an idea of the energy intensity of the industries considered. The cost of energy incurred on producing Rs 1 worth of output was also calculated. The beverage and tobacco industries incur the highest energy cost to produce output worth Rs 1. The wood and wood product industries required energy worth Rs 0.20 to produce output worth Rs 1. The carpet and rug industries were in the third position. The remaining industries required less than Rs 0.10 of energy to produce output worth Rs 1. Clearly, the beverage and tobacco, wood and wood product, and the carpet and rug industries are the most energy-intensive industries in the manufacturing establishment of Nepal. An interesting feature of the most energy

intensive industries is that the beverage and tobacco and the carpet and rug industries are the most wood-energy intensive industries. The demand for output of these industries is growing, therefore, the demand for wood will also continue to grow and this has grave implications for the environment as deforestation will be acclerated.[1]

Table 6: Average Price of Energy Input by Type of Energy and Industry
Nepal Manufacturing Sector (1986/87)

Industry Classification		Wood Rs/kg	Electricity Coal Rs/kg	Kerosene Rs/kWhr	Diesel Rs/lit	Rs/lit
Food and food processing	Mean	0.453	1.563	0.964	5.373	6.902
(NSIC 3112-3122)	Std	0.100	0.408	0.068	0.352	2.318
Beverages and tobacco	Mean	0.459	1.581	1.002	4.925	4.771
(NSIC 3131-3134)	Std	0.062	0.217	0.002	3.564	3.374
Textiles, apparel & footwear	Mean	0.607	1.754	1.034	5.577	7.266
(NSIC 3211-3216, 322-324)	Std	0.156	0.352	0.191	0.417	0.451
Carpets and rugs	Mean	0.527	1.428	1.044	6.179	8.064
(NSIC 3214)						
Wood and wood products	Mean	0.450	1.555	1.036	6.294	7.335
(NSIC 3311, 3319, 332)	Std	0.050	0.179	0.113	0.464	1.891
Paper, chemical, and rubber	Mean	0.445	1.712	1.016	5.835	8.123
(NSIC 34, 35, 36)	Std	0.100	0.347	0.028	0.415	0.906
Basic metals and fabricated	Mean	0.468	2.031	1.075	6.562	7.311
(NSIC 371, 381)	Std	0.054	0.310	0.152	0.528	0.989

Source: Census of Manufacturing, Central Bureau of Statistics, 1986/87

Note: There is only one industry under the carpets and rugs category.

[1] The growing demand for food and beverage industries is indicated by the fact that Nepal is considered to be self-sufficient in the production of alcoholic beverages and the tobacco industry has been experiencing a boom.

Table 7: Average Quantity of Energy Consumption by Type of Energy and Industry
Nepal Manufacturing Sector (1986/87)

Industry Classification	Wood Quintals	Coal Quintals	Electricity 000' kWhr	Kerosene Litres	Diesel Litres
Food and food processing	15527	704	2176	3821	180226
(NSIC 3112-3122)	26998	2319	3248	5775	80731
Beverages and tobacco	46363	899	268	6959	127069
(NSIC 3131-3134)	59639	1271	190	5628	177272
Textiles, apparel & footwear	4624	555	2804	4433	66855
(NSIC 3211-3216, 322-423)	7304	790	4492	6100	122126
Carpets and rugs	64642	0	412	1942	
(NSIC 3214)					
Wood and wood products	11815	201	1496	2525	270345
(NSIC 3311, 3319, 332)	16709	284	1281	1803	353320
Paper, chemical, and rubber	13585	10983	6489	5078	160780
(NSIC 34, 35, 36)	27846	15957	9723	3739	91757
Basic metals and fabricated	857	783	2315	5758	272472
(NSIC 371, 381)	989	1549	2918	8758	443304

Source: Census of Manufacturing, Central Bureau of Statistics, 1986/87

Note: There is only one industry under the carpets and rugs' category.
The means are contained in the first line and standard deviation in the second line for each industry group.

Table 8: Average Budget Shares of Energy Input by Type of Energy and Industry
Nepal Manufacturing Sector (1986/87)

Industry Classification	Total Cost (Rs'000)	Energy Budget Shares					Energy Cost to Produce Rs 1 Worth of Output
		Wood	Coal	Electri-city	Kero-sene	Diesel	
Food and food processing	4347	0.18	0.03	0.45	0.01	0.26	0.09
(NSIC 3112-3122)	5233	0.21	0.07	0.32	0.03	0.22	0.08
Beverages and tobacco	3154	0.59	0.12	0.14	0.02	0.12	0.22
(NSIC 3131-3134)	3499	0.24	0.17	0.08	0.03	0.15	0.13
Textiles, apparel & footwear	3540	0.20	0.08	0.62	0.01	0.09	0.08
(NSIC 3211-3216,322-324)	5469	0.23	0.18	0.22	0.02	0.06	0.10
Carpets and rugs (NSIC 3214)	3959	0.86	0	0.11	0.003	0.03	0.18
Wood and wood products	3443	0.07	0.02	0.56	0.02	0.33	0.20
(NSIC 3311, 3319, 332)	3603	0.10	0.03	0.17	0.01	0.12	0.05
Paper, chemical, and rubber	9899	0.07	0.15	0.51	0.02	0.25	0.10
(NSIC 34, 35, 36)	11542	0.10	0.22	0.30	0.04	0.26	0.06
Basic metals and fabricated	4605	0.01	0.19	0.64	0.02	0.15	0.13
(NSIC 371, 381)	6029	0.01	0.16	0.15	0.02	0.14	0.07

Source: Census of Manufacturing, Central Bureau of Statistics, 1986/87

Note: There is only one industry under the carpets and rugs' category. The means are contained in the first line and standard deviation in the second line for each industry group.