8. Energy Use and Policy Implications

The results on price and substitution elasticities estimated provide insight into energy pricing policy. To recapitulate, it has been found that the demand for electricity, diesel, and kerosene is inelastic, with the demand for electricity being the most inelastic, followed by diesel. This was found to hold true for the entire manufacturing establishment as well as across the seven groups. The implication of this result is that, for small changes in electricity demand, firms are not likely to increase or decrease their demand for electricity, thus implying the demand for electricity to be relatively stable among the different energy sources. This has implications for the energy pricing policy. Given the inelastic nature of the demand, for large changes in electricity prices the manufacturing sector is not likely to curtail demand proportionately. Therefore, raising electricity prices (relative) as a means to generate revenue will not be an effective policy, at least in the short run. At the same time, providing subsidies by lowering the electricity price will also not encourage the manufacturing sector to consume more electricity. In the short run, the demand for electricity is conditioned by the firm size and the technology used and hence, small changes in electricity price are not likely to influence the demand for electricity in the manufacturing establishment. The same argument can be put forth in the case of diesel, although the demand for diesel is likely to be relatively more responsive to price changes than electricity demand. The possibility of raising the relative price of electricity, diesel, and kerosene to discourage consumption cannot be totally ruled out in the short run, given that the own-price elasticities of these energy types are all negative. However, the scope to discourage or encourage consumption through pricing policy is fairly limited in the short run.

On the basis of results, it appears that policies aimed at influencing electricity demand have to also rely on non-price actions as well. In the short run, raising the energy price is likely to result in an increase in production costs, given the size and technology of the firm. This cost will ultimately be passed on to consumers. The gains or loss in social welfare have to be judged from more of a macro-perspective. Electricity is domestically produced and discouraging its consumption through pricing policy implies that the manufacturing sector is likely to substitutes electricity with other energy types. The substitution elasticities estimated indicate that large substitution possibilities exist between most energy types in the manufacturing sector. Many industries use more than one energy type in the Nepalese manufacturing sector, perhaps at different stages of production. Making electricity relatively more expensive than the other energy types can bring significant changes in the energy mix consumed by this sector, given the state of the technology which characterises this sector.

For example, the results show that the demand for diesel is more highly sensitive to changes in the electricity price rather than to its own price change. Given the strong substitution relationship between these energy types, there is ample scope for reducing (increasing) diesel consumption through removal of tax (subsidy) on the electricity price. Similarly, kerosene demand is highly influenced by coal prices. Such knowledge of cross-price relations are vital for devising successful energy pricing policies. If the policy is to gradually reduce the financial burden of importing diesel and kerosene (by the manufacturing sector), the manipulation in the price of their substitute (electricity) is more effective than mere manipulation of their own prices.

The shares of diesel and kerosene together account for about 22 per cent of the energy budget share of the manufacturing sector. The drain on foreign exchange is already substantial (40 per cent of the export earnings are spent on importing petroleum products as a whole). Continued reliance on these imported energy inputs, therefore, implies that more foreign exchange will have to be diverted for their importation. Energy input is a variable cost for the manufacturing sector. For industries that export their products and earn foreign exchange, greater reliance on the imported energy inputs will be at the cost of plant modernisation, and this also requires foreign exchange. Already many industries in Nepal use technology that is old and cannot invest in modernisation. This has grave consequences for the domestic export industries because they cannot compete in the export markets while product quality and prices suffer as a result of decay, obsolescence, and lack of new capital investments, thereby reducing efficiency in this sector. The implications, however, are not confined to the manufacturing sector alone. Since all sectors of the

economy compete for foreign exchange, if more foreign exchange is diverted to the importation of petroleum products, less foreign currency is available for other sectors of the economy.

The implications of exchange rate depreciation also has implications for the growth and efficiency of the manufacturing sector as well as the whole economy. Exchange rate depreciation implies more diversion of domestic resources to the importation of petroleum products, leading to similar implications as discussed above. In addition, exchange rate depreciation is also likely to raise the domestic price of the products manufactured by the industries and will have direct impact on the relative prices of consumable items. Of course, over-valued domestic currency results in inefficient use of foreign exchange and has to be discouraged. The recent policy towards a more relaxed exchange rate regime made by HMG is a step in the right direction and will over time ease the problem of 'over-valued' domestic currency.

It was also found that fuelwood and coal have positive own-price elasticities and reasons have already been forwarded as to why such might be the case at least in the case of fuelwood. In terms of quantities consumed (expressed in tonnes of coal equivalent), fuelwood continues to be the energy type most consumed by the manufacturing sector. Some industries, such as the carpet, rug, sugar refinery, and beverage are heavy users of fuelwood. Continued use of fuelwood has a direct impact on the rate of deforestation; and this is already a serious environmental problem in Nepal.

It should be pointed out that electricity is domestically produced and its demand is also the most inelastic in the manufacturing sector. Increasingly, more industries in Nepal are beginning to rely on electricity as the main source of energy. The continuous shortage and unreliable supply of electricity can be a major constraint input in the growth of the manufacturing sector. Household consumption of electricity is also increasing in the country and households compete with the manufacturing sector in terms of electricity consumption. Nepal's potential for electricity generation is enormous (second in the world after Brazil) but the ever-escalating production cost has added to the skepticism regarding whether Nepal has a comparative advantage in electrical energy production. Other countries in the world are known to produce electricity at a much cheaper rate than Nepal. Since the technology used to generate electricity is borrowed from the developed countries, it is surprising why costs in Nepal exceed costs in these countries, even after discounting the transport cost, exchange rate differences, and other costs.

If electricity production lags behind industrial growth, and as investors have to rely increasingly on imported energy sources, the growth of this industry will be seriously jeopardised as foreign currency for energy imports, a variable input, will have to compete strongly with foreign currency for capital investments in this sector, as well as in the rest of the economy. Furthermore, new production of electricity has a gestation period that is fairly long. Output growth as well as modernisation can therefore be retarded, and this will have an impact on the efficiency of the domestic industries. Within such a context, the scope for employment generation by the manufacturing sector will also be limited, especially in urban areas, where in the future the bulk of new employment opportunities will have to be generated by the manufacturing sector. Therefore, policies that encourage the production and use of more electricity have to be given top priority. This energy source is non-polluting as well. Since the potential to generate electricity within Nepal is enormous, not only will industries have a more assured supply of energy from domestic sources, but income, employment, and foreign currency impacts can also be significant and positive.

The present energy demand analysis based on econometric techniques is the first of its kind to be carried out for the Nepalese manufacturing sector. Therefore, the results from this study need to be cautiously used. Many questions need to be better explored in order to understand more precisely the demand for energy in the manufacturing sector. Most of the manufacturing establishments appear to use more than one fuel. This could be the result of shortage or unreliability in supply of the desired fuel. Therefore, shortage can lead to captive power generation. Backup systems involve higher unit investment costs because they lack economies of scale and generally consume more expensive types of energy. Over capitalisation will result in inefficient use of scarce resources, especially convertible currency, if such backup systems have to be imported from third countries. Unreliable supply or supply shortages will encourage the continued reliance

on fuelwood among some industries, and this can lead to further deforestation. Clearly, the extent of unfulfilled demand needs to be assessed for a more reliable formulation of a long-run energy policy.

Finally, the present study's focus has been on estimating the energy demand of the manufacturing sector. Relative energy prices have been used to explain energy demand. Pricing policy is an important tool for demand management, especially in the medium and long terms. Once a firm's technology has been decided, the ability of firms to respond to relative energy prices in the short run is limited. Pricing policy is one aspect of energy policy. Other aspects of energy policy would require detailed examinination of investment policies, exchange rate policies, policies concerned with power generation, and other factors. The present study is thus fairly limited to provide concrete guidelines on energy policy.