DEMAND AND PRICING OF COMMERCIAL ENERGY IN SRI LANKA

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This paper is one of the 18 papers, published under a special series of publications by the Sri Lanka Economic Association (SLEA) with financial assistance from the United States Agency for International Development (USAID). The objective of these publications is to provide economic literature on current and topical themes on the economy of Sri Lanka to a broad audience that is interested in economic issues, but has little or no background in theoretical economics, while maintaining high analytical standards. Hence, the papers have been written in simple language avoiding the use of sophisticated technical terms, mathematical equations and models etc. which are normally found in economic literature.

THE DEMAND AND PRICING OF COMMERCIAL ENERGY

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Traditional sources of fuel, particularly firewood and other forms of biomass such as coconut and palmyrah waste, paddy husk and coir dust have always provided the bulk of the energy requirements in Sri Lanka, while the household continues to be a major energy consumer, largely using common indigenous fuels. This pattern of energy use has remained virtually unchanged for a long time, because the industries and the services have come to the forefront as major energy users only recently with the quickening of the pace of development in the economy with new industries coming into being and the expansion of services and the emergence of a wide variety of new activities. Commercial energy used in Sri Lanka consists largely of oil and electricity, while a large portion of the biomass falls into the category of non-commercial energy. Another major source of non commercial energy is direct solar power which is used for drying agriculture and fisheries products and for the extraction of salt from sea water. Very recent Socio Economic Surveys have confirmed that the traditional sources of energy, mainly firewood, continue to provide more than 70 per cent of the energy requirements, while hydro electricity accounts for about 10 per cent and petroleum fuels contributing about 19 per cent of the energy needs. However, if only commercial energy is

taken into consideration, petroleum fuels will account for about 65 per cent of the total and hydro electricity about 35 per cent.

The main sources of commercial energy are petroleum, electricity and firewood. In regard to firewood, the bulk of the firewood and agro waste widely used for cooking cannot be treated as commercial energy because especially in the rural and estate areas it is a free good which is collected from ones own garden or from forests. Even where householders have to pay for firewood it costs much less than other fuels. It is this low cost factor that continues to account for the popularity of firewood, and for this reason would remain the predominant household fuel in future years as well. The Consumer Finance Survey of 1986/1987 shows that firewood was used for cooking by 90 per cent of the households in Sri Lanka, that in the rural sector 95 per cent used firewood and in the estate sector it was 99 per cent. In the urban areas the higher income households use LPG and electricity for cooking. But even among them the recent price hikes in the electricity tariff, in kerosene and LPG have deterred many households from using electricity and petroleum fuels more widely for cooking. Firewood plays a major role in the supply of household energy but rising firewood prices have had only a limited effect on the major portion of consumer demand, because the major portion of firewood needs of the households is obtained free. In Sri Lanka the household is the major energy user taking up 67. 6 per cent of the share, transport 12.5 per cent, industry 17.5 per cent and commercial activities 2.4 per cent.

However, if only commercial energy consumption is taken into account transport becomes the leading energy consumer with 53.4 per cent of the total, households next with 19.9 per cent, industry 18.4 per cent and the commercial sector taking up 9.1 per cent.

In the last one and half decades, the demand for commercial energy of all types has increased by leaps and bounds and this trend continues. Several factors have contributed to this development. The economic liberalisation policies which were first introduced in 1977 and progressively expanded and effectively implemented since then have resulted in a sharp increase in the level of investment and economic activity everywhere and a large number of small and medium energy using manufacturing industries in the urban and rural areas have come into existence. In the agricultural sector, the use of pumps and mechanical farming equipment for cultivation, irrigation, harvesting and preparing agricultural products for the market have increased the demand for energy even though the bulk of ploughing of paddy fields is still done with the use of buffaloes. In the services sector, the demand for energy more than quadrupled in a matter of 15 years with the sharp increase in the number of commercial and private vehicles, The energy needs of transportation are met by auto diesel and petrol. The more intensive use of vehicles to meet the increased activity in the economy resulted in a higher per vehicle consumption of petroleum fuel, particularly auto diesel. The liberalisation programme pushed up the demand for energy through a free flow of imports of manufactured consumer goods of all kinds.

Between 1956 - 1976, import restrictions were intensified and manufactured consumer goods were not available in the Island. Restrictions on imports of durable consumer goods were introduced in those years despite the increasing popularity of modern household goods and office equipment in many other countries in the developed and developing world. All these consumer goods and equipment used some form or another of energy. The liberalisation of imports after 1977 flooded the market with electrical and electronic goods and equipment which are widely used in the households and offices. In the years of sluggish economic activity from 1970 to 1977, electricity use showed an annual average growth of 6.2 per cent while in the period 1977 to 1983 of rising economic activity, electricity use rose by more than 9.5 per cent. The introduction of television in 1978 contributed to a progressive increase in the demand for electrical energy. It has been estimated that at peak viewing times over 400,000 television sets in the Island consume more than 40 megawatts of power. The energy consumption developments in the post 1977 period were quite distinctive and were different from the pattern and the volume of demand for energy that occurred in the preceding decades of this century.

THE DEMAND AND PRICING OF ENERGY IN THE PRE SECOND WORLD WAR PERIOD

Speaking relatively, before the second world war Sri Lanka depended on commercial energy only to a limited extent. If one is able to identify the different categories of energy users in the nineteen twenties and thirties, the largest amount of energy was used

for lighting and cooking in the households. The fuel needs for cooking in the households were met primarily from firewood. Since the population of Sri Lanka before 19-0 was less than seven million, the household demand for firewood was met without much damage to the Island's forest cover which was at that time commercially exploited only to a limited extent, although the practice of cutting down the most valuable timber trees could be traced to Dutch times. Every part of the city of Colombo and the other towns had small firewood depots where logs were brought and split into small pieces. In the village, firewood was gathered from the dead trees and branches which were found in the forests or ones own garden. In the estates, the workers used wood cuttings from tea bushes and the shade trees that grew on the estates. The principal means of providing lighting was kerosene and coconut oil. The use of kerosene for cooking had not become popular. In the more affluent households in Colombo, coal gas supplied by a private firm the Colombo Gas and Water Company was used for cooking, heating and lighting. Before the second world war all streets in Colombo were lighted with gas lamps and gas lights were found in a large number of urban homes. In terms of prices prevailing at that time the cost of energy for domestic and commercial use was indeed very low. If one may recall these times, in the nineteen thirties and forties one hundredweight (cwt) of firewood was 75 cents including the costs of delivery and for households with 7 or 8 persons two cwts were more than sufficient for the month. Today, a hundred weight of firewood costs more than Rs. 60/=.

The use of electricity in Sri Lanka became popular mainly after 1936. In the absence of industries electricity was mainly used for lighting houses and offices. In the years preceding the 1920s electricity was supplied by a private firm E. C. Boustead & Company. The establishment of the Department of Government Electrical Undertakings in the late nineteen twenties expanded the supply of electricity to different parts of the city of Colombo and the suburban areas. Electricity was used in the nineteen thirties, forties and fifties mainly for lighting households and for the operation of simple household appliances and equipment which consisted mainly of radios and electric fans. Other forms of electrical household equipment which are widely used today had not yet come on the market. In industry electric motors were used to drive machinery and equipment in the few industries that existed.

Energy was used extensively in the plantations for the processing and manufacture of tea, coconut and rubber products. Of these three items tea was relatively more energy intensive than coconut and least of all rubber. Commercial energy was used in the operation of rolling machinery in the tea factories and for the dryers. The tea factories had equipment at that time which had electric motors, oil engines or steam plants using firewood or coal. Some of the estates had their own mini hydro electric plants because water was plentiful in the hill country. Unfortunately, very few of these plants remain today. Other factories that did not have electricity generated steam by the use of wood or coal to fire the boilers and the energy produced was transmitted to the tea making equipment through a series of roller belts or

shafts. The energy used to produce steam was largely firewood and a few factories were able to minimise the cost of wood fuel by growing trees on the estates. All tea estates at that time had adequate supplies of timber for fuel because trees were planted among the tea bushes to produce shade and leaf fall as manure. It would appear therefore, that the basic cost of energy in the manufacture of tea in the first four decades of the present century was quite low. For most estates firewood was a free good. Very few estates therefore had to pay to obtain their requirements of firewood. In the case of estates with mini hydro power plants, the operating costs were minimal because water that came down from the upper elevations was a free good and due to regular rainfall, storage did not have to be too large. Costs were even lower because the expenditure on installing water wheels and generators was not very high and the cost of maintenance was low.

The other plantation industry which was a fairly big energy user was coconut. The coconut palm is also a source of energy because the waste products from the palm, the oil and coir dust are used as fuel. Several products were derived from the coconut palm for export and the most notable among these were fibre, desiccated coconut, copra and coconut oil. The energy required in the coconut industry was provided by steam driven or later on by electric motors. This was true of all three categories of mills, fibre, desiccated coconut and coconut oil. Although coconut shell when burnt forms a very efficient fuel for the generation of

heat and steam since charcoal was also exported, very few coconut processing plants used coconut shell charcoal as a fuel.

In the rubber industry where the main products were latex crepe and sheet, the use of energy was at a very minimum and the rubber rollers, especially in the smaller estates, were mostly operated by hand. For minor export crops like cocoa, cardamom, cinnamon, clove, pepper and citronella energy was required only in the process involved in the extraction of cinnamon, clove and citronella oil and these industries largely depended on firewood. Most of the other products such as cocoa beans, pepper, cloves and cardmoms were dried in natural sunlight. In the pre-second world war years, there were only a few large paddy mills in the Island. More than 60 per cent of the rice was imported and local production was very small. To par boil rice either paddy husk or firewood was used. A few of the larger rice mills operated with electric motors. In the greater part of the rural area most of the paddy produced was hulled and husked by mortar and pestle in the households.

In the pre second world war period transportation was one of the major services and petrol and diesel were used to drive motor vehicles. The buses at that time were all privately owned by six of seven leading companies which served the entire Island and most of these buses had diesel engines. Petrol vehicles constituted mostly motor cars which were privately owned. At that time there may have been about 40,000 cars in the Island, about 3,000 buses and 20,000 lorries and other heavy vehicles. In the private sector, the main

means of transportation were the use of lorries for the transport of goods from the plantations and other produce from domestic agriculture and industry. The bullock cart was a very popular and an economical mode for transporting goods and did not use up any energy and in the pre-war years were widely used in the cities. In most rural areas bullock carts and hand carts still continue to operate.

The government owned railway was very popular as a cheap means of transportation of both passengers and goods. Until the late fifties most of the railway engines were steam driven and they used imported coal which was quite cheap. Before 1939, the railway for the first time operated five diesel electric train sets on the coastline. During the war years some of these steam engines were converted to use firewood. After the mid fifties for the first time the Ceylon Government Railway decided to operate diesel electric train sets and rail cars. From the foregoing it will be seen that the use of energy in Sri Lanka, in the pre-second world war years, was limited and a fair amount of the total energy requirements was met out of local resources mainly firewood and other biomass material for cooking.

Kerosene oil was widely used for lighting and kerosene lamps, particularly hurricane lanterns and pressure lamps with mantles, were popular in all parts of the Island. The poor village homes widely used coconut oil lamps for lighting because it was the cheapest means of illumination. In the forties, a bottle of coconut oil cost as little as 10 cents. Two main components of imported energy at that time

were coal for the railway and petroleum fuels for motor vehicles and for the generation of electricity. Most of the electrical generating stations, particularly the Stanley Power Station at Kolonnawa and the Pettah Power Station. had throughout used imported coal to operate steam plants to generate power. The power stations serving cities outside Colombo used diesel or oil engines to produce electricity. For domestic purposes, energy requirements were largely met out of internal resources while motor vehicles, the railway and the generation of electricity depended on imported fossil fuels. In regard to the pricing of all forms of energy a free market operated and there was no government intervention whatsoever except during the war years. The prices were fixed by the private distributing companies such as Shell, Caltex and Mobil Oil for petroleum products and the Colombo Gas and Water Company for coal and coal gas. The price of firewood was determined competitively by firewood dealers.

DEMAND FOR ENERGY IN THE EARLY POST WAR YEARS

After 1948, the changes in the sources and the pattern of use of energy took place very slowly. One of the major decisions to diversify the sources of energy in Sri Lanka was taken by the first independent government to develop hydro power resources which had remained untapped other than in the estates. Several leading Sri Lankan engineers had advocated the development of hydro power resources in the forties and even much earlier. The first World Bank loan was utilised in the early fifties to construct the first stage of the Norton Hydro

Power Complex. It was indeed a small unit with a capacity of only 25 megawatts. It was a good beginning because this decision recognised the important role that hydro electricity, a primary source of energy, could play in the future development of Sri Lanka.

However, the demand for commercial energy grew at a relatively small pace upto the early sixties and the changes in the cost and price of energy were insignificant. For instance, the price of petrol before 1960 was about Rs. 1.50 per gallon and there was agreement on pricing by the foreign companies handling the distribution of petroleum. At a time when other countries, which had recently got their independence were following liberal economic policies and permitting the imports of vehicles and manufactured goods, Sri Lanka after 1959, took a contrary course and began restricting the imports of vehicles and almost all other manufactured goods other than capital equipment. All these contributed to restrict the demand for energy, since the growth in the then existing traditional business and commercial activity, particularly in the plantations, was very small. After 1960, a fair number of import substitution industries came into being and they used electrical machinery and equipment. The industries in the private sector were light industries while the heavy power users were mainly owned by the state and those that fell into this category were the cement, steel, leather, hardware, chemicals, plywood and paper manufacturing plants. Even these state industries that were first set up during the war years and

later developed in the fifties and sixties, were not very large energy users and their needs of electricity were easily met from the steam generation plants and the newly created hydro capacity.

As a result of these developments, the only demand for energy after 1960 came from the more than 1,500 small privately owned industries set up between 1960 and 1965. These were all import substituting industries and several of them were nothing more than mere assembly plants where imported components were put together. The very nature of the industrial structure that emerged at that time was not one which resulted in an inordinate demand for energy. Throughout this period, energy in Sri Lanka was cheap and this was despite the fact that petroleum refining and distribution was done by the Ceylon Petroleum Corporation

In the meantime however, electricity was being used in more and more homes for purposes of lighting and since electricity was very cheap up to the seventies, some of the middle class homes started using electricity for domestic cooking, although people cannot now afford to do so due to the high domestic tariffs. The Government Electrical Undertakings in the late sixties and early seventies advertised very widely encouraging people to use electricity for cooking. Since the cost of generating electric power with water, cheap coal and oil was low, the government was able to supply power to a progressively increasing number of consumers at a low price. However, it has to be emphasised that the number of electricity users in the early sixties was not more than about 50,000 both domestic and industrial. The rest

of the country continued to use firewood and kerosene extensively for the purpose of lighting and cooking.

The demand for electricity at that time was met by new investments in both thermal and hydro generation. The gradual increase in the demand for additional power, which was about 5 percent in the sixties, was met by constructing a steam turbine thermal power station in Grandpass with a 50 megawatt capacity. Additionally, it was also to serve as a thermal back up station for the expanding network of hydro electricity power stations. Before 1970, additional hydro capacity was created by establishing the Wimalasundara Power Station and the Polpitiya Samanala Power Station thus raising total hydro capacity to about 200 megawatts by 1970,

By that time, the Government Electrical Undertakings had been converted to the Ceylon Electricity Board and the Board was seriously considering proposals made by various advisers that Sri Lanka had excess power supplies which could be exported to India. It was obvious that this notion was based on a wrong premise. It was not understood that the low demand for energy in the sixties and seventies was mainly due to the lack of industrial development in the Island and the policies at that time which led to a slowing down of economic activity in general. Furthermore, the government was committed to a policy of subsidising practically all goods and services to the people and there was no assurance that the prices charged for all forms of energy retailed by the government, particularly kerosene and electric power, was correct. In any event, kerosene was subsidised from the beginning because the price of petrol was

fixed in a way that it would cover the subsidy on kerosene.

INCREASE IN THE DEMAND FOR ENERGY IN THE OPEN ECONOMY ERA

A very large increase in demand and a substantial diversification of the sources and the types of energy emerged with the liberalisation programme which was launched in 1977. Almost four years prior to that a major change globally in the cost and pricing of energy took place. This was spurred on by the decision of the Organisation of Petroleum Exporting Countries (OPEC) to jack up the prices of crude oil by more than 300 percent in 1973. This international pricing decision affected Sri Lanka in the same way that it affected all other developed and developing countries.

However, at that time, Sri Lanka was less dependent on petroleum fuels than many other developed and developing countries because the industrial demand for energy at that time was low and the economy was in a sluggish state with business activity and new investment at a very low ebb. Furthermore, imports of energy using equipment, appliances, and vehicles were restricted since the introduction of restrictive policies after 1956. Although the bulk of the supply of electricity came from hydro sources, the oil price hike starting in 1973, had a tremendous negative effect on the economy and it continued to worsen the economic outlook. These adverse effects would have been far more unfavourable had the pace of industrialisation in Sri Lanka been

high in the sixties and the seventies, with large increases in the demand for energy, as it was the case in other fast growing countries such as South Korea, Taiwan, Hongkong, Singapore and Malaysia.

Sri Lanka had to increase the price of all petroleum fuels by more than 300 percent in 1973, almost overnight: The continuing restrictions on the import of motor vehicles and household equipment helped to keep the volume of petroleum imports at a fairly constant level. Had there been free imports of vehicles and manufactured goods, Sri Lanka would have had no option but to meet a petroleum bill which would have escalated almost instantly by more than 400 per cent. The oil shock was so severely felt that the motorists who were accustomed to buy petrol in the nineteen fifties and sixties at Rs. 1.35 to 1.75 per gallon were now called upon to pay more than Rs. 7.00 per gallon in one stroke and this was shortly to be followed by a further price hike which took the price of retail petrol to more than Rs. 10/- per gallon.

One could recall the day immediately following the raising of crude oil prices by the Organisation of Petroleum Exporting Countries (OPEC). In Colombo and elsewhere, the roads were virtually bereft of vehicles. People started travelling by public transport and bicycles because they felt that the price increase of petrol by more than 300 per cent in one stroke and a further sharp increase shortly after, was something which they could not withstand The price increase of all petroleum products had a multifaceted effect on the economy and the immediate result was a sharp fall in domestic demand for petroleum fuels, parti-

cularly petrol and diesel oil. But consumer resistance to the price hikes was short lived and it was not before long that the public gradually got used to higher prices and they started resuming consumption to the earlier levels. Within six months after the OPEC fuel price hike consumption had risen to earlier levels. But there was a more salutary outcome, in that the public had become more conscious of energy conservation than at any time before and the objective of all types of petroleum energy consumers was to keep expenditure on petroleum fuels at the lowest possible level. For the first time, they became aware that energy of all kinds was not cheap and that an appropriate price in terms of long term resource availability had to be paid for all forms of energy and particularly fuels based on non-renewable sources. After the oil price increase in 1974, the industrial use of firewood began to increase. Several small industries began to move back from the use of furnace oil to firewood. Among them were brick and tile factories, tea factories and many other raw material processing industries. The use of firewood has continued since then as it is still the cheapest commercial energy.

In the Sri Lankan context the impact on economic growth of the oil price hike was relatively small because, in any event, overall economic activity was at a low ebb as a consequence of the restrictive and very inward looking economic policies that had been followed for decades. The restrictive and socialist economic policies of that time tended to minimise investments of all kinds and hardly any new business or commercial activity was evident. The bulk of the

public passenger transport, particularly the CTB, was owned by the Government and the higher costs of diesel and petrol had to be met from the Government budget. The oil price increase imposed further strains on the budget which had already been under pressure due to the recurring deficits arising out of extensive welfare expenditure and the financing of the losses made by inefficient and poorly managed Government corporations in the industrial and services categories. The Government budget had to shoulder the major burden of the increase in the cost of energy and the resulting enhanced losses of many inefficient public sector enterprises. The oil price increases tended to worsen the balance of payments situation because the prices of Sri Lanka's major primary product exports continued to fall without any relief, with oil taking up a major portion of the country's import bill.

In the 1970s, the Government was reluctant to pass on the higher cost of petroleum products, particularly diesel and kerosene, to the consumer because the price of kerosene was politically sensitive and furthermore, economic policy was heavily weighted by welfare considerations. The Ceylon Transport Board because it was charging artificially low fares had to be heavily subsidised and the consumer was not made to pay for the higher cost of petroleum products. The financial problems of the CTB were compounded by the waste and malpractices that existed in the Coporation. It was a common practice for bus operators to illicitly sell the highly subsidised diesel at lower prices to consumers in the private sector. Subsidies on kerosene to a large extent, helped to cushion the impact of the oil price hike on the households particularly in the

rural areas. Diesel prices were heavily subsidised in order to keep the cost of transport of goods and passengers low. This was consistent with the policy of the SLFP Government in power and with their strong commitment to socialist and welfare policies. This was also the case in many other industries which were operated by the Government up to 1977. By this time the Railway had progressively moved away from steam traction to diesel electric traction and the Railway too had to buy diesel and lubricants for its locomotives at much higher prices despite the fact that diesel carried a heavy subsidy. Had the Railway continued with the steam locomotives, the 19 3 OPEC price increase would have not seriously affected its operations.

Since the Government was committed to welfare oriented policies, most of the price burdens and the price increases were shouldered by the Government. Through the system of subsidies the people in Sri Lanka had got used to low and unrealistic fuel and product prices. Price distortions and imbalances were found in most enterprises and activities. The Government that was wedded to socialist policies found it difficult to curb these inappropriate and non-viable price arrangements. Furthermore, pricing policy was indeed a politically sensitive issue and the Government that was in power wanted to maintain fuel prices at very low levels, despite rising international costs of energy and the severe stress that these artificial price structures imposed on the foreign exchange resources. Political parties were only bent on making short term gains to ensure their return to power and did not think that sound economic policies mattered.

The pricing policy of energy at this time was not founded on pragmatic considerations. The policy of subsidies was continued in the pricing of petroleum products. Of the petroleum products handled by the state owned Ceylon Petroleum Corporation, kerosene was the most sensitive item and it carried a very large subsidy. A gallon of kerosene was sold at Rs. 3/- while the ex-refinery cost was more than Rs. 20/-. Diesel was also subsidised because it always had a major impact on the transport of goods, particularly items of day to day use which directly influenced the cost of living.

THE UPSURGE IN DEMAND FOR ENERGY AFTER LIBERALISATION IN 1977 AND PRICING POLICY

The rapid expansion of investment, the favourable economic expectations and the high annual rates of growth, seen in the economy after 1977, resulted in a very sharp increase in the requirements of all forms of energy. The demand for the types of energy used in Sri Lanka, other than coal, grew tremendously. Furthermore, the possibilities of harnessing other sources of energy particularly solar power has been explored. Fortunately, the pricing policy in the late seventies, after the new Government took office, has been such that it was instrumental in creating a reasonable balance between supply and demand and has also looked after the welfare of the consumer especially those that had very low incomes. The Government in the short term followed the policy of subsidising energy to a limited extent, as it did in the pre 1977 years, even though after 1977 the demand was much higher. Kerosene prices were progressively increased

after 1977, but yet despite this kerosene carried a small subsidy. The new prices were more reflective of real costs, but not entirely. Although, some petroleum products, notably diesel, still carried a subsidy this was a positive move towards a more realistic pricing policy.

A good part of the subsidy on kerosene and diesel continued to be covered by the profits made on selling petrol at high prices. Throughout these years, and even after 1977, the basic elements of the petroleum pricing policy remained. On the other hand, non-petroleum fuel sold by the private sector showed more appropriate and rational pricing arrangements in terms of supply and demand. Firewood still continued to be popular in the 1960s and early 1970s, and was sold at very much higher prices than before, which reflected the scarcity of timber resources the higher costs of transportation and the rising prices of alternate fuels such as kerosene and electricity. The nineteen seventies saw the steady increase in the use of kerosene for cooking purposes and the demand fo· kerosene therefore went up sharply, although kerosene prices did not reflect real costs. Since most of the urban and semi urban households were using kerosene cookers, there was a substantial subsidy for consumers of this product, although those who used firewood as fuel had to pay more realistic prices. After the mid seventies the use of LPG began to displace kerosene as a cheap and convenient fuel for domestic cooking. Even LPG was not priced at a level where costs were fully covered with an adequate margin of profit.

Although the Ceylon Petroleum Corporation has not made major losses it has always endeavoured to cover its overall costs, particularly higher expenditure on imports resulting from frequent adjustments of the exchange rate by making profits on particular products. The latter problem became very acute with the devaluation of the rupee very frequently after 1977. By repeatedly raising the prices of petrol and petroleum products, other than diesel and kerosene, the Petroleum Corporation was able to avoid making huge losses. The Petroleum Corporation has been the supplier of fuel for international transportation. It has supplied aviation fuel to Air Lanka and other airlines operating through Colombo and to ships that call at harbours These prices have been determined on an internationally competitive basis, although there have been reports that aviation fuel to Air Lanka at certain times was supplied at concessionary rates.

The upward price adjustment in petroleum fuel prices after 1977 presumably compelled lower and middle class families to continue to depend on firewood. Mainly because it is not only available, but is still a good deal cheaper than petroleum products like kerosene and LPG. In the villages which are surrounded by home gardens and forests firewood has for a long time been available free. Although sometimes forest trees are cut down for firewood, most villagers do not do this, but they collect the dried branches and twigs which are abundantly available in both the wet and dry zone forests. At least 30 percent of the villagers are able to get firewood at no cost. But this trend cannot last for ever. The rapid depletion of the forest cover and the progressive

decrease in the supply of the fuel wood will mean that, sooner or later, these rural households will have to look for other sources of commercial energy for cooking. The choice before them would be to use LPG or firewood which is available on a commercial basis. The expansion of the firewood industry would obviously mean that this would happen at the expense of the country's fast depleting forest cover. The supply situation, would not be satisfactory unless adequate fuelwood plantations are opened up and the current policy of reafforestation is effectively accelerated.

After the first OPEC price increase in 1973, there was a second significant increase in 1979. This happened at a time when the UNP new Government was in the process of putting into effect the open economy policy, which involved cutting down subsidies, containing budgetary expenditure and raising the levels of investment. This also involved major changes in the pricing policy of petroleum products. The new pricing policy on energy was reflected in the sharp increase in the price of both firewood and kerosene after 1979. Undoubtedly, the pricing policy on imported commercial fuels affected the price of firewood which rose rapidly between 1973 and 1979. Firewood prices rose by 117 per cent between 1979 and 1984. To some extent, this resulted in the short run in the middle and poor households shifting from firewood to kerosene for cooking. Sensitivity of price changes in the use of energy in the households is seen in the shift from firewood to kerosene for cooking in the period before 1979, until a sharp increase in the price of firewood took place. After 1979, there was a reversal of this trend

with the price of kerosene rising at a faster rate than firewood and many consumers shifting back to firewood. The increase in the price of kerosene induced urban households to switch to LPG which is a more efficient and convenient fuel than kerosene.

Firewood is not an easily substitutable and an efficient form of energy as compared to electricity and petroleum which are the principal forms of commercial energy and its use in modern industry is somewhat limited. Petroleum products account for about 19 per cent of the country's energy requirements while electricity provides about 10 per cent. Electricity in the Sri Lankan context has an advantage over other forms of modern energy, because with good rainfall, the Ceylon Electricity Board is able to meet the country's entire requirements from its hydro power stations, The contribution of hydro power to the country's energy requirements varies with the incidence of favourable rainfall. Apart from firewood, hydro electricity is the only source of renewable indigenous energy and in the past hydro electricity has provided about 35 per cent of the commercial energy needs. In drought weather conditions, even as recently as the first half of 1992, the Ceylon Electricity Board has had to resort to extensive thermal generation when the water levels in the hydro reservoirs were very low necessitating the import of more oil.

The use of oil to generate electricity has imposed a heavy burden on the country and the balance of payments and has tended to raise costs of production everywhere. It often tends to use up valuable foreign exchange which could have been profitably diverted

to the country's development. This problem is compounded because of the very low tariff applied to small city and rural electricity consumers. The higher tariffs applicable to industries imply that the latter have to pay for or subsidise the small consumer. The higher costs of industrial production that results, tends to make the export oriented industries less competitive and raises the price of manufactured goods. In the period 1980 - 92, when the demand for electricity for industrial and domestic purposes rose sharply, the additional power needs were met, particularly in periods of drought, by resorting to extensive thermal generation. As a result, a higher proportion of the country's export earnings had to be diverted to pay for oil imports. The problem became worse when this additional amount of money had to be paid for oil imports for power generation at times when the world prices of crude oil have tended to rise. In 1982, 1.94 million metric tons of crude oil and 275,381 metric tons of refined products were imported, due to the need to generate more power by thermal means. In 1982, the value of petroleum imports rose from Rs. 9.9 billion to Rs. 12.1 billion, which is an increase of 22 per cent, because the Electricity Board had to continuously use its thermal power plants.

During 1978-82, the demand for commercial energy rose at an annual rate of about 9 per cent compared to the annual rate of growth in the period 1970-79 of 3.3 per cent. This significant increase in the rate of growth of commercial energy is attributable to the transformation which was brought about by the drastic changes in the

economic policies between the two periods. After 1978, considerable pressure was exerted on the economy by the spectacular rise in the demand for energy on account of the quickening of the pace of industrialisation and the much higher levels of commercial and business activity in all parts of the economy.

DEMAND FOR ENERGY AND PRICING 1977 - 1990

As indicated earlier, the Ceylon Petroleum Corporation has been committed, especially up to 1977, to maintain the prices of auto diesel and kerosene at artificially low levels. In this context the Ceylon Petroleum Corporation used to subsidise kerosene and auto diesel out of the profits made on petrol. The UNP Government that came into power in 1977 was committed to progressively do away with all forms of subsidies and subsidies on petroleum products, notably kerosene and diesel, were not excluded from this policy. Prices of both these products were raised at the earliest available opportunity. However as a measure of relief for the poor, with effect from 1979, the Kerosene Stamp Scheme was introduced. This replaced the general subsidy on kerosene and the most poor families were able to obtain relief after the upward revision of kerosene prices by getting a monthly financial entitlement. The subsidy on auto diesel was withdrawn in 1980. However, some of the petroleum products sold to the Sri Lanka Transport Board and the Ceylon Government Railway involved a subsidy in the form of a rebate granted to them. This rebate was reduced and it dropped from Rs. 139 million in 1981 to Rs. 86 million in 1982.

The years 1978 - 80 were landmarks in the reorientation of pricing and subsidizing policies on energy, particularly petroleum products. This was indeed a healthy development because in the preceding two decades the consumption of kerosene had risen in a spectacular manner. Cheap kerosene was used as a substitute for other petroleum products, particularly petrol. The progressive increase in kerosene consumption meant that the Ceylon Petroleum Corporation had to import more refined kerosene than was produced at the refinery. From a fixed quantity of crude oil the Corporation used to produce the maximum quantity of its lowest priced product kerosene at the expense of superior and more profitable products. Therefore, if the low priced kerosene output is increased it would mean that the Corporation would have to produce less of the more profitable other products and in the process, its earnings would get reduced and it would have to import higher priced refined products. The new pricing policy of the Government on petroleum products, in fact, helped the Corporation to solve some of the other problems it had faced over a long period, particularly, that of maintaining an optimum product mix at the refinery, or the significance of producing the maximum quantities of the most profitable products and having to import at high cost products such as kerosene which carried a heavy subsidy.

Despite the policy of cutting down subsidies by increasing retail prices and having a relatively high industrial tariff, the demand for power continued to surge after the liberalisation of the economy. The consumption of electricity grew at the rate of 10.1 per

cent in 1978 - 82. The sharp shortfalls in the supply of power in 1982 were overcome by the instaliation of six gas turbines each of 20MW, increasing the total generating capacity of the system by 120MW. The main disadvantage of gas turbine generation is that these are fuel guzzling machines which raise the average costs of power generation and which also sharply raises the cost of power to the consumer. When a decision was taken to install these gas turbines it became a matter of great controversy, because some groups were advocating the feasibility of gas turbines, while others were for the cheaper forms of thermal generation such as diesel plant and steam turbines. Although the gas turbines are comparatively short lived and costly in terms of fuel consumption, their capital cost of installation is less and they have the advantage that they can take up a sudden increase in the load on the grid in a very short space of time. However, it could be presumed that, whatever the arguments for and against, they have been used to meet the shortfalls in power requirements at times when there were sharp increases in the demand for power resulting from higher economic growth.

After 1980, the operation of thermal plants, especially gas turbines, has meant a sharp escalation in costs for the Ceylon Electricity Board and the Ceylon Electricity Board therefore, had to introduce a Fuel Adjustment Charge on consumers who were using more than 150 units per month. The new pricing policy of electricity and petroleum fuels was meaningful in the context of a general policy of energy conservation and diverting the use of the energy to areas which would contribute to increase national produc-

tivity and profit. Up to 1977 - 78, the distribution of energy among users was influenced by subsidies, price controls and regulations to ensure low prices for particular uses and certain categories of consumers. The earlier policy had led to the rapid and wasteful use of energy, it denied power to priority users and it greatly hampered the generation of more money for new investments to improve the electricity supply to consumers and for other activities.

From 1983 onwards, the energy outlook tended to improve considerably. But at the same time, the demand for energy tended to increase at a slower pace until 1988 due to disturbances and unsettled conditions in the Island. The energy policy thereafter was designed to keep down unnecessary consumption through appropriate prices which were essential for the proper management of energy and its conservation. As indicated earlier, one of the main ways of conserving energy was to make energy more expensive by raising prices and imposing a Fuel Adjustment Charge. This charge had to be frequently revised upwards because the Ceylon Electricity Board had often to pay the Petroleum Corporation much higher prices for its supplies of heavy diesel and furnace oil, not only with the rise in world petroleum prices, but each time there was a further devaluation of the rupee. In turn, the Petroleum Corporation had to regularly meet the higher cost of imported crude oil and refined products, not because of the increase in the price of crude oil, but due to the frequent depreciation or the fall in the value of the Sri Lanka rupee. The Petroleum Corporation and the Electricity Board had no option but to pass on the higher costs to the consumer.

As evidence of the expansion in activities in all parts of the economy by 1983, the total energy consumption in Sri Lanka had risen to the equivalent of 4. 1 million metric tons of oil, meaning that, if all the country's energy needs were met from oil it would have needed 4.1 million metric tons of oil. Of this, commercial energy was equal to 1.8 million metric tons of oil or about 44 per cent of the total. Hydro power and thermal electricity contributed about 14 per cent of the total commercial energy supply, while petroleum products provided 96 per cent and LPG 1 per cent. Firewood contributed 2.3 million metric tons in terms of oil or 56 per cent of the Island's energy requirements.

With the departure from price controls and subsidies in the nineteen eighties, a large number of price revisions took place for all forms of commercial energy. In 1983, the retail prices of petroleum products were increased in March and July 1983 in order to recover the increased costs of oil imports. By this time the earlier price revisions had brought the kerosene price almost equal to the actual cost: and consumption had fallen by 7 per cent. The latter shows the extent to which perhaps there had been wasteful and unnecessary use of kerosene. The monthly value of kerosene stamps in 1982 was Rs. 9.50 per family and this was increased to Rs. 21 per family in 1983. The Ceylon Petroleum Corporation received Rs. 141 million from the Treasury to meet the cost of the subsidy on kerosene. From 1983 the consumption of petrol increased sharply showing that car owners mostly belonged to an affluent class and the much higher prices have not prevented them from using more petrol. Furthermore, a large

number of these vehicles are owned by Government for the use of officials while private sector establishments provide vehicles to their staff as a fringe benefit. For these categories, the cost of fuel is not a very material factor and high prices do not tend to deter consumption.

The use of LPG became more popular especially after the increase in kerosene prices and the quantity of LPG used in 1983 was 8078 metric tons, which was an increase of 23 per cent over the previous year, or double the amount of LPG consumption in 1979. This shows that more households were switching to LPG and more gas was being used from that time for cooking purposes. Due to the limited level of LPG available from the local refinery, the Colombo Gas and Water Company had to import more LPG in 1983 to meet the shortfall. In 1983, the Ceylon Electricity Board increased the Fuel Adjustment Charge from 110 per cent to 185 per cent, but it gave relief to the low income households by exempting those consuming less than 150 units from the surcharge. This of course meant that the larger consumers, including industry, had to subsidise the small consumers. For example, in 1983, the Ceylon Electricity Board was able to recover about 50 per cent of the cost of thermal power generation which was Rs. 2433 million from the Fuel Adjustment Charge. In the meantime, despite the increase in the price of electricity, there was a progressive increase in the number of households using electricity. In 1983, 15 per cent of the households in the Island had electricity.

The Fuel Adjustment Charge did not affect the extension of electricity to the rural areas, mainly because of the exemption of the middle income and low income families from the surcharge. Had the charge been uniformly imposed on all consumers, the cost of electricity in the rural areas, where the bulk of the poor people reside, would have been seriously affected. One reason for the exemption of these categories from the Fuel Adjustment Charge was to give effect to the present policy of the Ceylon Electricity Board which is to provide electricity to the rural areas so that the heavy investments in the power generation will benefit all classes of people. In 1983, 330 rural electrification schemes were completed bringing the total number of schemes to 3362 and this should be compared with the 943 schemes that existed in 1977.

In 1985, the Energy Conservation Fund Act No. 2 of 1985 was enacted with an initial capital of Rs. 5 million. In 1985, the entire electricity supply came from hydrel sources and there was a marked reduction in thermal generation. The policy of the Board was to bring about savings and reduce the losses in the generation, transmission and distribution of electricity. It was able to reduce the loss from transmission and distribution from 17 percent in 1984 to 16 percent in 1985. The policy of better energy management and correct pricing policies were not introduced for electricity only, but for other categories of energy such as petroleum products and firewood. To promote the efficient use of firewood 20,000 clay stoves were distributed under the Wood Stove Development Programme.

The progressive increase in the overall energy consumption continued and by 1985, the total energy used in the Island had risen to 6 million tons of oil equivalent from 5.9 million tons in 1984. In 1985, there was no change in the price of petroleum products, but the consumption of petrol and other products such as kerosene, heavy diesel and furnace oil fell and this was partly due to disturbances in the Island. Heavy diesel and furnace oil consumption invariably fell because the Ceylon Electricity Board did not use petroleum fuel to generate thermal power. LPG was another product which has seen a steady rise in use and by 1985, the total quantity used for cooking and industrial purposes was 12,590 metric tons, In 1985, the Ceylon Electricity Board reduced its tariffs by introducing the 'Time of Day' tariff scheme which was designed to shift the demand for electricity from peak hours which is from 6 pm - 9 pm to non-peak hours 9 pm - 6 am. The tariffs during peak hours were made higher than during non-peak hours. In 1985, the Fuel Adjustment Charge was withdrawn, but despite the high cost of electricity sales increased by 10 percent.

In 1986, more power was available from the hydro power stations in the Mahaweli Scheme and the total generating capacity of the Ceylon Electricity Board, consisting of 746 MW of hydro power and 270 MW of thermal power, rose to 1916 MW. In 1986, with the downward price movement of world oil prices and the reduced demand for some petroleum products, the total expenditure on petroleum imports tended to come down. In 1986, the price of all petroleum products remained unchanged and the price of furnace oil

was reduced by Re. 1/= per litre. In 1987, the Ceylon Electricity Board had to resort to thermal generation once again.

At the beginning of 1988, the electricity tariff was further increased and the charges were raised by 20 per cent on all consumers using over 100 units. By 1986, the total number of rural electricity schemes had risen to 4,485 and in that year alone 1,095 new schemes were commissioned. The Electricity Board reported that in 1986 there were 370,048 domestic consumers of electricity and 62,537 industrial consumers. The bulk of the industrial consumers used commercial energy and only a very small number of them in the industrial sector used non-commercial energy such as firewood, charcoal, coconut husks and other materials from the coconut tree in tea dryers, brick and lime kilns, boilers and distilleries. In the sugar industry many of the producers of sugar and juggery use sugar cane refuse or bagasse to fire boilers and this also falls into the category of non-commercial energy.

In 1987, despite an overall generating capacity of 1138 MW the Ceylon Electricity Board had to resort to thermal generation once again. One reason for this was that in relation to the overall increasing demand hydro generating capacity was not adequate. In May, the Ceylon Electricity Board re-introduced the Fuel Adjustment Charge of 15 per cent on those using more than 150 units and in September, it raised the charge further by 30 per cent. In 1988, there was a further revision of electricity tariffs and the Fuel Adjustment Charge was raised to 20 per cent for those

consumers who used more than 100 units per month. Once again an increase in the price of petroleum products took place in 1989 in April and September. Due to the upward movement of crude oil prices and the depreciation of the Sri Lanka rupee, the Petroleum Corporation began to incur losses. Petrol prices were raised by 48 per cent, while all other petroleum product prices went up by about 18 per cent. However, the price of kerosene remained unchanged. Despite these rapid price increases, domestic consumption of petrol increased by 9 per cent due to more imports of cars and motor cycles. In the urban areas, LPG was progressively replacing both firewood and kerosene as a cooking fuel and in 1989, the increase was 23 per cent and the total quantity of LPG used was 29,505 metric tons.

In 1990, one of the major revisions of electricity tariffs took place when the Ceylon Electricity Board was in a position to generate more power than it had done before, with a generating capacity of 1289 MW. On 1st April, 1990, domestic tariffs were increased by 50 per cent for all consumers using more than 50 units. The industrial tariffs were raised by 34 - 43 per cent, commercial tariffs 55 - 64 per cent and hotels 59 - 69 per cent. With the completion of the major hydro power projects which were all financed by long terms loans, largely from the World Bank and other donor countries, the Ceylon Electricity Board was required, as a condition, to ensure a rate of return of 8 per cent on the average net assets, while maintaining the debt service ratio at not less than 1.5 and providing at least 30 per cent of the funds needed for capital works

from internal cash generations. Even these very sharp upward revisions of the tariffs did not affect sales, because the commercial and the industrial demand for power remained firm and sales rose by 9 per cent. Following upon the increasing price of electricity, petroleum prices were revised twice in 1990. The highest increase in petroleum products was for petrol, where the price was raised by 75 per cent. The price of furnace oil was raised from 30 - 34 per cent. The price of kerosene, which had not been increased since 1983, was raised by 34 per cent. However, these substantial price increases were not permitted to remain and with the fall in the world market price of oil prices were revised downwards on 27th December.

SIGNIFICANCE OF POLICIES

The foregoing analysis brings to light several significant features in energy pricing and the changes in consumer response to changes in price. From the policy stand point, two major periods could be identified. The period before 1977 was one where the policies were designed to enhance the welfare of the people with other objectives being somewhat subservient. Throughout this period, the price of energy in Sri Lanka was relatively low and even after the OPEC countries jacked-up the price of fuel. From 1973 onwards, the consumer was able to buy petroleum and other products at prices which were much lower than in many other developing and developed countries. In particular, it is known that Sri Lanka perhaps had the lowest price for kerosene than in any part of the

world. The pre 1977 Government was committed to policies which were guided by welfare considerations. Such policies involved heavy subsidies and the burden was shouldered by the Government budget. These policies resulted in the unrealistic pricing of products and very often the best use of energy was not being made. The only advantage seems to have been that the real income of the consumer was maintained and the impact of the high prices of energy on the cost of living was very small.

Furthermore, the pricing policies of energy in Sri Lanka did not reflect the scarcity of both renewable and non-renewable sources of energy. Even in regard to the domestic sources, these policies artificially depressed petroleum prices and in turn kept down the prices of commercial firewood which has not been a freely available resource. However, the data available shows that a fair proportion of the firewood has come from rubber trees that have been felled in estates prior to replanting. But what is not known is the extent to which trees that should not have been cut down in the normal course have been felled as commercial firewood. The felling of forests for firewood could be major problem, although details are not always available.

After 1977, the change in pricing policies were very important from a growth, economic and resource conservation point of view, because the price revision of imported and indigenous commercial energy was made at a time when the demand for

energy tended to skyrocket. Had the price of energy after 1977 increased sharply in terms of the strength of demand that existed then, there would have been no way to meet the demand without imposing untold burdens on the economy and in particular on the balance of payments. Several aspects need to be highlighted and the fact that certain categories of consumers were not given price advantages were significant. The new pricing policy of totally eliminating subsidies, especially on consumer items like kerosene, enables the Government to channel energy into areas where production and growth can take place. Particularly, in the industrial sector, the price of energy has been competitive in context of prices prevailing in other countries which were more heavily dependent on imported fuels, particularly petroleum products. The pricing of energy after 1977 affected all categories of fuel which included firewood and the resulting increase in the price of firewood indicated that commercial firewood was indeed a scarce commodity, and that the supply and price of firewood should reflect the extent to which the timber resources and forests in the Island have been depleted over the last several decades.

Outside the recent increases in the price of petroleum products due to upward movements in world prices, yet another factor that has strongly influenced the prices of petroleum and other fuels has been changes in the rupee exchange rate. The progressive devaluation of the rupee from Rs. 15/- to the dollar in 1977 to Rs. 44/- to the dollar in 1992, which is a devaluation of more than 300 per cent, has also

compelled the Petroleum Corporation to increase prices to the consumer. At present, in the case of petroleum products since world oil market prices are reasonably stable, because the OPEC countries were unable to agree upon a higher price formula, the main consideration that governs the pricing of petroleum products and even electricity and firewood, has been the movement of the rate of exchange.

The Government is today committed not only to remove subsidies to the Ceylon Petroleum Corporation but to make it a source of revenue. In fact, today, there is a tax of 45 per cent imposed on the Petroleum Corporation and this has meant that the Corporation must not only provide revenue to the Government but has to ensure its overall profitability. On the assumption that world crude oil prices will not rise significantly, the overriding factor in price determination in the future is the extent to which the rupee will depreciate over other currencies. Even small adjustments in the exchange rate are likely to cause major losses to the Petroleum Corporation unless price adjustments are made frequently in petroleum and other products. Devaluation of the rupee influences all other prices not merely the price of imported goods and thereby pushes up the cost of living. It will also push up the prices of commercial firewood because of the significant transportation and labour costs in the firewood that is commercially available in the urban and rural areas.

The Recent Pattern of Demand for Firewood and other Fuels in the Households

The Consumer Finance Survey undertaken by the Central Bank of Sri Lanka in 1986-87 has the most recent information published on the use of energy of different kinds and the amount spent. The most up to date information on the household use of energy will be available from the ongoing household survey on the Credit Needs of the Poor 1992/93 which is now being undertaken by the Central Bank of Sri Lanka for the Credit Co-ordinating and Monitoring Committee. Broadly, the 1986 - 87 survey shows the changes that have taken place in the household consumption of energy and on expenditure. From this survey, it is possible to tentatively arrive at figures to make a distinction between commercial energy and non-commercial energy used in the households. Energy used by households, that is not paid for, would fall into the category of non-commercial energy, while all forms of energy, including firewood, which is purchased by the consumer, would fall into the category of commercial energy.

The survey shows that 92.4 per cent of all households in the Island use firewood for cooking meals. In the urban sector the percentage of households using firewood is 79.8 in the rural sector 98.4 and in the estate sector 99.1. This shows that the main source of energy for domestic cooking is firewood. In regard to the use of kerosene for cooking, the all Island figure is only 0.75 per cent of the households. In the urban sector 2.3 per cent of the households use kerosene for cooking, in the rural sector 0.05 per cent, and in the estate sector kerosene is not used at all. More

households seem to use electricity, and the amount used here is higher than kerosene and this is true of all three sectors. In the urban sector 3.5 per cent of the households use electricity for cooking, it is 0.15 per cent in the rural sector and 0.34 per cent in the estate sector, giving an all Island figure of 1.33 per cent. The use of gas, mainly LPG, became quite popular in the last decade and its use is increasing in the urban areas, where 12.6 per cent of the households use this fuel.

In regard to the free or non-commercial firewood, in the urban sector, 23.8 per cent of the value of firewood used has been available free of charge, while 67.5 per cent of the value of firewood used in the urban sector has been purchased. Accordingly, in the urban areas, the expenditure on firewood is 67.50 per cent of the total amount spent on firewood. In the rural sector the bulk of the firewood used, which has been valued, has not been paid for and this figure amounts to 82.8 per cent. The value of firewood purchased amounts to only 14.5 per cent of the total quantity used. These figures substantiate the widely accepted conclusion that in the rural areas the bulk of the firewood is available free from ones own garden, from neighbouring gardens or from forests. In the estate sector the amount of firewood available free is higher than even in the rural sector.

As much as 89.4 per cent of the value of firewood used in the estates has been obtained from own gardens and government forests. The value of firewood purchased in the estate sector has been only 2.17 per cent. From the data in the Survey it has been

possible to derive the expenditure on firewood per household in the three sectors. In the urban sector, the amount spent is Rs. 2.40 a day, in the rural sector Rs. 1.98, and in the estate sector Rs. 1.95. On this basis, the monthly expenditure on firewood for the Island as a whole is Rs. 379.80 per household (at Rs. 60 per cwt of split firewood) which is roughly equal to 6.33 hundredweights per month. The figure for the year is therefore Rs. 4,548/= which is equal to 75.8 hundredweights. On a rough estimate the total value of firewood used in the households in the Island during a year is over Rs. 15 billion and it could be assumed that about 70 - 75 per cent of this has been made available free of charge.

In the use of energy for lighting, kerosene is widely used in the rural and estate sectors. Although, it ranks second in importance in the urban sector, where 35.3 per cent of the households use it, 80 per cent of the households in the rural sector and 91 per cent in the estate sector use kerosene. In the urban sector, the easy availability of electricity and the convenience that it affords has helped 64 per cent of the households to have electric lighting. The figure for the rural sector is 18.2 and in the estate sector it is very low at 3.6 per cent. Unlike in cooking there is no free energy source for lighting. Many houses still use coconut oil lamps for lighting in the rural areas and is much cheaper though less efficient than kerosene. The only exceptions however are the use of solar and bio gas. But even in regard to these sources, although the use of solar power and bio gas does not involve recurring costs, the consumer nevertheless has to pay initially large sums of money to install such facilities.

The households are the biggest energy users in Sri Lanka and the latest Consumer Finance Survey 1986/ 1989 undertaken by the Central Bank of Sri Lanka confirms that the demand for both commercial and non commercial energy in the households in the urban, rural and estate areas is largely satisfied by firewood. This primarily follows the pattern in the use of energy that has been present from the time when the first Consumer Surveys were conducted in the 1950s. The predominance of firewood as the major source of energy has remained unchanged, despite higher living standards among all segments of the population and the availability of alternate but more sophisticated types of fuel for households. The prime determinant of household energy would appear to be easy availability and the price.

The shift from firewood to other sources of energy has been very small due to the price trends of other fuels mainly LPG, kerosene and electricity. In this case, the choice of the kind of fuel used has been largely determined by price. As long as firewood remains a fuel that is easily accessible and is available without payment most households in the estate and the rural areas would continue to use it.

In the urban sector, the use of firewood is still very extensive and is much cheaper than LPG, though very much less efficient. For urban householders in the middle and low income brackets, although it is not convenient to use firewood specially in homes which are small and crowded, yet these people have no option because of the low cost of firewood, There is also the consideration that unlike in an open hearth,

where special costly equipment is unnecessary, other than a few bricks or a clay stove; for kerosene, electricity and gas, special appliances and cookers are necessary. They are not only costly for the low income groups but maintenance is even more expensive and other than in urban areas, maintenance men and spares are not available to keep them going. Furthermore, all these additional expenditure impose burdens on the middle class and the poor households who have fairly fixed incomes. Accordingly, with the rising price of electricity, LPG and kerosene, the vast majority of households in the urban areas, even though inconvenient, would prefer to use firewood in the future as well.

A change in this trend would come when timber supplies get progressively exhausted and the price of firewood will really reflect its scarcity. However, as long as Sri Lanka's rubber industry stays on, the regular felling of rubber trees would ensure a very satisfactory supply of fuel wood, in addition to waste material from coconut. Most of the villagers that make firewood splitting their livelihood and the firewood depots in the city obtain the bulk of their supplies from rubber.

What has been said here for cooking will not apply for lighting where the energy is used for a much longer time and on a more sustained basis. While in most households the average cooking time, where a hearth is used, may be 1 - 1 1/2 hours in the morning and a same period in the evening, in the case of lighting, the period of energy use, could be longer up to a minimum of 4 hours per day in most households.

With the introduction of Television, the use of energy, particularly electricity in the household, has lengthened in terms of hours and also increased the rate of consumption, There is a progressive shift towards the use of electricity particularly in the urban and the rural areas. However, this is a very slow trend. Today, the demand for electricity is determined by several factors.

Looking at it from the point of view of the household, the first issue is the initial high cost. A village home has to pay a sum of more than Rs. 6,000/= today to the Electricity Board to obtain a connection and this is so only if the overhead mains are close-by. Otherwise, the cost would very much higher or sometimes prohibitive. Then again the rural householder has to pay for the internal wiring of the premises. All these overhead costs tend to add to the cost of making electricity available. Although, the electricity tariff is still very attractive for small consumers who use less than 100 kw. hours or units per month, for those consumers in the urban areas who use television, refrigerators and other household appliances and whose monthly consumption exceeds 300 units, the electricity bill is not within the reach of the average fixed income earner in the urban areas. In the case of those whose bills have a consumption of more than 500 units, the monthly bill exceeds Rs. 1,500 without the Fuel Adjustment Charge and for a man whose total income is Rs. 5,000/=, he can ill afford to set apart 20 - 25 percent of his monthly income to pay electricity bills.

One factor that has sustained the use of kerosene for lighting has been the Kerosene Stamp Scheme which has insulated most of the households in the rural sector from the high cost of the product. Today there is greater appreciation and a preference for the use of electricity in the rural areas, not only because it is a clean and convenient medium of lighting, but it gives them access to the country's television channels which are now extremely popular everywhere.

In the estates, the use of electricity is very low, mainly because of the non-availability of supplies, other than to the factory and the buildings of the senior officials. A few tea estates still continue to generate their own electricity and it was indeed foolhardy for the electricity authorities in the 1960s, to have discouraged estates from having their own mini hydro stations, on the grounds that the national grid could supply cheap power because the bulk of the electricity would be available from hydro sources. Electricity is no longer cheap and many urban households which moved to cooking by electricity in the sixties and seventies, have now, moved back to LPG and the electric cookers in the kitchens serve an ornamental purpose and are not practically functional.

Electricity is the major source of energy in the industrial sector mainly because it is efficient and convenient. Environmentally too, it is the best form of fuel because of the low levels of air pollution and other forms of environmental degradation. Many industries have their own generators and some have found it more economical to run their diesel generators to operate the factories than to use power from the

national grid. Despite the growth of industry of all sizes in all parts of the island, the demand for electricity shows a peak at the time that the demand for lighting is at a maximum in the late evening. There is also an industrial peak which may occur between 10.00 a.m. and 3.00 p.m. but yet the lighting peak is more prominent. This industrial peak of course is not entirely appropriate because the number of factories that operate their own power plants are not known and equally, their capacities are not known. Hence. it has to be assumed that the industrial peak demand for electricity is in fact higher than what is shown in the demand curves of the Ceylon Electricity Board.

The services sector which is highly developed, largely uses petroleum fuels and electricity. Very little information is available on the use of energy in offices, shops, retail outlets, hotels and other commercial establishments. These establishments use electrical energy mainly for the purpose of lighting, air conditioning and operating electrical and electronic office equipment. The trend towards greater computerisation and the automation of office work has resulted in the upsurge of demand for commercial energy. The demand in this area has not only been sustained but has substantially expanded. For instance, every establishment today has an electric typewriter, a telex and fax machine, which are all dependent on electricity and the rapid improvement in the communication systems has increased the demand for electricity. In this commercial sector the price of electricity does not influence the demand, but the convenience and the sophistication of the new equipment has become the determining

factor. The demand for electricity in this sector will continue because the commercial, retailing, marketing, communication, financing and ancillary services have expanded with the growing buoyancy in business activity.

Public and private offices which never used electricity before for lighting in day time, have to use electricity for lighting offices in day time because of the modern architectural features of new buildings. Furthermore, since the liberalisation of the economy, air conditioning has become common place in all private sector offices, banks, retail and commercial establishments. The demand for cold storage at wholesale and retail points and the net-work of super market type shops have been major users of electricity. However, data is not readily available on the use of energy, mainly electricity in this sector, because these activities are not caught up in the regular consumer finance surveys which are primarily confined to the households.

The transport sector has been protected by providing diesel for commercial transport at much lower prices than petrol, Although little or no profit is made by the Ceylon Petroleum Corporation in the sale of diesel, the pricing policy of making a substantial profit has not been made applicable for diesel. The authorities will have to follow this policy in the future because transportation is socially and politically a sensitive area which effects the cost of living and even more the cost of production particularly for export. The problem with petroleum products is that their pricing is heavily influenced by frequent changes in the exchange rate. However,

devaluation of the rupee will tend to make all petroleum fuels cost much more and the consumer will invariably have to bear these costs. If transportation costs rise, other fuels like firewood will tend to move up, but very often, not to the same extent. While there is a strong advocacy for the maintenance of realistic pricing policies for petroleum energy yet the social costs of these policies cannot be ignored.

In the case of electricity, the large hydro electric works completed in the recent years, with perhaps one exception, have been financed from borrowing from international organisations and friendly donor countries. The present policies of the Electricity Board have been largely influenced by the views expressed by the World Bank and the International Monetary Fund. The World Bank being the major creditor has been in a position to influence the present policies. The pricing of electricity has a wide impact on all types of activity in the economy. Accordingly,while it is important that the Board must run at a profit, undue strains should not be imposed through high pricing of electricity on the economy and should not dampen business activity.

New forms of relatively inexpensive energy, mainly solar energy are being made available to the household and the hotels. Many affluent households are today using solar energy for heating water and large numbers of rural households are using solar panels for lighting, Although the recurring costs of solar energy are small the initial

capital expenditure tends to be quite high and is not easily within the reach of many households. the bigger hotels in the Island have been the major users of solar energy for heating water. Provided the capital cost can be met, this is a very satisfactory source of commercial energy, involving relatively inexpensive maintenance and creating no environmental hazards.

It is also possible for the country to go in for solar energy on a much wider scale and to make use of the experience and technology from other countries such as Russia, where extensive use has been made of solar energy and where entire towns and cities have been supplied with solar power. It is by increasing the use of solar energy that the country's petroleum consumption could be kept down. The advancement of solar energy technology in the western countries and the use of solar power in motor vehicles could make a major break through in economising in the use of petroleum fuels and Sri Lanka with nearly 11-12 hours of bright sunshine per day can maximise the energy from this new source.

SOME FACTORS INFLUENCING FUTURE PRICING POLICY

The foregoing analysis shows that the structural demand for commercial energy has now reached a point of reasonable stability, given the prevailing pattern of relative prices. Furthermore, substantial price alterations may not influence this demand

pattern very much as subsidies are at a minimum now and any significant change in the price of any type of fuel will sooner or later influence other prices. The acceptance of the principle of no subsidies and that prices should reflect the scarcity value of energy is a major step forward. However, adjustments in the exchange rate will continue to effect all prices of commercial energy both local and imported, In the last few years, fuel price have been heavily influenced by changes in the exchange rate and this influence has come through two channels, the resulting higher cost of petroleum fuels and the general increase in the prices that result from the devaluation of the rupee. The general price level and the relative prices of commercial fuels could be reasonably stabilized by keeping changes in the exchange rate to a minimum in the future.

Of course, the main arguments for exchange rate adjustments have come from the need to provide additional incentives to exporters and this is an argument used frequently by the IMF in support of devaluation. But, the fact cannot be ignored that devaluation of the rupee in turn increases the costs of production of export items through higher costs of raw materials, wages, and equipment and eventually the advantage to the exporter is short lived. The pricing policy of the Ceylon Electricity Board has been influenced in the past by the recurrent devaluation of the rupee and the incidence of poor rainfall in the Island.

For some years, both these factors have played a significant part and in drought periods invariably, the Board has to use thermal generation which means using high cost imported fuel. Another consideration is that the Ceylon Electricity Board has been advised to ensure a return of 8 per cent on its assets and this tends to keep the tariff at higher levels. For instance, in the first four months of 1992, due to very poor Island wide rainfall and severe drought in the hydro catchment areas, the Ceylon Electricity Board had to resort to thermal power extensively, and the cost of electricity went up by 25 per cent with the introduction of the Fuel Adjustment Charge.

Despite very favourable weather in July, August and September, 1992, the Ceylon Electricity Board still continues with the Fuel Adjustment Charge on the grounds that it has to recover the full costs of oil used for thermal generation. As the Fuel Adjustment Charge now operates, it amounts to a tax on the medium and large domestic consumers and on industry in general. These categories of consumers have to subsidise the electricity consumers that use less then 150 units per month who are exempted from the charge. The question of exempting the small consumer from the Fuel Adjustment Charge has to be reviewed because, small consumers also pay a lower tariff on the consumption of electricity. In this respect therefore, the subsidy to the small consumer is fairly high because he is also on a lower tariff. Furthermore, now that the kerosene subsidy has been withdrawn, with the poor entitled to kerosene stamps, the

implication of the pricing policy of the Ceylon Electricity Board is that the non kerosene stamp rural people and those on the estates who use kerosene, do not receive a subsidy, while those who have benefited from rural electrification schemes stand to get electricity at a concessionary price.

A duty of 45 per cent is payable on imported crude oil and since there is little or no subsidy on kerosene the non-kerosene stamp user pays a tax which raises the cost to about 40 cents per hour on the kerosene he uses for lighting. On the other hand the low income consumer who uses electricity pays only four cents for the same amount of illumination. There is however some rationality in this policy as long as all power in the country is from hydrel sources and there is no thermal generation, the object being to encourage purely indigenous sources of power. Since kerosene is used by nearly 70 per cent of households for lighting, kerosene prices should be kept within their means. But on the other hand, lowering kerosene prices could involve the substitution of kerosene for diesel and encourage people to use it for cooking, as it happened in the nineteen seventies when kerosene was very cheap. Low priced kerosene will also mean more imports of refined kerosene at much higher prices because the local refinery cannot meet the entire demand. Further, there is no reason to allow kerosene to be used for domesiic cooking in rural areas when there is firewood and agricultural waste available.

In the case of LPG, current sales have exceeded the local refinery production and a fair amount has to be imported. It should not be treated as a refinery by-product and therefore priced low. Since LPG is an imported product, pricing should not make it so attractive to make it a substitute for firewood and biomass although it is a clean and efficient fuel. In the case of exported petroleum fuels like fuel oil, naphtha, bunker and aviation fuels they should be priced at internationally competitive prices so that aircraft and ships will refuel in Sri Lanka. Sometimes, the high customs duty on crude oil does not always make this possible, but the policy of internationally competitive pricing should remain in order to maintain exports.

The present pricing policy of the Ceylon Electricity Board does not give any price concessions to the large consumers and particularly, to industries. The question arises whether electricity should be given cheap to certain households at the expense of the more productive users of power. Power must be available at a reasonable price for industrial use, particularly, for small industries which are now found in the households, and in the rural areas. If the Fuel Adjustment Charge is not applied to the small consumers, the best policy would seem to be to put the small consumer on the same basic tariffs as the medium and large consumers of electricity, as there is little justification for a double subsidy. While it is true that people in the rural areas should get electricity because of environmental considerations and the need to have access to modern conveniences, but the concessionary price at which electricity is made avai-

lable to the rural areas has to be looked at in a context where the bulk of the people in the rural areas, even though they are engaged in profitable agricultural activities, do not pay income taxes. It has been estimated that this subsidy to the low income consumers in 1991 was over Rs. 900 million.

There is also the consideration that the cost of supplying electricity to the rural areas is fairly high, because the transmission lines have to be extended over long distances to provide electricity to small clusters of households, which pay very little for electricity with their bills not even coming to Rs. 200 per month. Then again, the lengthening of the low tension transmission lines also involves a heavy loss of power in transmission. It is believed that this loss is in the region of 17 to 20 per cent. This means that of the power generated by the Ceylon Electricity Board there is no revenue received from this 20 per cent and to some extent, this amounts to a further subsidy to the people in the rural areas. In the towns and suburban areas, however the transmission loss has now been considerably reduced by better systems of cabling, sub-stations, metering and switch gear. Also the illicit tapping of power has been cut down.

The Ceylon Electricity Board also now faces a heavy debt service commitment on the various hydro power schemes which have come into being in the period 1983 up to date. It is known that some of these schemes, particularly Kotmale, has had major cost over-runs and no single scheme was completed within the original budget and very often the government had to go in for commercial loans. Then again,

there is a more recent catastrophe, the Samanalawewa Hydro Power Scheme in Balangoda. It has been reported that almost Rs. 20 billion or US 400 million has been spent on this scheme. The actual cost of this scheme has therefore escalated by more than 400 per cent. There are loans that have to be repaid in regard to Samanalawewa, and the cost over-run due to poor workmanship and defective planning has also been financed by loans from countries from where contracting firms have come. The Ceylon Electricity Board has been financing the costs and the cost over-runs of Samanalawewa. Even if the scheme comes on stream eventual y, vast additional sums will have to be paid to strengthen the weak geological structure. Due to the continued heavy seepage of water, if the scheme cannot be finally commissioned the Ceylon Electricity Board would have two costs to bear, the revenue loss that would result from not generating 120 MW of power and the cost of servicing the large debts incurred for the project.

It is obvious therefore, that the Ceylon Electricity Board which is now required to produce a return of 8 per cent on its assets would have to pass on the additional costs to the consumer. These higher costs would have to be borne by the domestic consumer and industry, which will mean that industrial costs will at best remain at the present level or rise higher. An additional cost would be the cost of producing the power lost from Samanalawewa which is 120 MW from alternative sources for which further loans will have to be obtained. With the continuing increase in demand for electricity, with 200 garment factories planned to come into production shortly and with

many small industries being set up in the rural areas under the Poverty Alleviation Programme and the proposed establishment of other small industries such as the 200 lapidaries, the Ceylon Electricity Board will have to provide power for this increase in demand which on the average could amount to 12 - 14 per cent per annum in the next 7 years. Since new hydro generation capacity is not only costly, but time consuming, the Ceylon Electricity Board will have no option but to go in for diesel or coal fired power plants, which would use imported fuels.

The task before the Ceylon Electricity Board as far as pricing is concerned, is to bear all these considerations in mind and not to allow the price of electricity to rise further imposing heavy burdens on middle class consumers who would have to consume 150 to 300 units of power every month and also the large industrial consumers who are providing employment to a fast growing work force. At a time when living standards are rising in all areas, not merely in the towns, it is important that electricity should be priced in a way that most households would be in a position to use appliances like refrigerators, fans, floor polishers and basic kitchen equipment, ruling out cooking by electricity, which of course, is very costly. If the price of electricity is raised further and if the present Fuel Adjustment Charge is absorbed into the main tariff, as it has been done in the past, electricity would not be attractive to the consumer, and if incomes do not rise consumers may move away into less efficient, less convenient and environmentally damaging fuels. The avoidance of all these factors would depend on a carefully designed pricing policy by the Ceylon

Electricity Board. This would also involve the optimum use of the hydro plants in the Island and the conservation and proper management of water resources which would include sound meteorological forecasts of the rainfall in the Island.

Firewood would remain the principal source of non-commercial energy, while it would contribute substantially to commercial energy as well. It has been estimated that the Island's forest resources have been depleted from a level of about 50 per cent in 1945 to approximately 23 per cent today. This has not been due entirely to the cutting down of trees as fuel-wood, but to the clearing of forest land for new agricultural and settlement schemes. Sri Lanka's population is now not growing at an alarming rate, the rate of increase is about 1.3 per cent, which is among the lowest in Asia, and compares well with the current growth rates in the more developed countries. It has been established that Sri Lanka's population will reach a maximum of about 22 million by the year 2020, and decline thereafter. Taking this into consideration, the most prudent policy would be not to clear forests further for settlement and land utilisation. If there is proper management of the latter, in the already cleared areas there is scope for settlement of larger numbers especially if industries are developed. What matters in settlement is proper land use and not a vast expanse of land supporting dwellings. More extensive and profitable land use could be made with the cultivation of commercial crops and the establishment of industries and this would alleviate the need for clearing forests for further land settlement and extended agriculture.

The policy also calls for a more intensive rate of reafforestation. With a wide range of species of timber trees available for planting, both in the wet zone hill country and in the dry zone the prospects for rapid reafforestation is far better in Sri Lanka than in most other South Asian countries. Unfortunately, tree planting drives in the country have been more a ceremonial and festive occasion than one of pragmatic achievement. The dry zone offers best prospects with extensive areas that could be replanted with Teak, Satin, Margosa, Milla and Ebony trees. Similarly, in the wet zone, Teak, Mahogany, Nedun and Jak can be grown on an extensive scale. One advantage is that in the wet zone, unlike in the dry zone, species such as Teak, Satin and Ebony grow three times as fast as in the dry zone and all these factors must be taken advantage of.

Since fuelwood will continue to be the largest source of non-commercial energy and a major source of commercial energy it is important that the reafforestation drive be properly planned. The felling of rubber trees cannot be depended upon to continue to provide the bulk of the firewood. For one thing, unlike the old rubber trees, the new budded rubber trees are small in size with a smaller girth and therefore, the wood yield is lower. Once the replanting programme gathers momentum fewer rubber trees would be felled. Also. there are no indications that both rubber replanting and new plantations are increasing. There has been stagnation in rubber production, because of the unattractive price for rubber at present; and the continuing low price of crude oil will not help to increase rubber prices further, because synthetic

rubber competes very keenly with the natural product. There are large quantities of fallen trees and twigs on the road sides and in the forests and this wood is allowed to rot away. A plan of action is necessary to mobilize this wood preferably by getting the private sector involved and by this means the quantity of commercial firewood available could be increased.

One notices, that wood and fibre waste are not used extensively as substitutes for split firewood and commercially sold forest wood. The utilization of wood waste, paddy husk, wood shavings and coir dust could be increased considerably. There are mountains of coir dust in the coconut growing areas. Research should be undertaken immediately to convert the fibre dust into brickets which will burn easily. A problem with coir dust is its high moisture content but natural sunlight could be used to dry the dust and compress into brickets. This could turn out to be a much cheaper source of fuel than firewood and it could help ultimately to save a good portion of the country's remaining natural forest cover. Similarly paddy husk could be converted to brickets and paddy husk does not have a very high moisture content.

The above constitute some areas of action which could finally help in the formulation of a reasonable set of prices for the different forms of commercial energy that have been discussed in this paper. The pricing policy would not mean anything very much without a comprehensive, integrated and properly conceived plan of action which will involve minimising imports of petroleum fuels, avoiding unnecessary devaluation, the proper management of hydro power resources and the associated debt commitments, rapid

reafforestation and the quick utilisation of the most primary energy source solar energy and also explore the potential of wind as a source of energy in a country blessed with two strong monsoon wind currents. If energy prices are to remain commercially viable and attractive such a plan of action is very necessary. Otherwise, the main determinant of price would tend to be the cost of imported fuels which are heavily influenced always by the devaluation of the rupee.

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