Sri Lanka Energy Balance 2007

An Analysis of Energy Sector Performance

Sri Lanka Sustainable Energy Authority

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EXECUTIVE SUMMARY

In the development drive launched by the Government of Sri Lanka, the role of the energy sector has bean clearly identified to the extent of defining specific targets the sector has to achieve to sustain these development ventures. While this highlights the importance of the sector to the whole economy, the need to monitor the progress and the performance of the sector is also emphasised.

In order to direct the sector to match the country's specific needs, the Ministry of Power and Energy and the Ministry of Petroleum Resources Development have been given the authority over the two main divisions of the sector, electricity and petroleum, respectively. The electricity sector is dominated by the state owned Ceylon Electricity Board (CEB) while an equivalent role is performed by the Ceylon Petroleum Corporation (CPC) in the petroleum sector. Other government and private sector organisations also have active involvements in different segments of the sector such as electricity generation and distribution in the electricity sector, and importation and distribution of petroleum products in the petroleum sector. Private sector participation in the energy sector activities, which commenced in the mid nineties has increased considerably since then. The presence of Lanka Indian Oil Company (LIOC) in the downstream petroleum distribution business and the role played by the large number of independent power producers (IPPs) in the electricity generation business are examples of intense involvement of private organisations in the energy sector.

Since the entire energy requirement cannot be met only through indigenous resources, Sri Lanka is dependant on imported energy sources. Even though the country is blessed with many different forms of indigenous energy resources in the form of biomass, hydropower, wind power and solar power, actual use of these sources are limited by technological, socio-economic and political reasons. Petroleum and coal have been identified as the two main non-indigenous energy forms that can supplement the local resources in fulfilling the country energy demand. In Sri Lanka, biomass is still the main energy supply source, satisfying a greater portion of the heating energy requirements of the domestic sector. While hydropower has already been extensively developed for electricity generation, studies have indicated that there is a large potential for wind power development in the country. Studies are presently underway to establish the availability of offshore petroleum resources within the territory of Sri Lanka.

At present, the total primary energy requirement of the country is met with biomass (47.4%), hydropower (9.5%) and imported petroleum (43.0%), while electricity remains the main secondary energy source. The total amount of electricity generated during 2007 was 9,901 GWh out of which 60% was from oil burning thermal power plants while the balance 40% was almost entirely from hydropower. Share of electricity generation from non-conventional sources remained very small.

By the end of year 2007, the national electrification level had increased to 80% of the total households in the country, which is considered a significant achievement in comparison to other countries in the region. The petroleum distribution remained stable with the two suppliers; CPC and LIOC operating a widespread distribution network around the country.

The use of biomass, which accounts for the largest share energy supply in the country, is estimated to have decreased in 2007, compared with 2006. This is largely due to the increased use of petroleum and electricity in meeting the energy demand growth and fuel switching from biomass to petroleum in the domestic sector. The increase in petroleum and electricity use in 2007 compared to 2006 was 3% and 5% respectively.

Similar to previous years, the largest energy consumer in 2007 was the household and commercial sector, using a share of 48% of country's total energy demand. Transport and industrial sectors equally shared the balance energy demand with each claiming a share of 26% of the national energy demand. The entire energy requirement of the transport sector was met through liquid petroleum.

In terms of Return on Assets (ROA), CEB recorded its worst financial performance ever, with almost a 5% loss with reference to its assets value. The tariff revision made effective early in 2007 was not sufficient to bridge the gap between the high cost of production and the selling price of electricity, which widened towards the latter part of the year with the increase in oil prices in the international market.

However, CPC recording profits in 2007, after its losses in 2006, was an encouraging sign for the energy sector, especially considering the rapid increase in oil prices in the international market from around 60$/bbl to 100$/bbl during the year.

With the increasing petroleum prices, the country is facing many challenges to keep its retail energy prices at a range affordable to the consumers. More use of indigenous resources and efficient use of energy have been identified as the key to counter these challenges in the long run. The establishment of Sri Lanka Sustainable Energy Authority (SEA) in 2007 and assigning the responsibility of achieving the above two objectives to SEA indicates that the country has taken the necessary initiatives in achieving its long term energy objectives, despite short term difficulties that might arise in the coming years due to volatile energy prices.

ACKNOWLEDGEMENT

Sri Lanka Sustainable Energy Authority wishes to express its sincere thanks to the following institutions for their valuable cooperation in the compilation of the "Sri Lanka Energy Balance 2007" and the Analysis of Energy Sector Performance.

- Ministry of Power and Energy
- Ceylon Electricity Board
- Ceylon Petroleum Corporation
- Department of Census and Statistics
- Central Bank of Sri Lanka
- Sri Lanka Energy Managers Association
- Administrative Unit, RERED project at the DFCC Bank
- All institutions, which responded positively to our request to provide relevant data

Data for Sri Lanka Energy Balance 2007 was compiled by
Sri Lanka Sustainable Energy Authority

This publication was written by
Sri Lanka Energy Managers Association

LIST OF ABBREVIATIONS

C&F	Cost and Freight
CEB	Ceylon Electricity Board
CHP	Combined Heat and Power
CPC	Ceylon Petroleum Corporation
ECF	Energy Conservation Fund
ESC	Energy Supply Committee
ESCO	Energy Service Company
ESD Project	Energy Services Delivery Project
FOB	Free On Board
GCal	Giga calories
GDP	Gross Domestic Product
GEF	Global Environmental Facility
GWh	Giga Watt hour
IPP	Independent Power Producer
kcal	kilo calorie
kg	kilo gram
kJ	kilo Joule
kVA	kilo Volt Ampere
LA	Local Authority
LECO	Lanka Electricity Company
LIOC	Lanka Indian Oil Company
LPG	Liquid Petroleum Gas
MW	Mega Watt
NERD Centre	National Engineering Research and Development Centre
NREL	National Renewable Energy Laboratory of United States
OE	Oil Equivalent
RERED Project	Renewable Energy for Rural Economic Development Project
Rs.	Rupees
SEA	Sri Lanka Sustainable Energy Authority
SPP	Small Power Producer
toe	Tons of Oil Equivalent
USAID	United States Agency for International Development

CONTENTS

List of Tables

LIST OF FIGURES

1 INTRODUCTION TO ENERGY SECTOR

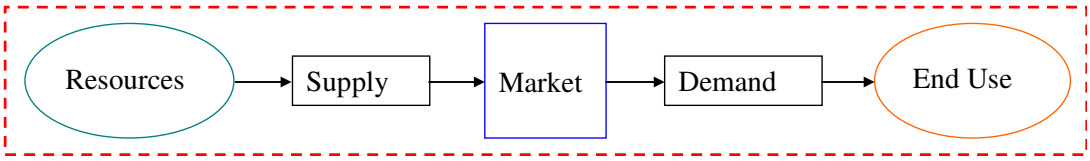
1.1 Stages of Energy Flow

Energy sector encompass all the stages of all forms of energy used in the country. Following are the different stages of an energy form.

- Energy Resource
- Energy Supply including conversion/production and distribution
- Energy Demand
- End Use

Energy sector is the combination of all above stages of different energy forms which are interrelated as illustrated in Figure 1.1.

Figure 1.1 – Energy Sector Composition



Above flow diagram explains that, due to various end uses of energy, a demand exists in the market, which is fulfilled by the energy supply using the available resources. This follows the basic demand supply economic model valid for any scarce resource.

1.1.1 Energy Resources

A natural resource is considered an energy resource, if it can be converted to a usable form of energy. There are numerous forms of energy sources in the world and different countries use different resources, primarily selected on economic principles. However, environmental and political reasons also influence the selection of a country's energy portfolio.

Availability, either local or global, is not necessarily the only factor considered for use of a particular resource as an energy supply source. More importantly, the use must be economical compared with other available sources. Hence, the technology available for converting the

resource to a more usable form is important in the selection of an energy resource for energy supply. Change of technology and availability of resource over time can change the economics of using the resource for energy supply. Therefore, the resources used by a country for energy requirements also change with time.

Indigenous Resources

Due to the geo-climatic conditions, Sri Lanka is blessed with several forms of renewable energy resources. Some of them are widely used and developed to supply the energy requirements of the country. Others have the potential for development when the technologies become mature and economically feasible for use. Following are the main renewable resources available in Sri Lanka.

- Biomass
- Hydro Power
- Solar
- Wind

In addition to the above indigenous renewable resources, the availability of petroleum within the country territory is being investigated.

Global Resources

In the international market, many forms of energy sources are available for Sri Lanka to import and use for its energy needs. However, up to now, Sri Lanka has been using only petroleum fuels for this purpose. Increasing petroleum prices have prompted Sri Lanka to examine the feasibility of using other sources such as coal and Liquefied Natural Gas (LNG) to replace liquid petroleum. Following are the most common energy sources globally available for energy supply purposes.

- Petroleum
- Coal
- Natural Gas
- Nuclear Energy

More recently, new energy supply technologies such as biofuels and hydrogen have emerged as alternatives to the above conventional technologies. However, use of these technologies for energy supply purposes is still limited in Sri Lanka.

1.1.2 Energy Supply

To understand the status of the energy sector of a country, what is more important is not the availability of different energy resources, but the extent of use of these resources. As explained earlier, mere availability of a resource within a country does not guarantee its utilisation. Therefore, it is more important to analyse the resources which are actually being used to meet the energy demand of the country. Following are the three main energy supply forms in Sri Lanka.

- Biomass
- Petroleum
- Electricity

Energy supply is essentially the conversion of energy resources from one form to a more usable form. However, this conversion can vary from producing electricity from the potential energy in a hydro reservoir to refining crude oil into petrol or diesel.

1.1.3 Transmission/Distribution

For all energy supply sources, there must be a distribution mechanism through which the demand can be served. From the production or storage facilities of the energy supply system, the distribution system transports the energy to the end user.

However, biomass distribution network is quite simple, and in most cases, non-existent. The majority use of biomass is at domestic level, where the source and the point of use; both happen to be within the same home garden. Even in industrial usage, the distribution is a one-to-one arrangement, which links the source to the user through a direct biomass transport.

In the case of petroleum, the distribution is from the petroleum storage facilities up to end user points such as vehicles, power plants and industries; channelled through local depots and filling stations.

For electricity, the distribution starts from the generating station (power plant) and ends at consumer points such as households and industries. Therefore, high voltage transmission network, medium voltage regional networks and low voltage local distribution networks are collectively considered as the energy distribution system of electricity.

1.1.4 Demand

For the energy sector, demand drives the market. Demand arises due to energy needs of households, industries, commercial buildings etc. According to the needs of the user, the supply of energy has to take different forms. For example, the energy demand for cooking is in the form of biomass in rural areas while it is in the form of either LP gas or electricity in urban areas. Therefore, not only the quantity of energy, even the quality and the form it is delivered, is determined by the demand.

In this report, the demand is categorised in terms of end user sectors and is not based on the actual usage or the application of energy.

1.2 Sector Governance and Organisations

1.2.1 Energy Sector Governance

Ministry of Power and Energy had been the sole governing authority of the sector until late 2005. However, with the establishment of the Ministry of Petroleum and Petroleum Resources Development, the responsibility of managing the petroleum sector was transferred from the Ministry of Power and Energy to this new ministry. At present, the power sector and petroleum sector are separately supervised by these two independent ministries, headed by two different ministers. Biomass sector operates independently and informally, with very little interaction with the energy sector governing structure.

In addition to the involvement of the government, private organisations and the general public are also considered stakeholders of the energy sector. Public Utilities Commission of Sri Lanka (PUCSL) is responsible for the overall smooth operation of the energy sector with powers to monitor and regulate its operations. However, empowering the PUCSL to take up this role is awaiting full implementation. In the interim, the above two ministries act as the regulators of the respective sectors.

Public and private sector organisations collectively contribute in both supply and demand sides of the sector, while the domestic sector involvement is quite prominent in the biomass sector.

1.2.2 Public Sector Organisations

Ministry of Power and Energy

The Ministry of Power and Energy is the main body responsible for the management of the power sector. The Ministry comprise several divisions; discharging its functions in planning, and in the supervision of sub-sectoral state institutions. From time to time, the subject of Energy has been combined with others such as Irrigation and Lands, in the establishment of the Ministry. The following state-owned energy institutions presently operate under the supervision of Ministry of Power and Energy.

Ceylon Electricity Board (CEB)

Established in 1969, CEB is empowered to generate, transmit and distribute electricity in the country. CEB presently generates about 60% of electrical energy supplied through the national grid, while the balance is generated by private power plants. The entire 220 kV, 132 kV and 33 kV network is owned and operated by CEB. CEB directly serves 90% of gird connected electricity consumers in the country.

Lanka Electricity Company (Pvt) Ltd (LECO)

LECO was established in 1983 to distribute electricity in areas previously served by Local Authorities (Municipal Councils etc.). LECO receives electricity from CEB at 11 kV and distributes in LECO franchise areas. LECO serves about 10% of the customers in the country. LECO's franchise area steadily expanded from 1983 to 1990, and the company implemented a major rehabilitation program in the newly acquired distribution networks, which has reduced the losses from 33% in 1990 to 4% in year 2007.

Sri Lanka Sustainable Energy Authority (SEA)

Sri Lanka Sustainable Energy Authority (SEA) was established on 1st October 2007, under the Sri Lanka Sustainable Energy Authority Act. No.35 of 2007. The responsibilities previously held by the Energy Conservation Fund in the area of energy efficiency was transferred to this new authority while some additional duties including development of renewable energy resource base of the country were also assigned to the SEA. Broadly, the role of SEA is identified as formulating strategies to meet the energy needs of the country and effectively implementing these strategies on behalf of the Ministry of Power and Energy.

Ministry of Petroleum and Petroleum Resources Development

The following Departments and Statutory Institutions are presently operational under the supervision of Ministry of Petroleum and Petroleum Resources Development.

- Ceylon Petroleum Corporation
- Petroleum Resources Development Company
- Ceylon Petroleum Storage Terminal Ltd.
- Petroleum Resources Development Secretariat

While the role of Ceylon Petroleum Corporation is quite significant in the present context, the other three institutions are providing facilitating roles to the petroleum supply and exploration ventures recently initiated by the government.

Ceylon Petroleum Corporation (CPC)

Established in 1961, CPC imports, refines and distributes petroleum products in the country. CPC owns and operates the only refinery in Sri Lanka, with a daily throughput of 50,000 barrels. The demand for petroleum products has significantly increased, with the sale of all petroleum products for all sectors recording an increase from 1,466,280 MT in year 1993 to 3,970,748 MT in year 2007. Fuel oil demand is steadily increasing owing to new power plants, while the demand for auto diesel and petrol has also increased rapidly with the expanding transport sector.

1.2.3 Private Sector Organisations

There are numerous private sector organisations involved in the energy sector and they take part in the supply, distribution and sale of electricity and petroleum. The private sector organisations in the electricity sector includes Independent Power Producers (IPP) supplying electricity to the CEB for resale and Small Power Producers (SPP) producing power using renewable technologies. Annex 1 provides a list of all IPPs and SPPs.

In the petroleum sector, in addition to the CPC, several private companies are involved in the distribution and sale of petroleum products and LP gas. Details of these companies are also given in Annex 1.

2 ENERGY RESOURCES

2.1 Indigenous Energy Resources

2.1.1 Biomass

Large quantities of firewood and other biomass resources are used for cooking in rural households, despite the fact that they have access to grid electricity.

Even though the majority of energy needs of the rural population are fulfilled by the use of firewood, there are possibilities of further increasing the use of biomass for energy purposes in the country, especially for electricity generation. The concept of biomass based electricity generation (commonly referred to as Dendro Power) holds much promise for Sri Lanka.

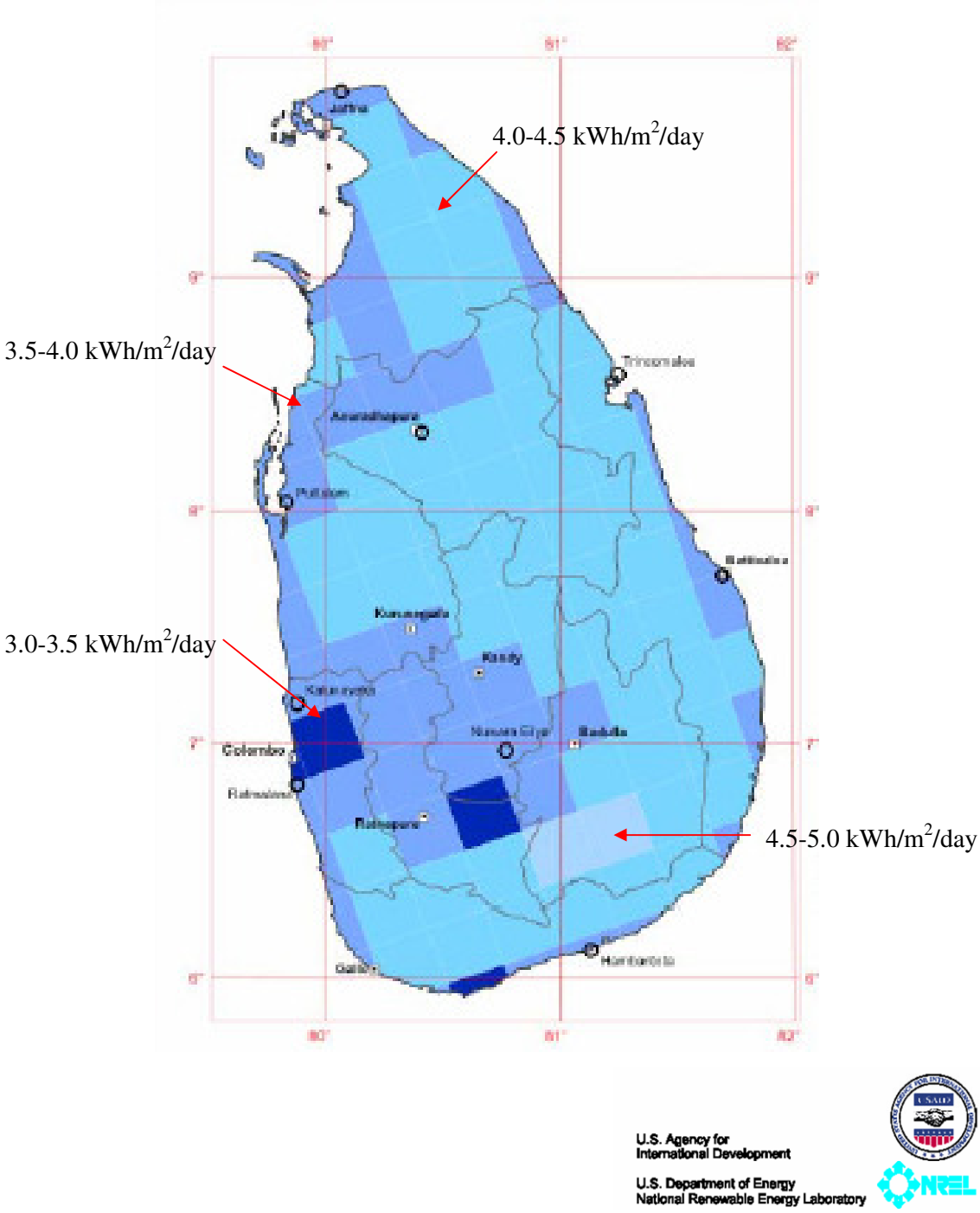
2.1.2 Hydro

Hydro power is a key energy source used for electricity generation in Sri Lanka. Better part of the major hydro potential has been already developed and they are delivering valuable low cost electricity to the country. Currently, hydro power stations are operated to supply both peaking and base electricity generation requirements. However, a few major sites are still classified as 'not economically feasible' for development. Apart from the grid connected hydro power stations, many small-scale hydro power applications are in operation serving off-grid loads. A substantial number of small scale hydro sites has been identified for future developments.

2.1.3 Solar

Being located close to the equator, Sri Lanka does not experience a marked seasonal variation in solar radiation over the island, though significant spatial differentiation could be observed between the lowlands and mountainous regions. As estimated in the solar resource map of Sri Lanka developed by the National Renewable Energy Laboratory (NREL) of USA (Figure 2.1), over most part of the flat dry zone, which accounts for about two-thirds of the land area, solar radiation varies from 4.0 – 4.5 kWh/m^2/day. Solar radiation levels remain as low as 2.0 – 3.5 kWh/m^2/day over high plains of Nuwara Eliya due to significant cloud cover over most parts of the day. Thus, substantial potential exists in the dry zone of Sri Lanka for harnessing solar energy.

Figure 2.1 – Solar Resource Map of Sri Lanka

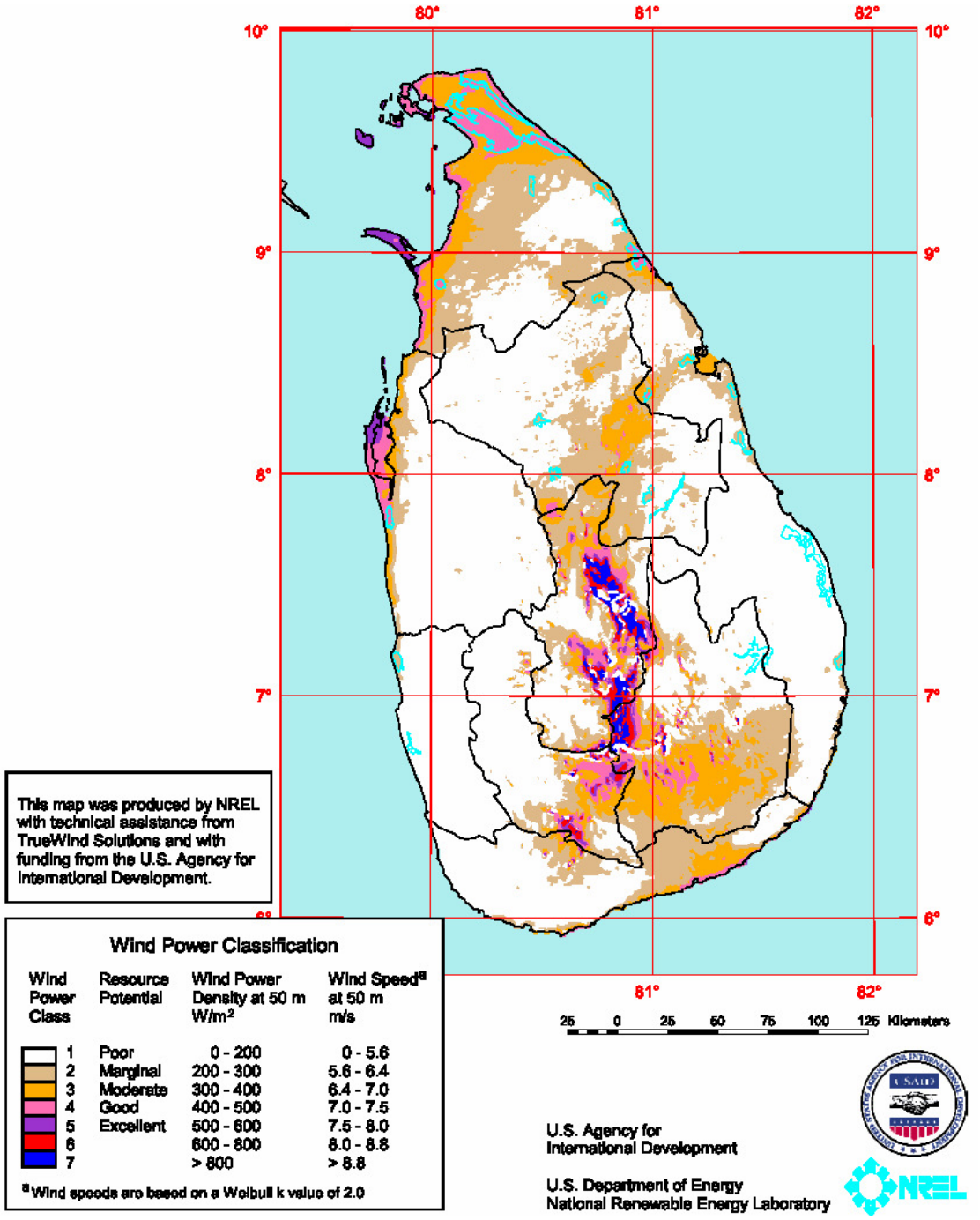


Though not measured and officially reported, substantial use of solar energy is observed in drying and water heating applications.

2.1.4 Wind

According to the Wind Energy Resource Atlas of Sri Lanka (Figure 2.2) developed by National Renewable Energy Laboratory (NREL) of United States, there are nearly 5,000 km^2 of windy areas with good-to-excellent wind resource potential in Sri Lanka.

Figure 2.2 – Wind Resource Map of Sri Lanka



About 4,100 km^2 of the total windy area is land and about 700 km^2 is lagoon. The windy land represents about 6% of the total land area (65,600 km^2) of Sri Lanka. Using a conservative assumption of 5 MW per km^2, this windy land could support almost 20,000 MW of potential installed capacity. If the windy lagoons are included, the total wind potential increases to approximately 24,000 MW.

2.1.5 Petroleum

Although there have been several petroleum exploration attempts in the past, none did propagate into a commercial level. However, with two rounds of seismic analyses recently carried out in the Mannar basin, signs of availability of petroleum resources have been reported, prompting the government to seriously consider the prospects of off-shore oil exploration. Purchase of seismic data collected by the Norwegian geophysical company, TGS Nopec, of the speculated area of interest and inviting oil companies and governments (such as India and China) to commence oil exploration activities in the region are some progressive steps taken in this line. However, it may yet take a few years more to have a firm understanding of the exact nature of the resource availability. Until such time, imported petroleum, which currently accounts for about 43% of primary energy supply, will continue to play a major role in Sri Lanka's economy. As a result of high thermal electricity generation, the demand for diesel oil and fuel oil has increased substantially, adding to the existing imbalance in the demand pattern and refinery production.

Ceylon Petroleum Corporation (CPC) and Lanka Indian Oil Company (LIOC) are responsible for the total supply of petroleum to the county with the exception of LPG and marine bunkering. LPG supply is carried out by Shell Gas (Lanka) Pvt Ltd. and Lanka Auto Gas Filling Stations (LAUGFS). Pvt. Ltd. After liberalisation of the bunkering market in 2001, a number of private operators entered the market under license issued by Ministry of Power and Energy.

2.1.6 Summary of Indigenous Resources in Sri Lanka

Table 2.1- Indigenous Primary Sources of Energy in Sri Lanka

Indigenous Energy Source	Typical User Groups	Typical Applications	Scale of use
Biomass	Household	Cooking	Widespread
	Commercial	Hotels, Bakeries	Widespread
	Industry	Tea drying, Brick and tile	Widespread
	Private power plant	For sale to utility	One 1MW power plant
		Own consumption	Several villages and factories
Hydro power	Electricity utility owned large multipurpose systems	For retail to customers	Major power plants
	Commercial grid-connected	For sale to utility	61 power plants
	Village-level off-grid electricity	Household use	195 power plants
	Industrial off-grid electricity	Tea industry	32 power plants
	Industrial mechanical drives	Tea Industry	Negligible, one or two remaining
Solar Power	Solar photovoltaic	Household lighting	About 128,500 units
	Grid connected PV	For sale to utility	One unit
	Solar Thermal	Hot water systems in commercial and domestic sectors	Widespread
	Informal use	Household and agricultural use	Widespread
Wind Power	Grid Connected Wind	For retail to customers	One pilot power plant
	Off-grid power plants	For residential use	A few dozen
	Water pumping	Agriculture	A few dozen

2.2 Global Energy Resources

As explained previously, petroleum, coal, natural gas and nuclear energy are the four main energy sources used in other countries. However, in Sri Lanka, only petroleum is imported in large scale to the country as a source of energy while the use of other sources is still being studied. The use of refined petroleum products and coal is described in Table 2.2**.**

Table 2.2 – Use of Global Energy Resources in Sri Lanka

Imported Energy Source	**Typical User Groups**	**Typical Applications**	**Scale of use at Present**
Crude Oil and refined products including LPG	Household	Lighting, cooking	Widespread
	Commercial	Hotels, bakeries	Widespread
	Industry	Furnaces, kilns, boilers	Widespread
	Transport	Rail, road, air and sea	Widespread
Coal	Railways	Railways	Negligible
	Industry	Kilns	Cement industry and foundries
		Boilers	One unit

3 ENERGY SUPPLY

Energy needs of the country are fulfilled either directly by primary energy sources such as biomass and petroleum or by secondary sources such as electricity produced using petroleum, biomass and hydro power.

3.1 Supply from Primary Energy Sources

3.1.1 Energy Supply from Biomass

Biomass is the most common source of energy supply in the country with the majority use coming from the domestic sector for cooking purposes. Due to the abundant availability, only a limited portion of the total biomass usage is channelled through a commodity market and hence the value of the energy sourced by biomass is not properly accounted.

Sources of Production

Biomass comes in different forms. Following are the most common forms of biomass available in Sri Lanka.

- Fuelwood
- Municipal Waste
- Industrial Waste
- Agricultural Waste

Conversion

Home gardens and forests supply the major portion of the biomass requirement of the country. A very little amount of biomass is converted to charcoal and electricity. Biomass is mostly used 'as-it-is'. Although there is a potential for biomass based electricity generation, developments are still at their initial stages. The first grid connected biomass based power plant (of 1MW capacity) was commissioned in Walapane in October 2004 within the Small Power Purchase scheme of the CEB. In addition, a small scale (appr. 0.3MW) biomass based power plant is operational at the Factory of Haycarb Ltd. in Madampe, producing electricity for factory use, as a supplement to the grid supply.

Table 3.1 - Biomass Conversions

Primary Source	Conversions
Firewood (natural yield, home gardens, dedicated woodlots)	Thermal energy for boilers to generate steam for industry uses and electricity generation and combustible gases to drive Internal Combustion engines for electricity generation
Coconut Shell	Charcoal, activated carbon; mostly for export as a non-energy product
Baggase	Thermal energy to generate steam for boiler-turbine units used for electricity generation
Wood	Charcoal; mostly for the hotels and household markets

3.1.2 Energy Supply from Petroleum

The only refinery in Sri Lanka, located in Sapugaskanda, converts imported crude oil and produce refined products to supply almost half of the petroleum demand of the country. This refinery has a daily throughput of 50,000 barrels of crude oil. The refinery and a number of distribution facilities are owned by CPC while the rest of distribution facilities are owned by private sector organisations including LIOC.

Petroleum Imports

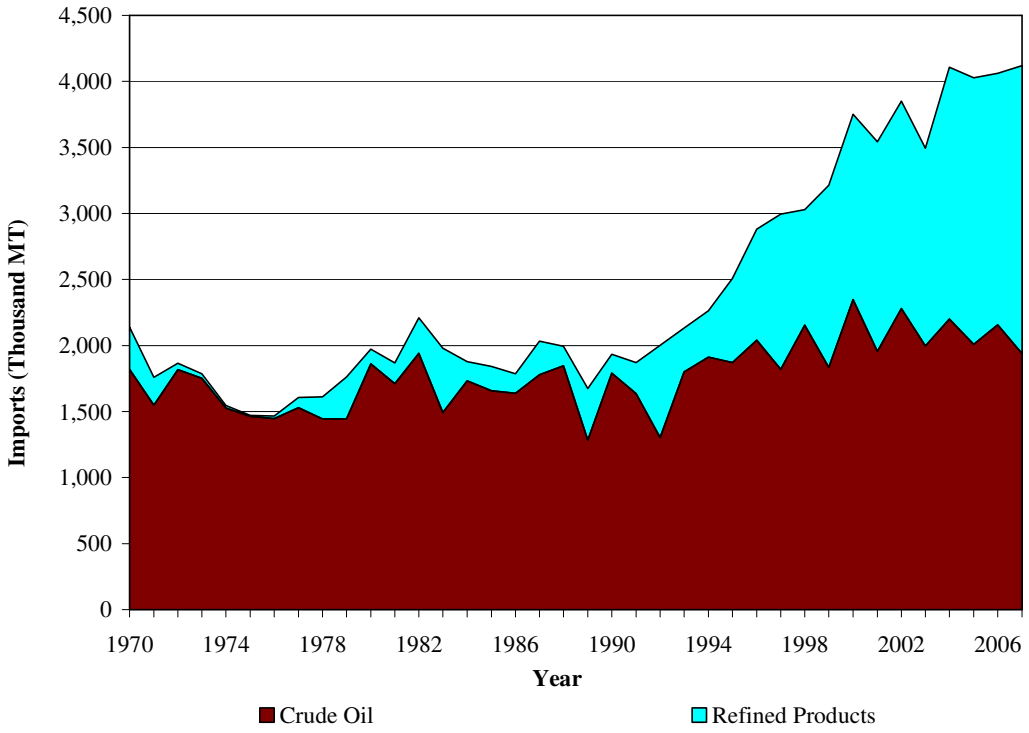
In year 2007, crude oil imports reduced by 10.1% to 1,938,700 MT compared with the previous year, while the import of finished products increased by 16% to 2,180,600 MT. This increment was especially visible in the importation of auto diesel and super petrol.

Table 3.2 – Crude Oil and Petroleum Product Imports

Thousand MT

Year	1980	1990	2000	2001	2002	2003	2004	2005	2006	2007
Crude Oil	1,861.0	1,791.3	2,348.9	1,954.9	2,281.0	1,995.7	2,200.7	2,008.4	2,157.0	1,938.7
Refined Products										
LPG	0.0	16.9	133.6	126.0	137.0	141.6	148.2	149.1	158.1	156.2
Super Petrol	0.0	0.0	5.0	43.8	56.2	117.4	149.5	288.5	229.6	328.9
Jet A-1	58.4	31.4	199.8	137.9	175.0	144.4	200.7	200.8	223.2	161.9
Kerosene	0.0	0.0	10.2	15.5	19.7	3.1	57.3	45.5	37.6	20.7
Auto Diesel	42.6	93.2	988.9	1,156.7	1,081.0	1,055.4	1,348.9	1,054.8	1,070.5	1,321.1
Fuel Oil	0.0	0.0	62.0	105.2	96.8	37.3		270.8	160.7	191.8
Sub Total	**101.0**	**141.4**	**1,399.4**	**1,585.1**	**1,479.0**	**1,499.3**	**1,904.7**	**2,009.5**	**1,879.7**	**2,180.6**
Other Products										
Avgas	1.0	0.4	0.1	0.2	0.1	0.1	0.1	0.1	0.2	0.2
Bitumen	8.7	0.0	3.5	2.5	3.0	0.0	0.0	8.9	25.5	27.6
Solvents	0.2	0.4	0.0	0.0	0.0	0.3	0.0	0.2	0.1	0.0
Sub Total	10.0	0.8	3.7	2.6	3.1	0.4	0.1	9.2	25.8	27.8
Grand Total	**1,972.0**	**1,933.5**	**3,752.0**	**3,542.7**	**3,764.0**	**3,495.4**	**4,105.5**	**4,027.1**	**4,062.5**	**4,147.1**

Figure 3.1 - Petroleum Imports



Export of Surplus Products

Sri Lanka did not export any surplus petroleum products in 2007. Table 3.3 shows the gradual reduction of surplus exports of petroleum products by Sri Lanka during past three decades.

Table 3.3 - Export of Surplus Petroleum Products

Thousand MT

Year	1980	1990	2000	2001	2002	2003	2004	2005	2006	2007
Direct Exports										
Naphtha	130.3	75.6	124.6	81.8	59.6				43.35	
Super	0.4									
Avtur	0.0									
Kerosene										
Auto		2.7								
H/M/Diese										
Fuel Oil	182.9	98.3					38.0			
Sub Total	313.6	176.6	124.6	81.8	59.6	No	38.0	No	43.35	No
Others										
Avgas	0.0									
Total	**313.6**	**176.6**	**124.6**	**81.8**	**59.6**	**No**	**38.0**	**No**	**43.35**	**No**

Petroleum Refinery Operations

Country's petroleum product requirements are met either as direct import of finished products or by processing imported crude oil at the 2.3 million MT per year (50,000 bbl / stream day) CPC refinery at Sapugaskanda (The refinery process flow is illustrated in Figure 3.2).

CPC purchases most of its crude oil requirement from the open market. However, more recently, state-to-state deals between the Government and state owned oil companies of Iran, Saudi Arabia, United Arab Emirates and Malaysia have supplied considerable amounts of crude oil at advantageous prices to the CPC. Details of crude refined over the past ten years are given in Table 3.4.

Figure 3.2- Sapugaskanda Refinery Process Flow Diagram

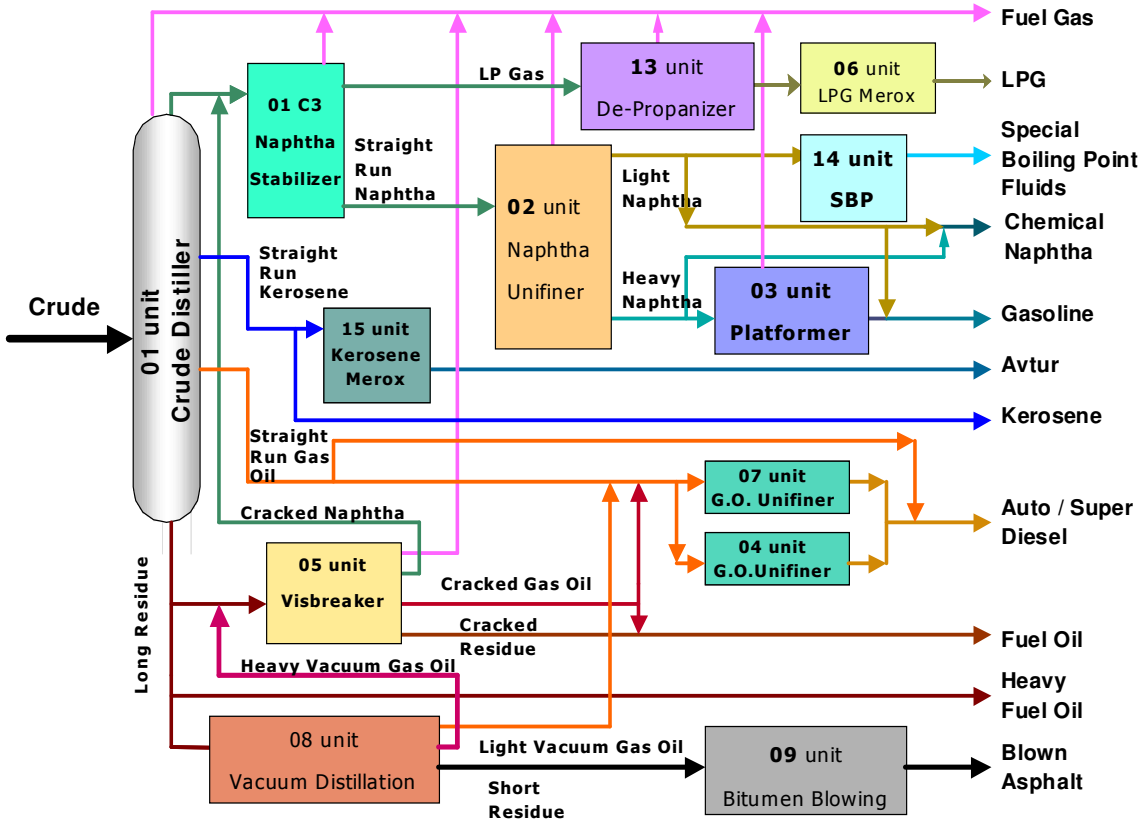


Table 3.4 – Types of Crude Oil Refined at Sapugaskanda Refinery

Thousand MT

Year	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Arabian Light	408.29	374.17	495.45	272.63	525.26	189.22	173.17	188.22	236.67	98.98
Iranian Light	1,190.35	966.40	1,096.50	1,148.46	1,021.45	1,263.79	1,613.26	1,380.95	1,567.74	1,493.02
Airlie										
Miri Light	373.02	312.44	482.86	422.03	469.75	393.52	424.26	414.58	335.73	36.66
Gulf of suze	0.13		-							
Upper Zakum	155.45	186.71	185.87	165.24	208.24	177.07	5.96			
Tapis blend										
Oman Crude										135.68
Dubai Crude										134.74
Total	**2,127.25**	**1,839.72**	**2,260.68**	**2,008.36**	**2,224.70**	**2,023.61**	**2,216.65**	**1,977.75**	**2,140.13**	**1,899.08**

Figure 3.3 - Crude Oil Refined at Sapugaskanda Refinery in Year 2007

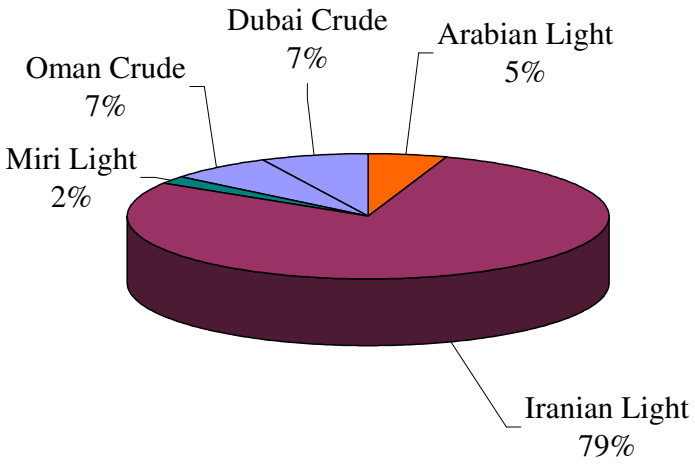


Figure 3.4 - Refined Product Output from Sapugaskanda Refinery in Year 2007

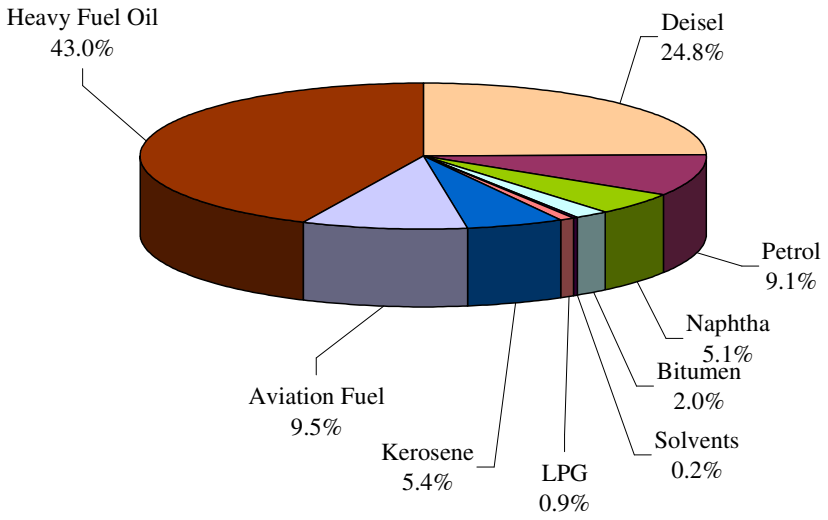


Figure 3.3 shows the Crude Oil input to the refinery in 2007 and Figure 3.4 shows the refined product output from the refinery.

The refinery maximum throughput is less than the country requirement for petroleum products. Besides, its production slate differs from the mix of product demand. Although the refinery is operated at maximum design capacity to meet the demand for middle distillates, kerosene, Jet A-1 and diesel, these products are still in deficit with a need for supplementary imports. Except for Naphtha, which can be substituted by auto diesel in its use in power generation, all petroleum products had to be imported to supplement refinery production in 2007. Details of refinery output are given in Table 3.5.

Table 3.5- Refined Products from Sapugaskanda Refinery

MT

Year	1980	1990	2000	2001	2002	2003	2004	2005	2006	2007
Crude Input	**1,885,203**	**1,758,272**	**2,260,677**	**2,008,360**	**2,224,703**	**2,023,605**	**2,216,646**	**1,977,751**	**2,140,132**	**1,899,080**
Fuel Gas										
L.P.G.	7,477	18,692	16,117	15,470	18,161	15,443	15,460	13,047	14,721	16,237
Chemical Naphtha	150,850	73,291	112,613	104,720	109,714	94,247	97,272	113,308	109,175	91,768
SR Naphtha										
Super Petrol	109,371	179,281	212,766	189,313	226,161	195,603	202,657	160,684	2,885	
Regular									190,700	163,291
Aviation Turbine fuel	62,171	100,589	92,159	89,294	72,119	96,277	126,378	113,831	130,926	171,043
Kerosene	179,341	171,097	191,865	179,139	196,419	153,480	143,808	142,092	143,956	97,409
Auto Diesel	384,311	463,012	736,422	614,055	702,216	608,056	632,651	571,169	628,210	444,593
Super Diesel						5,013	24,834	7,190		
Heavy Diesel (HS)	58,810	53,015					19,725			
Heavy Diesel (LS)										
MDO	36,948									
Fuel Oil 500s	8,970	6,427	29,283	26,138	22,893	24,806	17,009	20,580	16,510	
Fuel Oil 800s	81,872	28,389	39,131	33,572	26,460	36,503	30,117	37,408	35,135	100,932
Fuel Oil 1000s	270,526	102,340	177,546	128,756	105,611	64,109	73,755	68,054	88,063	4,505
Fuel Oil 1500s	370,230	445,581	207,104	260,873	328,634	326,238	414,022	336,271	372,985	393,850
Fuel Oil 1600s										
Fuel Oil 2000s	7,328									
Fuel Oil 3500s	5,951		282,943	238,006	290,665	261,808	251,103	236,749	253,513	272,380
SBP	1,288	2,818	3,373	2,214	1,853	2,814	4,113	4,044	5,878	4,467
LAWS	1,062	1,501								
Bitumen	26,174	26,211	65,132	45,118	34,205	40,625	50,315	51,785	55,386	35,197
Total Output	**1,762,680**	**1,672,244**	**2,166,454**	**1,926,668**	**2,133,258**	**1,925,022**	**2,103,219**	**1,876,212**	**2,048,043**	**1,795,672**
Own Use & Loss	**122.52**	**86.03**	**94.22**	**81.69**	**91.45**	**98.58**	**113.43**	**101.54**	**92.09**	**103.41**

Compared to 2006, total refinery output reduced to 1,795,672MT in 2007. All products recorded lower outputs, compared to 2006, except fuel oil & aviation turbine fuel. Zero production of super petrol during 2007 is another noticeable event.

3.1.3 Supply from Hydro

The topography of the country provides an excellent opportunity to harness the energy stored in river water which flows from the central hills of the country to the ocean surrounding the island. Though the use of hydro resource for direct motive power was common in yesteryears, electricity production has become the sole use of hydro resource in recent times. Therefore, hydro contribution as an energy supply source is always through its secondary form which is electricity. The share of hydro in the total electricity production will be discussed in detail in a later section while an overview of the hydro power system in Sri Lanka is provided here.

Sri Lanka has two main hydro power complexes consisting of several power plants in each. These two main hydro power complexes are the Laxapana complex and the Mahaweli complex. Laxapana complex is based on Kelani river while Mahaweli complex is based on Mahaweli river. In addition, there are two independent large scale hydro power stations, namely Samanalawewa and Kukule Ganga while small scale power plants such as Inginiyagala and Uda Walawa are also generating hydropower using their respective reservoir storages. For administrative purposes, these isolated hydropower plants are grouped together as a single complex identified by the CEB as the 'Other Hydro' Complex.

The small power producers (SPP) who operate small scale hydro power plants (mini hydro plants) also contribute to the primary energy supply through hydro power. Details of these contributions will be presented in Section 3.2.

In contrast to SPP hydro power plants, which are of 'run-of river' type, CEB-owned large hydro power plants posses storage capacities in the form of reservoirs, enabling these large power plants to be dispatched as and when they are mostly needed in the system. Table 3.6 provides a list of hydro power plants and their water storage capacities.

Table 3.6- Storage Capacities of Hydro Power Stations

Name of Hydro Power Station	Plant Capacity (MW)	Name of the Reservoir	Reservoir Live Storage (million m^3)	Generation for year 2007 (GWh)
Laxapana Complex				
Wimalasurendra	50	Castlereigh Reservoir	44.8	78.71
Canyon	60	Maussakelle Reservoir	123.4	136.04
Laxapana	50	Norton Pond	0.4	235.47
Samanala	75	Laxapana Pond	0.4	373.03
New Laxapana	100	Canyon Pond	1.2	478.10
Mahaweli Complex				
Kotmale	201	Kotmale Reservoir	172.6	399.97
Nilambe	3	-	-	11.09
Ukuwela	38	Polgolla Barrage	-	185.87
Bowatenna	40	Bowatenna Reservoir	49.9	54.79
Victoria	210	Victoria Reservoir	721.2	604.29
Randenigala	122	Randenigala Reservoir	875.0	336.43
Rantembe	49	Rantembe Pond	21.0	169.47
Other Hydro Complex				
Inginiyagala	11	Inginiyagala Reservoir		39.90
Uda Walawa	6	Uda Walawa		5.67
Samanalawewa	120	Samanalawewa Reservoir	278.0	224.23
Kukule Ganga	70	-	-	269.82

3.1.4 Supply from Solar Energy

Solar energy is used mostly in non-commercial forms. Therefore, similar to biomass, the total usage of solar energy is not quantified properly. However, solar energy is the most frequently used form of energy in day to day life and its supply is unrestricted and persistent throughout the year in most parts of the country. Following are the most common uses of solar energy in Sri Lanka

- Drying
- Heating
- Electricity production

The Ceylon Electricity Board pioneered the introduction of solar photovoltaic technology in Sri Lanka during early 1980s and later solar photovoltaic applications saw a significant growth due the dedicated efforts of the private sector. NERD Centre played a very important role in popularising grid-assisted battery charging systems for lighting and television applications throughout Sri Lanka. NERD Centre was also instrumental in popularising solar thermal

systems for producing hot water and solar thermal applications for vegetable drying. In early 1980s, NERD centre was able to transfer this technology to local manufacturers and successfully established a network of manufacturers island-wide.

3.1.5 Supply from Wind

Wind as an energy source is used only in power generation and agricultural water pumping, and that too, to a very small extent.

Activities concerning the development of wind energy sources were first initiated in 1976 focusing on small-scale technologies, primarily for water pumping and electrification of remote areas. This paved the way for systematic studies on large-scale wind power generation to be undertaken by the CEB, having got experience in small scale applications. These activities led to the launching of the first-ever detailed wind monitoring programme in the south-eastern part of the country in 1988 by the CEB with the technical and financial assistance from the Government of Netherlands. In year 2003, a detailed wind energy atlas was prepared by National Renewable Energy Laboratory (NREL) of the United States of America under a technical assistance programme of USAID.

In 1999, CEB commissioned the first grid connected wind power plant primarily as a pilot project. The pilot wind plant is located in a 17 ha land closer to Hambantota town. The total capacity of the wind farm is 3 MW consisting of 5 wind turbine generators of 600 kW each.

3.1.6 Comparison of Primary Energy Supply Sources

Table 3.7 describes the primary energy supply of Sri Lanka over the period 1980-2007. Based on these data, Figure 3.5 illustrates the variation of contribution by each primary energy source over the period.

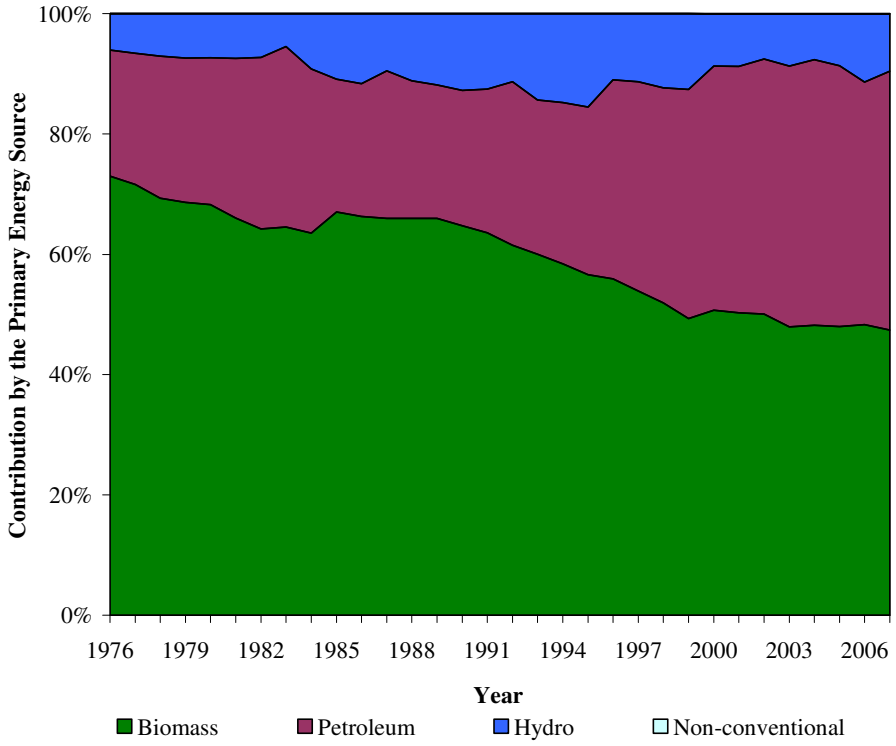
Table 3.7 - Primary Energy Supply in Sri Lanka

Thousand toe

Year	1980	1990	2000	2001	2002	2003	2004	2005	2006	2007
Biomass	3,310.76	3,829.41	4,469.81	4,291.84	4,310.57	4,371.84	4,513.25	4,626.12	4,747.85	4,723.05
Petroleum	1,183.04	1,329.82	3,575.32	3,498.21	3,652.57	3,955.76	4,131.90	4,172.25	3,965.47	4,287.26
Hydro	355.22	754.73	767.28	746.30	646.10	791.05	710.71	828.18	1,112.20	947.25
Non-conventional			2.73	2.70	3.21	3.43	3.59	3.91	4.08	4.35
Total	**4,849.02**	**5,913.95**	**8,815.13**	**8,539.05**	**8,612.45**	**9,122.08**	**9,359.47**	**9,630.47**	**9,829.60**	**9,961.91**
										%
Biomass	68.28	64.75	50.71	50.26	50.05	47.93	48.22	48.04	48.31	47.41
Petroleum	24.40	22.49	40.56	40.97	42.41	43.36	44.15	43.32	40.33	43.04
Hydro	7.33	12.76	8.70	8.74	7.50	8.67	7.59	8.60	11.31	9.51
			0.03	0.03	0.04	0.03	0.04	0.04	0.05	0.04

Non-conventional

Figure 3.5 - Share of Primary Energy Supply



3.2 Supply from Secondary Energy Sources – Production of Electricity

According to the terminology used in this report, only electricity is considered a significant secondary source of energy in Sri Lanka; purely because electricity is a product of an energy conversion process.

Electricity generation in the country can be broadly divided into two parts based on whether they are connected to the national grid or whether they run isolated. Sri Lanka has a main grid, which covers almost all parts of the country, apart from the Northern Province which is supplied by a separate mini grid. However, isolated power generating facilities are available in some locations either due to unavailability of national grid or as a matter of policy. In addition, standby power supplies are also available in most industries and commercial facilities, although their generation is very minimal due to the short-term nature of operation. The capacities and energy converted at these standby generators are not accounted for in this report.

The non-conventional off grid energy systems such as village and estate hydro plants and household solar photovoltaic systems are discussed separately in this report.

By the end of 2007, total installed power generation capacity of the country was 2,450 MW, of which 99.6% was grid connected. Therefore, the national grid can be considered the dominant electricity supply form of the country and hence, most of the analyses presented in the report will be for grid connected electricity supply.

Different modes of electricity generation (both grid connected and off-grid) in Sri Lanka are listed below.

(A) Grid connected generation

(i) CEB hydro power plants.

(ii) CEB non-conventional power plants (only wind power at present).

(iii) CEB thermal power plants (presently oil fired).

(iv) Hired plants (by CEB) to bridge the shortfall in capacity in the short-term, oil fired.

(v) Independent Power Producers (IPPs) (presently oil-fired thermal power plants).

(vi) Small Power Producers (SPPs) (presently mini hydro, a CHP plant, a solar power plant and two biomass based power plants, all embedded in the distribution network).

(B) Off-Grid Generation

(i) Self-Generation: Using own generating plants.

(ii) Off-grid (Industrial): Industries using their own generation as a matter of policy, keeping the grid supply as backup.

(iii) Off-grid (non-industrial): Mostly rural systems of small micro hydro, wind, solar and other renewable energy based systems.

3.2.1 Grid Connected Generation

As explained above, the electricity supply in Sri Lanka mainly flows through the national grid and a brief description of the national grid is given in this section. Off-grid electricity generation will be described in the next section.

Both CEB and private power producers generate electricity and supply to the national grid. In addition to CEB's own power plants, CEB purchases electricity to the national grid from these private power producers who have entered into contracts with CEB. While all the large-scale hydro power plants in the country are owned by the CEB, the mechanism to purchase electricity from renewable energy technologies has enabled many Small Power Producers (SPPs) to generate and sell hydro power to the national grid. Similarly, several Independent Power Producers are also operating fuel oil based thermal power plants and generate electricity to the national grid as and when the system needs power. With the increase of electricity demand and delays in construction of CEB's own power plants, the contribution from private power plants has increased significantly.

3.2.1.1 Different Categories of Power Plants in the National Grid

CEB Power Plants

As the sole operator of the Sri Lankan power system, until 1997, CEB owned and operated almost all the power plants in the national grid. Majority of these power plants were hydro based. With the saturation of large scale hydro power potential in Sri Lanka, more and more thermal power plants were introduced to the system, initially by CEB. However, private sector was the dominant investor in the recent thermal power plants connected to the grid.

With the completion of Kukule Ganga power project in 2002 (commissioned in 2003), apart from Upper Kotmale Hydro Power Project, most of the major hydro projects included in CEB's Long Term Generation Expansion Plan had been developed. By the end of 2007, a total of 16 hydro power plants, 6 thermal power plants and one wind power plant were in operation under the ownership of CEB.

Table 3.8 - Generating Capacity of CEB Power Plants

MW

Year	1980	1990	2000	2001	2002	2003	2004	2005	2006	2007
Major Hydro	315.0	997.0	1,117.0	1,117.0	1,117.0	1,187.0	1,187.0	1,187.0	1,187.0	1,187.0
Small Hydro	17.3	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5
Total CEB Hydro	**332.3**	**1,017.5**	**1,137.5**	**1,137.5**	**1,137.5**	**1,207.5**	**1,207.5**	**1,207.5**	**1,207.5**	**1,207.5**
Wind			3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Steam	50.0	50.0	50.0	50.0	50.0	50.0	50.0	0.0	0.0	0.0
Diesel Engine, Residual Oil		80.0	160.0	160.0	160.0	160.0	160.0	160.0	160.0	160.0
Diesel Engine, Diesel Oil	20.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
Total Diesel Engines	**20.0**	**88.0**	**168.0**	**168.0**	**168.0**	**168.0**	**168.0**	**168.0**	**168.0**	**168.0**
Total Gas Turbines	20.0	128.2	235.0	235.0	235.0	235.0	235.0	215.0	215.0	215.0
Combined Cycle				110.0	165.0	165.0	165.0	165.0	165.0	165.0
Total CEB Power Plants	**422.3**	**1,283.7**	**1,593.5**	**1,703.5**	**1,758.5**	**1,828.5**	**1,828.5**	**1,758.5**	**1,758.5**	**1,758.5**

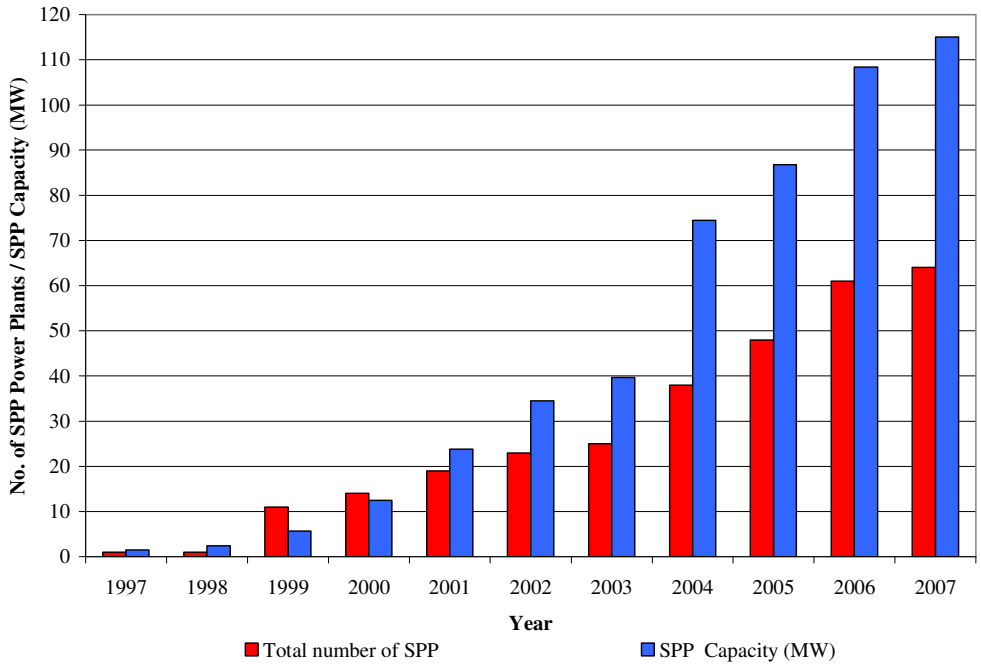
Independent Power Producers

Starting from 1997, many IPPs entered the electricity market, supplying electricity to the national grid. Altogether, 10 Independent Power Producers were operational by the end of 2007 with a total generating capacity of 566.5 MW. All IPPs in the grid, except the combined cycle IPP commissioned in 2003, use diesel engines for power generation. The combined cycle power plant uses auto diesel but with a higher overall efficiency compared with diesel engine power plants.

Small Power Producers

The number of small power producers increased rapidly over the period because of the attractive tariff offered by the CEB and the financial support provided by the RERED project. By the end of 2007, the total number of SPPs had increased to 64 adding a total of about 115 MW to the national grid.

Figure 3.6 – SPP Power Plants and their Capacities



Emergency Power

In year 2007 no emergency power plants operated in the grid, as in 2006.

Self-Generation by Customers

The rebate scheme for self-generation by customers was discontinued in 2003. Therefore, records for own generation by individual customers are not available from 2003 onwards.

Table 3.9 - Generating Capacity of Non-CEB Power Plants in the Grid

MW

Year	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
IPP										
Diesel Engine, Residual Oil	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0
Diesel Engine, Fuel Oil	24.0	24.0	84.0	84.0	123.5	123.5	223.5	322.5	322.5	322.5
Diesel Engine, Diesel Oil						* 15	* 15	*30	*30	*30
Combined Cycle						165.0	165.0	163.0	163.0	163.0
Total IPP	**75.0**	**75.0**	**135.0**	**135.0**	**174.5**	**354.5**	**454.5**	**566.5**	**566.5**	**566.5**
SPP										
Hydro	2.4	5.6	12.4	23.7	34.4	39.6	73.5	83.7	106.3	112.9
Combined Heat And Power		0.4	0.4	0.4	0.4	0.4	0.4	0.1	0.1	0.1
Biomass							1.0	1.0	2.0	2.0
Total SPP	**2.4**	**6.0**	**12.8**	**24.1**	**34.8**	**40.0**	**74.9**	**84.8**	**108.4**	**115.0**
Total Private Power Plants	**77.4**	**81.0**	**147.8**	**159.1**	**209.3**	**394.5**	**529.4**	**651.3**	**674.9**	**681.5**
Hired										
Diesel Engine, Diesel Oil	38.2	18.2	97.0	137.0	318.0	315.0	302.0	0.0	0.0	0.0
Total Non-CEB Plants	**115.6**	**99.2**	**244.8**	**296.1**	**527.3**	**709.5**	**831.4**	**692.1**	**674.9**	**681.5**

* Connected to a separate mini-grid in Jaffna area

New power plants

Several small privately owned hydro power plants were commissioned in 2007, raising the private small grid-connected hydroelectric generating capacity from 106.3 MW in 2006 to 112.9 MW in 2007.

There were no capacity additions by CEB power plants or by IPP power plants, during the year 2007.

Table 3.10 – Grid Connected Electricity Generation

MW

Year	1980	1990	2000	2001	2002	2003	2004	2005	2006	2007
Hydro										
CEB	332.3	1,017.5	1,137.5	1,137.5	1,137.5	1,207.5	1,207.5	1,207.5	1,207.5	1,207.5
SPP			12.4	23.7	34.4	39.6	73.5	83.7	106.3	112.9
Thermal										
CEB	90.0	266.2	453.0	563.0	618.0	618.0	618.0	548.0	548.0	548.0
IPP			135.0	135.0	175.0	354.5	454.5	566.5	566.5	566.5
Hired			97.0	137.0	318.0	315.0	302.0	0.0	0.0	0.0
Non Conventional										
CEB (Wind)			3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
SPP (Biomass + CHP)			0.4	0.4	0.5	0.5	1.4	2.1	2.1	2.1
Total	**422.3**	**1283.7**	**1,838.3**	**1999.6**	**2,286.3**	**2,538.0**	**2,659.9**	**2,410.8**	**2,433.4**	**2,440.0**

Table 3.11 - Electricity Generation by different Power Plants in the Grid

GWh

Year	1980	1990	2000	2001	2002	2003	2004	2005	2006	2007
Hydro										
CEB	1,480.1	3,144.7	3,153.8	3,044.9	2,588.6	3,190.0	2,754.7	3,222.5	4,289.5	3,602.9
SPP			43.1	64.7	103.5	120.3	205.6	277.4	344.5	344.0
Thermal										
CEB	188.8	5.0	2,205.3	1,895.5	1,952.6	2,247.9	2,506.9	2,162.0	1,669.0	2,335.5
IPP			863.6	1,057.8	1,243.3	1,745.7	2,087.0	3,177.4	3,136.1	3,559.3
Hired			443.4	471.1	939.2	394.4	509.2	0.0	0.0	0.0
Non Conventional										
CEB (Wind)			3.4	3.5	3.6	3.4	2.7	2.4	2.3	2.3
SPP (Biomass + CHP)			0.1	0.1	0.4	1.2	1.5	2.3	1.7	1.1
Total	**1,668.9**	**3,149.7**	**6,712.7**	**6,537.6**	**6,831.3**	**7,702.9**	**8,067.6**	**8,844.0**	**9,443.1**	**9,845.1**

%

Year	1980	1990	2000	2001	2002	2003	2004	2005	2006	2007
Hydro										
CEB	88.7	99.8	47.0	46.6	37.9	41.4	34.1	36.5	45.4	36.6
SPP			0.6	1.0	1.5	1.6	2.5	3.1	3.7	3.5
Thermal										
CEB	11.3	0.2	32.9	29.0	28.6	29.2	31.1	24.4	17.7	23.7
IPP			12.9	16.2	18.2	22.7	25.9	36.0	33.2	36.1
Hired			6.6	7.2	13.7	5.1	6.3	0.0	0.0	0.0
Non Conventional										
CEB (Wind)	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.1
SPP (Biomass + CHP)	very small	very small	very small	very small	very small	0.0	0.0	very small	very small	very small
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

As shown in Table 3.11, in year 2007, the total electricity generation in the national grid was 9,845.1GWh, a 4% increase from the previous year.

The rapid growth of small power producer (SPP) power generation which was seen in the recent past did not continue in 2007. Electricity generation from SPPs during the year was 344 GWh, almost equal to the year 2006 generation of 344.5 GWh. Hydropower plants of CEB and Small Power Producers supplied 40% of the total national electricity generation during the year, a noticeable reduction from the 49% share in 2006. Low rainfall is the main reason behind the observations.

Contribution by the CEB-owned wind power plant remained at 2.3GWh.

The balance of energy to national grid was provided by thermal sources and thermal energy contribution amounted to 5,895 GWh, a 23% increase compared with 4,806 GWh of 2006. This increase has resulted from the reduction in contribution from hydro power plants.

3.2.1.2 Different Technologies used by Power Plants in the National Grid

Table 3.12 – Generating Capacity in the Grid by Technology

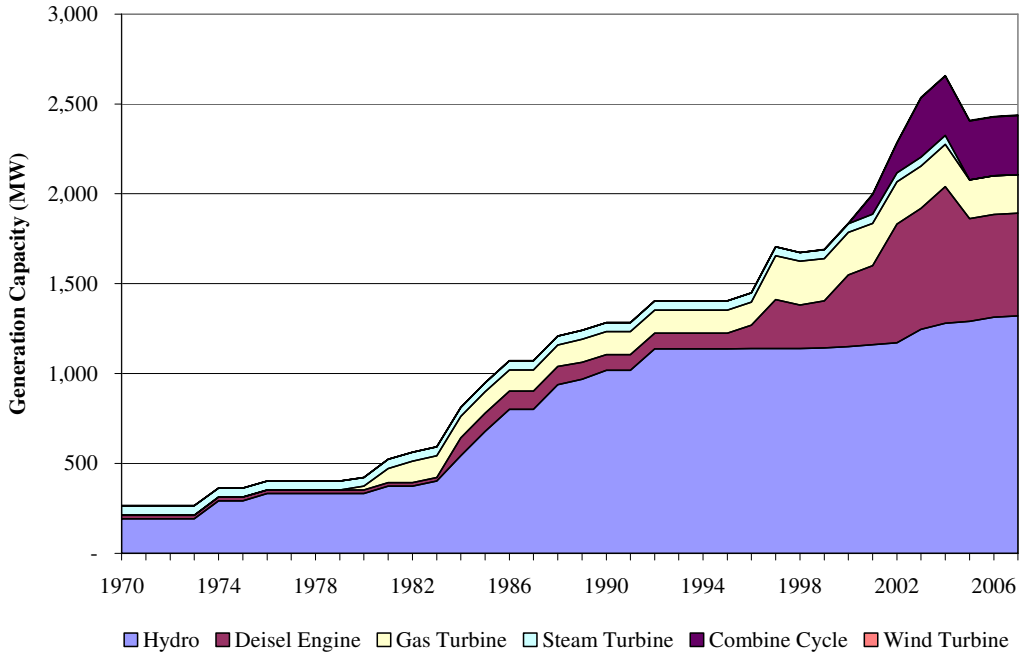
MW

Year	1980	1990	2000	2001	2002	2003	2004	2005	2006	2007
Hydro										
Major Hydro	315	997.0	1117.0	1,117.0	1,117.0	1,187.0	1,187.0	1,187.0	1,187.0	1,187.0
Small Hydro	17.3	20.5	32.9	44.2	54.9	60.1	94.0	104.2	126.8	133.4
Total Hydro	**332.3**	**1017.5**	**1149.9**	**1161.2**	**1171.9**	**1,247.0**	**1,281.0**	**1,291.2**	**1,313.8**	**1,320.4**
Wind			3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Steam	50	50.0	50.0	50.0	50.0	*50.0	*50.0	0.0	0.0	0.0
Diesel Engines										
Diesel Engine, Residual Oil		80.0	211.0	211.0	211.0	211.0	211.0	211.0	211.0	211.0
Diesel Engine, Fuel Oil			84.0	84.0	123.5	123.5	223.5	322.5	322.5	322.5
Diesel Engine, Diesel Oil	20	8.0	105.0	145.0	326.0	338.0	325.0	38.0	38.0	38.0
Total Diesel Engines	**20**	**88.0**	**400.0**	**440.0**	**661.0**	**672.5**	**759.5**	**571.5**	**571.5**	**571.5**
Gas Turbines, Diesel Oil	20	128.2	235.0	235.0	235.0	235.0	235.0	215.0	215.0	215.0
Combined Cycle				110.0	165.0	330.0	330.0	328.0	328.0	328.0
Combined Heat and Power			0.4	0.4	0.4	0.4	0.4	0.1	0.1	0.1
Biomass							1.0	2.0	2.0	2.0
Total	**422.3**	**1,283.70**	**1,838.30**	**1,999.60**	**2,286.30**	**2,538.0**	**2,659.9**	**2,410.8**	**2,433.4**	**2,439.6**

%

Year	1980	1990	2000	2001	2002	2003	2004	2005	2006	2007
Hydro		79.3	62.6	58.1	51.3	49.1	48.2	53.6	54.0	54.1
Wind			0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Steam		3.9	2.7	2.5	2.2	2.0	1.9	0.0	0.0	0.0
Diesel Engines		6.9	21.8	22.0	28.9	26.5	28.6	23.7	23.5	23.5
Gas Turbines		10.0	12.8	11.8	10.3	9.2	8.8	8.9	8.8	8.8
Combined Cycle				5.5	7.2	13.0	12.4	13.6	13.5	13.5
Combined Heat And Power			very small	very small	very small	very small	very small	very small	very small	very small
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Figure 3.7- Generating Capacity in the Grid by Technology



Contribution by Hydro Power Plants

Only a slight increase in the share of the installed capacity of hydropower was observed during 2007, as the only capacity additions to the grid came through the small hydro category. In the long run, the share of hydro power plants continues a reducing trend. This is due to the limited availability of new economically feasible sites for large scale hydropower development. According to CEB generation expansion plan, subsequent to Kukule Ganga hydroelectric power plant (70MW) commissioned in year 2003, only Upper Kotmale Hydro Power Project is left for development in the foreseeable future. Therefore, the hydro capacity share will be further reduced with the expected increase in system demand.

Contribution from Thermal Power Plants

Installed capacities of thermal power plants remained unchanged during 2007 as there were neither additions nor retirements of thermal power plants.

Contribution by Non-Conventional Electricity Generation

Table 3.13 gives a summary of the number of units, their capacity and annual electrical energy from non-conventional sources. All information about off-grid non-conventional electricity sources in Table 3.13 are estimates, based on information collected from government, non-

government and commercial institutions involved in supporting and marketing off-grid energy systems.

Table 3.13- Electricity Generation from Non-conventional Sources

Year	2002	2003	2004	2005	2006	2007
Grid-Connected Non-Conventional Energy Systems						
Number of Installations						
Wind Electricity	1	1	1	1	1	1
Small Hydro Electricity	22	24	35	44	57	61
Solar PV	1	1	1	1	1	1
Biomass			1	2	2	2
Aggregate Peak Capacity (kW)						
Wind Electricity	3,000	3,000	3,000	3,000	3,000	3,000
Small Hydro Electricity	34,424	39,594	73,454	83,687	106,334	112,900
Solar PV	100	100	18	18	18	18
Biomass			1,000	2,000	2,000	2,000
Energy (GWh)						
Wind Electricity	3.64	3.39	2.70	2.44	2.31	2.27
Small Hydro Electricity	103.46	120.29	205.58	277.45	344.65	344.00
Solar PV						
Biomass			0.12	2.28	1.78	1.1
Off-Grid Non-Conventional Energy Systems						
Number of Installations						
Off-grid hydroelectric Estate	32	32	32	32	32	32
Off-grid hydroelectric Village	112	127	141	167	176	195
Off-grid Solar PV Home Systems	34,285	52,862	76,166	97,105	114,883	128,527
Wind Battery Charging Systems	25	25	25	25	25	25
Aggregate Peak Capacity (kW)						
Off-grid hydroelectric Estate	3,226.2	3,226.2	3,226.2	3,226.2	3,226.2	3,226.2
Off-grid hydroelectric Village	712.8	867.8	1,007.2	1,210.9	1,358.2	1,506.2
Off-grid Solar PV Home Systems	1,371.4	2,207.4	3,258.4	4,264.2	4,978.5	5,806.0
Wind Battery Charging Systems	8.2	8.2	8.2	8.2	8.2	8.2
Estimated Useful Energy (kWh)						
Off-grid hydroelectric Estate	7,065,472	7,065,472	7,065,472	7,065,472	7,065,472	7,065,472
Off-grid hydroelectric Village	1,186,301	1,444,324	1,676,300	2,015,339	2,260,505	2,506,836
Off-grid Solar PV Home Systems	1,481,112	2,383,992	3,519,045	4,605,321	5,376,765	6,270,465
Wind Battery Charging Systems	5,747	5,747	5,747	5,747	5,747	5,747
Total Off-Grid Non-Conventional Systems						
Capacity (kW)	5,319	6,310	7,500	8,711	9,573	10,549
Energy (kWh)	9,738,632	10,899,535	12,266,564	13,691,878	14,708,488	15,848,520

Several non-conventional primary sources have been used for electricity generation in Sri Lanka. Solar photovoltaic systems have been increasingly used from early 1980s. Small isolated hydroelectric systems have been used in the tea processing industry for over 100 years. Small village-level hydroelectric systems are increasingly used in remote locations for household use. Installation of household solar photovoltaic systems and off-grid, community-

based, hydro power systems continued to progress with the financial assistance of World Bank funded RERED project. Development of local expertise in these areas was quite visible during the recent years.

Table 3.14- Hydro/Thermal/Non-conventional Energy Share in the National Grid

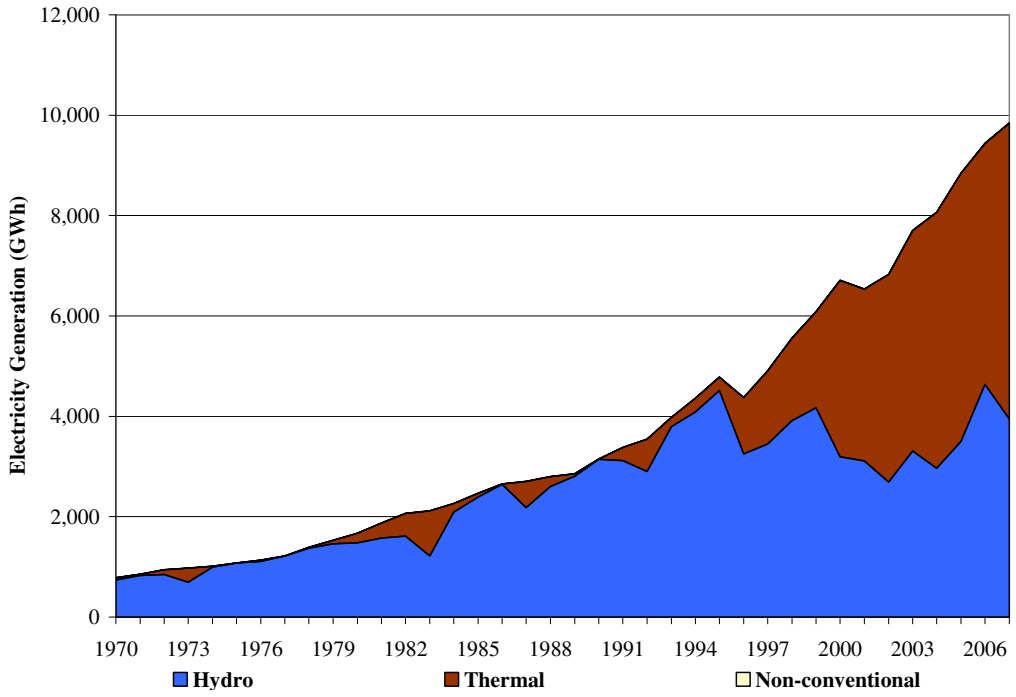
GWh

Year	1980	1990	2000	2001	2002	2003	2004	2005	2006	2007
Hydro, CEB and SPP	1,480.1	3,144.7	3,197.0	3,109.6	2,692.1	3,310.3	2,960.3	3,500.0	4,634.2	3,946.9
Thermal, CEB, IPP and Hired	188.8	5.0	3,512.5	3,424.4	4,135.6	4,389.2	5,104.6	5,341.6	4,806.8	5,895.9
Non-Conventional, CEB,SPP	0.0	0.0	3.4	3.5	3.6	3.4	2.7	2.4	2.3	2.3
Gross Generation to National Grid	**1,668.9**	**3,149.7**	**6,712.8**	**6,537.6**	**6,831.3**	**7,702.9**	**8,067.6**	**8,844.0**	**9,443.1**	**9,846.2**

%

Year	1980	1990	2000	2001	2002	2003	2004	2005	2006	2007
Hydro, CEB and SPP	88.7	99.8	47.6	47.6	39.4	43.0	36.7	39.6	49.1	40.1
Thermal, CEB, IPP and Hired	11.3	0.2	52.3	52.4	60.5	57.0	63.3	60.4	50.9	59.9
Non-Conventional, CEB,SPP	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0
Gross Generation to National Grid	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Figure 3.8- Hydro/Thermal/Non-conventional Energy Share in the National Grid



3.2.1.3 Fuel Usage and Conversion Efficiency in Power Generation

Thermal power plants operating in Sri Lanka primarily use petroleum fuels such as diesel, fuel oil, residual oil and naphtha. Table 3.15 shows the most common fuels used in power

generation in Sri Lanka, their calorific values and quantities consumed by grid connected and off-grid power plants.

Table 3.15- Fuel Consumption in Electricity Generation (Grid-connected and Off-grid)

Million liters

kJ/kg	Year	1980	1990	2000	2001	2002	2003	2004	2005	2006	2007
42,303	Fuel Oil	47.4	1.2	248.8	256.2	241.4	193.8	241.3	503.6	472.7	517.4
42,086	Residual Oil		0.1	297.8	276.5	303.7	302.8	263.2	270.1	265.9	296.2
44,196	Auto Diesel	15.6	1.5	526.6	434.4	530.7	335.2	507.6	311.8	314.8	471.9
47,139	Naphtha				44.8	79.2	144.8	138.1	179.6	91.2	137.6
	Total	**63.0**	**2.8**	**1,073.2**	**1,011.9**	**1115.0**	**976.6**	**1,150.2**	**1265.1**	**1,144.6**	**1,423.1**

Table 3.16- Generation and Fuel Use in Different Types of CEB Thermal Power Plants

Year	1980	1990	2000	2001	2002	2003	2004	2005	2006	2007
CEB Gross Generation (GWh)										
Steam, Fuel Oil	140.1	1.1	228.4	200.1	69.0	0.0	0.0	0.0	0.0	0.0
Diesel Engine, Residual Oil		85.6	981.9	917.4	988.4	1,001.0	810.0	849.2	852.8	960.0
Diesel Engine, Diesel	30.3	5.1	19.1	26.5	19.0	61.2	9.5	6.9	10.5	11.9
Gas Turbines, Diesel Oil	18.4	127.2	975.9	681.7	405.8	330.7	580.0	299.2	72.4	267.9
Combined Cycle, Diesel Oil				25.0	251.4	315.4	582.1	333.7	392.6	578.1
Combined Cycle, Naphtha				44.8	219.0	539.6	525.4	673.0	340.6	517.6
CEB Fuel Use (Million Litres)										
Steam, Fuel Oil	47.4	17.0	87.0	77.5	28.3	0.0	0.0	0.0	0.0	0.0
Diesel Engine, Residual Oil		19.0	217.8	204.1	219.6	222.6	178.8	188.7	189.1	213.1
Diesel Engine, Diesel	8.5	1.5	6.8	8.4	6.5	17.6	4.3	3.0	3.6	4.5
Gas Turbines, Diesel Oil	7.2	56.9	374.5	276.4	160.6	120.1	215.3	106.1	25.9	97.0
Combined Cycle, Diesel Oil				8.3	81.8	79.1	129.3	74.6	89.0	126.3
Combined Cycle, Naphtha				17.0	79.2	144.9	138.1	179.6	91.2	137.6
CEB Power Plant Thermal Efficiency (%)										
Steam, Fuel Oil	26.5	27.0	23.6	23.2	21.9					
Diesel Engine, Residual Oil		39.6	39.6	39.5	39.5	39.5	39.8	39.5	39.6	39.6
Diesel Engine, Diesel	34.4	32.0	27.1	30.4	28.2	33.5	21.1	22.3	27.8	25.5
Gas Turbines, Diesel Oil	24.8	21.5	25.1	23.8	24.3	26.5	26.0	27.2	26.9	26.6
Combined Cycle, Diesel Oil				29.1	29.6	38.4	43.3	43.1	42.5	44.1
Combined Cycle, Naphtha				29.2	30.6	41.3	42.1	41.5	41.4	41.7
CEB Gross Thermal Generation (GCal)	162,368	231,439	1,896,595	1,630,133	1,679,249	1,933,209	2,155,900	1,859,282	1,435,269	2,008564
CEB Fuel Energy Input (GCal)	593,924	870,727	6,369,870	5,489,346	5,258,267	5,239,851	5,938,471	4,882,340	3,617,810	5,189,019
CEB Power Plant Overall Efficiency (%)	27.3	26.6	29.8	29.7	32.0	36.9	36.3	38.1	39.7	38.7

Table 3.17- IPP Generation, Fuel Use and Efficiency

Year	2000	2001	2002	2003	2004	2005	2006	2007
IPP Gross Generation (GWh)								
Diesel Engine, Residual Oil	352.1	353.1	377.0	353.7	377.9	362.4	342.6	371.0
Diesel Engine, Fuel Oil	470.3	704.7	702.9	601.6	1,265.1	2,228.1	2,076.3	2,293.5
Diesel Engine, Diesel				24.8	36.9	111.1	97.6	104.6
Combined Cycle, Diesel				497.7	407.1	475.8	619.7	790.2
IPP Fuel Use (Million Litres)								
Diesel Engine, Residual Oil	80.0	72.4	84.1	80.2	84.4	81.4	76.8	83.1
Diesel Engine, Fuel Oil	141.8	158.1	193.6	189.7	237.3	500.0	468.8	513.5
Diesel Engine, Diesel				6.8	10.1	25.9	26.9	28.7
Combined Cycle, Diesel				131.7	107.7	96.3	163.4	209.4
IPP Efficiency (%)								
Diesel Engine, Residual Oil	38.7	42.8	39.4	38.8	39.4	39.1	39.2	39.2
Diesel Engine, Fuel Oil	29.8	40.0	32.6	28.4	47.9	40.0	39.8	40.1
Diesel Engine, Diesel				32.9	32.9	41.4	35.0	35.1
Combined Cycle, Diesel				41.8	36.4	47.6	36.5	36.3
IPP Net Thermal Generation (GCal)	707,298	909,692	928,740	1,270,975	1,794,786	2,732,531	2,697,075	3,060,990
IPP Fuel Energy Input (GCal)	2,141,073	2,222,510	2,677,120	3,840,849	4,151,906	6,673,153	6,940,276	7,857,632
IPP Power Plant overall Efficiency (%)	33.0	40.9	34.7	33.1	43.2	41.1	38.9	39.0

Table 3.18- Hired and Off-Grid Thermal Generation and Fuel Usage

Year	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Private Power Plants (Hired)										
Diesel Engine, Diesel Oil (GWh)	18.00	34.00	484.60	471.10	939.20	394.40	509.24	N/A	N/A	N/A
Estimated Diesel Use (Million Litres)	5.40	10.20	145.40	141.30	281.80	118.32	152.77	N/A	N/A	N/A
Self Generation By Customers										
Self Generation (GWh)	114.00	107.80	166.70	106.70	140.80	*	115.00	N/A	N/A	N/A
Estimated Diesel Use (Million Litres)	34.20	32.30	50.00	32.00	42.30		34.50	N/A	N/A	N/A
Off-Grid Systems, Industrial										
Generation (GWh)		78.40	82.40	129.50	105.10	16.74	39.20	40.05	40.05	40.05
Fuel Oil Use (Million Litres)		19.50	20.00	20.70	19.50	3.88	3.88	3.88	3.88	3.88
Diesel (Million Litres)				12.30	7.20	0.07	5.93	5.93	5.93	5.93

* Rebate scheme was suspended in 2003. Therefore accurate data is not available for this period

3.2.2 Off-Grid Generation

In some instances, power generation is done in isolation to the national grid, due to reasons such as unavailability of the grid, economic and reliability reasons, and until 2003 for self-generation requirements.

(i) At least two large industries operate power plants for their own requirements, keeping the grid as backup. A few other smaller industries also operate their generators continuously for reliability requirements.

(ii) Renewable energy systems, such as small hydro (for industries and households), wind and solar photovoltaic systems for households.

Table 3.19 summarises the off-grid generating capacity and energy, from the three forms of generation.

Table 3.19- Off-grid Generation of Electricity

GWh

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Off-Grid Systems, Conventional											
Self Generation by Customers	235	114	107	167	107	141	-	115	-	-	-
Off-Grid Systems, Industrial	-	-	78	82	130	105	17	39	40	40	40
Off-Grid Systems, Non-Industrial	-	-	-	-	-	-	-	-	-	-	-
Sub Total Off-Grid, Conventional	235	114	186	249	137	246	17	154	40	40	40
Off-Grid Systems, Non-Conventional											
Small Hydro, Industrial			7.1	7.1	7.1	7.1	7.1	7.1	7.1	7.1	7.1
Small Hydro, Household			0.4	0.7	1.1	1.2	1.4	1.7	2.0	2.3	2.5
Solar Photovoltaic, Household			-	0.4	0.9	1.5	2.4	3.5	4.6	5.4	6.3
Wind Energy, Household			-	-	-	0.0	0.0	0.0	0.0	0.0	0.0
Sub Total Off-Grid, Non-Conventional			7.5	8.2	9.1	9.8	10.9	12.3	13.7	14.8	15.9
Total Off Grid	**235**	**114**	**194**	**257**	**146**	**256**	**28**	**166**	**54**	**55**	**56**

Off grid electricity generation has recorded a substantial reduction in the recent past, primarily due to the reduction of self generation by customers. This is a result of the suspension of the rebate schemes previously offered to encourage industries with standby power to utilise their own generation capacity to bridge system capacity shortages.

3.2.3 Total Electricity Generation

The bulk of electricity generation in Sri Lanka is from grid-connected power plants. Table 3.20 gives the summary of electricity generation from grid-based and off-grid, conventional and non-conventional sources.

Table 3.20 - Total Gross Electricity Generation in Sri Lanka

GWh

Year	1980	1990	2000	2001	2002	2003	2004	2005	2006	2007
Hydro, CEB and SPP	1,480.1	3,144.7	3,197.0	3,109.6	2,692.1	3,310.3	2,960.3	3,500.0	4,634.2	3,946.9
Thermal, CEB, IPP and Hired	188.8	5.0	3,512.5	3,424.4	4,135.6	4,389.2	5,104.6	5,341.6	4,806.7	5,895.9
Non-Conventional, CEB			3.4	3.5	3.6	3.4	2.7	2.4	2.3	2.3
Self-Generation by Customers			166.7	106.7	140.8	0.0	115.0	0.0	0.0	0.0
Off-Grid, Conventional			82.4	129.5	105.1	16.7	39.2	40.1	40.1	40.1
Off-Grid, Non-Conventional			8.2	9.0	9.7	10.9	12.3	13.7	14.7	15.9
Gross Generation Sri Lanka	**1,668.9**	**3,149.7**	**6,970.2**	**6,782.7**	**7,087.0**	**7,730.5**	**8,234.0**	**8,897.7**	**9,498.0**	**9,901.1**
Generation Growth Rate Sri Lanka	**9.4%**	**10.2%**	**11.1%**	**-2.7%**	**4.5%**	**9.1%**	**6.5%**	**8.1%**	**6.7%**	**4.24%**

%

Year	1980	1990	2000	2001	2002	2003	2004	2005	2006	2007
Hydro, CEB and SPP	88.7	99.8	45.9	45.8	38.0	42.8	36.0	39.3	48.8	39.9
Thermal, CEB, IPP and Hired	11.3	0.2	50.4	50.5	58.4	56.7	62.0	60.0	50.6	59.5
Non-Conventional, CEB			0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0
Self-Generation by Customers			2.4	1.6	2.0	0.0	1.4	0.0	0.0	0.0
Off-Grid, Conventional			1.2	1.9	1.5	0.2	0.5	0.5	0.4	0.4
Off-Grid, Non-Conventional			0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2
Gross Generation Sri Lanka	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

As far as supply from secondary energy sources is concerned, the above discussed conversion of primary energy in the form of hydro potential or petroleum to electricity is the most prominent. However, the conversion of petroleum fuel to steam which is used as an energy source in most industries for their thermal application can also be considered a secondary form of energy. Though widely used, the quantum of steam generated, the quality and the end use is not recorded properly, which restricts the discussion on supply from secondary energy sources to be limited to electricity.

4 ENERGY DISTRIBUTION AND PRICING

The supply of energy includes generation/conversion and distribution to end users. Distribution is the process of delivering the energy from its source to the ultimate end use. For convenience, the terminal points of distribution are considered to be from the measuring point at generation/conversion to the measuring point at the end user.

4.1 Electricity Distribution

Distribution of electrical energy is through the transmission and distribution network, the main difference between the two being the voltage at which the power is delivered. Transmission is mainly at voltages 132kV and 220kV whereas distribution is done at 33kV, 11kV and 400V.

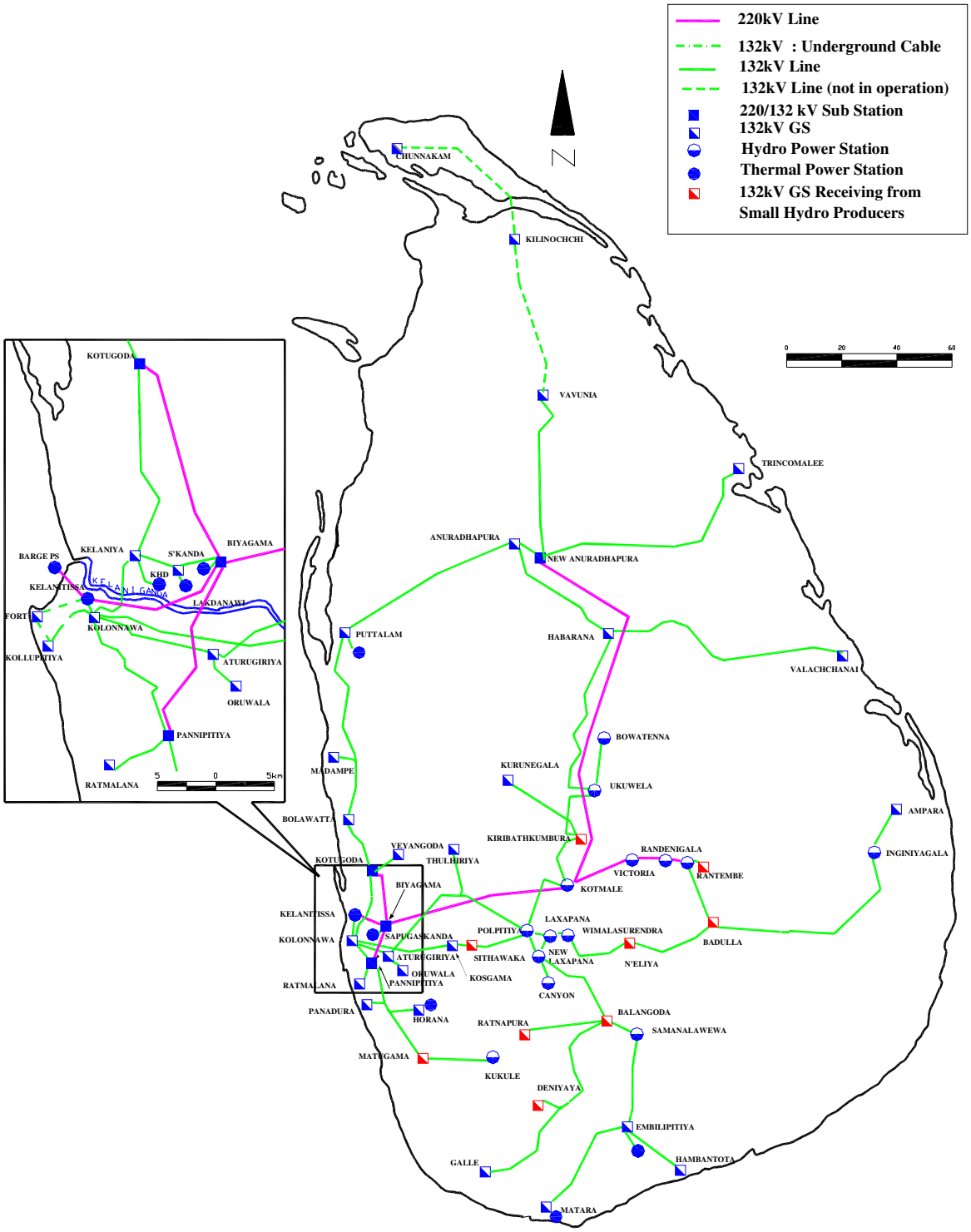
4.1.1 Transmission and Distribution Networks

4.1.1.1 Electricity Transmission Network

Sri Lanka has a single transmission network for the country with the exception of a small area in the Northern Province. As a result of the on going war, the transmission line linking Jaffna Peninsula in the northern end of the country has been destroyed, isolating the generation and distribution facilities in Jaffna from the main grid. However, efforts are underway to rebuild the transmission line and reconnect the peninsula to the main grid.

The national grid consists of the overhead transmission lines interconnecting large scale power plants scattered mostly in the central region and the western province, and grid substations where the distribution networks spread from. Apart from the most common transmission lines carrying power at 132kV, a limited amount of 220kV transmission lines are also available in the network. These 220kV transmission lines strengthen the network, especially between nodes having heavy power flows such as Kotmale-Biyagama and Kotmale-Anuradhapura.

Figure 4.1- Electricity Transmission Network



4.1.1.2 Electricity Distribution Network

Electricity distribution and sales in Sri Lanka have been handled by,

- Ceylon Electricity Board (CEB)
- Local (Municipal) Authorities (LA)
- Lanka Electricity Company (Pvt) Ltd. (LECO)

In 1970s, CEB and Local Authorities (LA) were the only distributors. Over the period from 1983 to 1995, LA networks were transferred to CEB and LECO, and some of the CEB networks too were transferred to LECO.

At grid substations, the high voltage electricity in the transmission network is converted to 33kV to be distributed within the locality. In some instances, the 33kV electricity is again converted to 11kV at primary substations and then distributed to customers. Distribution networks operated by LECO use 11kV as the distribution voltage. However, both CEB and LECO steps down the distribution voltage again to 400V prior to delivering power to small customers such as households and commercial buildings. For a limited number of industrial and commercial establishments, electricity is provided and metered at the distribution voltage itself. The distribution responsibility of both CEB and LECO ends at the metering point up to which the maintenance work is carried out by the utility service provider**.**

4.1.2 Electrification

Except street lighting, all categories of grid electricity consumers increased in 2007. While Table 4.1 shows the number of electricity consumers in the grid, Table 4.2 shows the share of electricity consumers of CEB and LECO separately. Figure 4.2 shows the trend of household electrification over time.

Table 4.1- Electricity Consumers Served by the Grid

Nos.

Year	1980	1990	2000	2001	2002	2003	2004	2005	2006	2007
Domestic	164,719	787,838	2,475,357	2,672,435	2,801,956	2,971,833	3,160,029	3,338,859	3,563,373	3,780,959
Religious	3,272	8,131	17,826	18,300	19,316	20,382	21,430	22,287	23,617	24,945
Industrial	4,472	14,197	31,231	32,429	33,813	35,325	36,943	38,299	39,530	41,298
Commercial	34,869	108,304	293,356	305,298	330,459	352,260	378,104	403,602	425,809	450,072
Street Lighting	325	1,100	1,569	1,940	2,484	2,975	3,127	4,050	3,945	3,923
Total	**207,657**	**919,570**	**2,819,339**	**3,030,402**	**3,188,028**	**3,382,775**	**3,599,633**	**3,807,097**	**4,056,274**	**4,301,197**

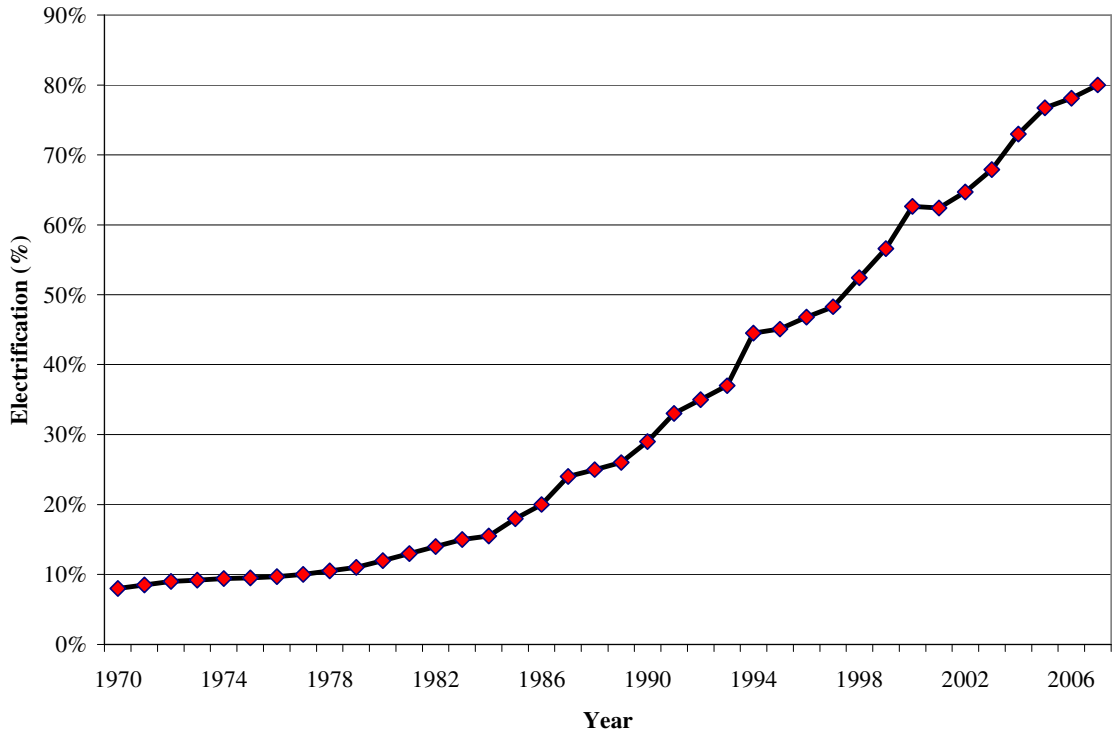
Table 4.2- Electricity Consumers in the Grid, CEB and LECO

Nos.

Year	1980	1990	2000	2001	2002	2003	2004	2005	2006	2007
CEB										
Domestic	164,719	628,741	2,191,301	2,364,853	2,491,349	2,648,988	2,823,654	2,988,223	3,203,049	3,409,440
Religious	3,272	8,131	16,041	16,805	17,448	18,482	19,508	20,365	21,574	22,804
Industrial	4,472	12,990	27,231	28,914	29,781	31,182	32,666	34,020	35,431	37,270
Commercial	34,869	89,254	255,676	274,515	289,092	308,024	331,022	353,401	376,150	397,435
Street Lighting	325	790	1	1	1	1	1	1	1	1
Sub total CEB	**207,657**	**739,906**	**2,490,250**	**2,685,088**	**2,827,671**	**3,006,677**	**3,206,851**	**3,396,010**	**3,636,205**	**3,866,950**
LECO										
Domestic		159,097	284,056	307,582	310,607	322,845	336,375	350,636	360,324	371,519
Religious		0	1,785	1,495	1,868	1,900	1,922	1,922	2,043	2,141
Industrial		1,207	4,000	3,515	4,032	4,143	4,277	4,279	4,099	4,028
Commercial		19,050	37,680	30,783	41,367	44,236	47,082	50,201	49,659	52,637
Street Lighting		310	1,568	1,939	2,483	2,974	3,126	4,049	3,944	3,922
Sub total LECO		**179,664**	**329,089**	**345,314**	**360,357**	**376,098**	**392,782**	**411,087**	**420,069**	**434,247**

Note: CEB considers street lighting as one account, while LECO counts the street lighting systems individually as separate accounts.

Figure 4.2 - Household Electrification in the Grid



The number of off-grid electricity consumers increased significantly over the past few years. This increase was largely achieved through the increased use of solar photovoltaic. Table 4.3 shows the details of off-grid electrification. All estimates are based on data available from ESD and RERED programs, which were instrumental in the development of off grid household electrification in the country.

Table 4.3- Off-grid Electrification

Year	2000	2001	2002	2003	2004	2005	2006	2007
***Off-grid Solar Photovoltaic Households**	10,000	20,906	34,285	52,862	76,166	97,105	114,883	128,527
Wind Battery Charging Systems			25	25	25	25	25	25
***Estimated Number Off-grid Hydroelectric Consumers**	365	573	1,732	2,545	3,711	4,594	5,129	5,869

*Based on the data from ESD and RERED projects

4.2 Petroleum Distribution

As explained previously, Sri Lanka meets the country petroleum demand entirely by imported petroleum brought in as either crude oil or refined products. Since the processing capacity of the CPC-owned refinery is not sufficient to meet the country demand, considerable amounts of petroleum products have to be imported and directly sold in the local market.

4.2.1 Distribution Structure

Until 2002, CPC was responsible for all aspects of petroleum supply, with the exception of retail marketing of LPG. By 2002, CPC owned and operated the refinery, all the import, storage and distribution terminals, and about 350 filling stations. In addition, there were about 700 privately-owned filling stations.

In 2002, the Government embarked on a process to restructure the petroleum supply industry. As a result, the Indian Oil Corporation (IOC) was invited to takeover and operate 100 filling stations (previously owned by CPC) and the China Bay installation (storage tanks). By the end of year 2003, LIOC had undertaken the ownership of 130 filling stations (out of which some were previously owned by private companies).

Ownership of the petroleum distribution network by the end of 2007 was as follows.

CPC (owned by Government of Sri Lanka): Refinery, adjoining mini-distribution terminal, Orugodawatte Tank farm and about 100 filling stations.

LIOC (owned by Indian Oil Company): About 130 filling stations and the China Bay storage facility.

Third distribution company (owned by the Treasury): Not operational, but 100 filling stations designated to this company are operated by CPC.

CPSTL (jointly owned by the Government, CPC and LIOC): Kolonnawa and Muthurajawela storage/distribution facilities, and 13 regional distribution depots.

The refinery located in Sapugaskanda consists of 50,000 barrels/day processing plant and a 540,000 MT crude oil tank farm. The refinery gets crude oil from the Single Point Buoy Mooring (SPBM) facility installed about 10km offshore and also from the four crude oil storage tanks of 40,000 MT (each), located in Orugodawatta. Part of the refinery output is stored at Sapugaskanda storage facility for distribution and the balance is pumped to the Kolonnawa storage facility.

The Sapugaskanda tank farm (mini-distribution facility) receives products only from the refinery. This has a total storage capacity of 60,000 MT in twelve tanks for diesel, kerosene and fuel oil.

Refined products from the refinery as well as imported products are received via pipelines to tanks at Kolonnawa. The Kolonnawa installation has a total capacity of 250,000 MT in 40 tanks for finished products and product loading facilities for loading railway bogies, which transport products to most of the bulk depots and to road tankers. Aviation fuel to the Katunayake airport is supplied from the Kolonnawa terminal through rail and road tankers.

The Muthurajawela tank farm started operations in 2004. With the construction of this tank farm, Sri Lanka's storage capacity for finished petroleum products increased by 250,000 MT. Muthurajawela tank farm consists of 21 tanks of 10,000 m^3 capacity and 8 tanks of 5,000 m^3 capacity. These tanks store and distribute diesel and kerosene. Along with the tanks, CPC installed a new SPBM system, where 60,000 DWT (deadweight tonnage) ships could use the buoy for discharging imported finished products direct from sea to tanks via a submarine pipeline. This terminal includes a loading facility to distribute products by road tankers. However, rail transportation of petroleum products stored in the Muthurajawela tank farm is constrained due to the absence of a railway line.

Petroleum supply for retail sale is done at the following storage/distribution facilities

1. Muthurajawela
2. Kolonnawa
3. Sapugaskanda mini distribution facility
4. China Bay storage facility
5. 13 regional depots.

Lanka Marine Services (LMS) located at Bloemandhal in Colombo receives imported products directly as well as from the Kolonnawa terminal via pipelines, and provides bunker fuel to ships via pipelines connected to Dolphin pier and also from South jetty. LMS terminal has a storage capacity of 23,000 MT of fuel oil and 6,800 MT of diesel.

Some LPG is produced at the CPC refinery, but most of the country's LPG requirement is imported. LPG is imported through the Colombo Port, and also via a conventional buoy mooring system (CBM) for the Shell Gas Lanka facilities at Muthurajawela.

Residual oil (heavy furnace oil) is transferred directly from the refinery to the 160MW Sapugaskanda power plant owned by the Ceylon Electricity Board (CEB) and to the 51MW residual oil power plant owned by Asia Power for the production of electricity to the national grid. The refinery LPG production is delivered to the private distributor by means of road tankers and then filled into bottles for onward distribution to consumers.

As previously explained in this report, Sri Lanka meets all its petroleum demand by imported petroleum brought in as crude oil or refined products. Since the refinery capacity of the CPC-owned refinery is not sufficient to meet the country demand, considerable amount of petroleum products have to be imported and directly sold in the local market. Whether locally refined or directly imported, petroleum is channelled through the same distribution network which consists of several tank farms located in Kolonnawa, Sapugaskanda and Trincomalee, the local depots and the distribution stations (filling stations) spread all around the country.

4.2.2 Petroleum Prices

The petroleum prices in the domestic market have been increasing over the years. However, the price variation in the domestic market has always followed the international market price variation with a certain delay. For some products such as Kerosene and Auto Diesel,

government tax concessions and subsidies dampen the domestic price increases against volatile international prices.

The tax impact on petroleum prices is also significant, especially in some products such as petrol. The reason for petrol prices to be considerably higher than any other petroleum product is the tax impact. Due to the wide use of diesel, especially for goods and mass transportation, diesel price variations are carefully controlled by the Government to reduce its impact on the macro economy, especially the inflation.

4.3 Biomass Distribution

Distribution of some energy sources is not as complicated as electricity or petroleum. For instance, biomass, which meets almost half the country energy demand, is predominantly self-supplied. Abundant availability, especially in rural areas where the usage is most common, has simplified the distribution of biomass. The actual value of biomass is often misrepresented by its discounted price due to the simplified sourcing options. In terms of the cost of alternate fuels avoided, biomass has a significantly higher value to the economy.

Though the use of biomass was limited to household thermal energy needs and small-scale industrial requirements, with the expected growth in biomass use for electricity generation and industrial applications, the price and value of biomass will also be accounted in a more meaningful manner. However, the distribution structure of biomass has not developed yet to a commercial level to be discussed with reasonable accuracy.

5 ENERGY DEMAND

Supply of energy discussed up to now is a direct consequence of the demand for energy, which is analysed in detail in this chapter. Energy is a vital building block for economic growth. Similar to 2006, industrial and transport sectors accounted for 26% of the total energy demand in the country, while household, commercial and other sectors accounted for the balance 48% of the total national energy consumption.

5.1 Electricity Demand

5.1.1 The System Demand

The generating system needs to be able to meet the peak demand of the national grid. As it was the case in 2006, the electricity supply system managed to fulfil the energy demand in 2007, without much difficulty.

Electricity demand is discussed with respect to two aspects. The first being the energy demand where the cumulative electrical energy requirement is met by the supply system. The peak demand is the other criterion to be fulfilled in meeting the national electricity demand. Since the national demand profile has an evening peak, the capability of the supply system in meeting the demand during the evenings (i.e. peak period) is important. Figure 5.1 shows the hourly demand profile on a day in year 2007, when the highest daily peak demand was recorded (which was on 28th of November). Table 5.1 shows the development of the system peak demand over the years.

Figure 5.1- System Demand Profile on November 28th, 2007

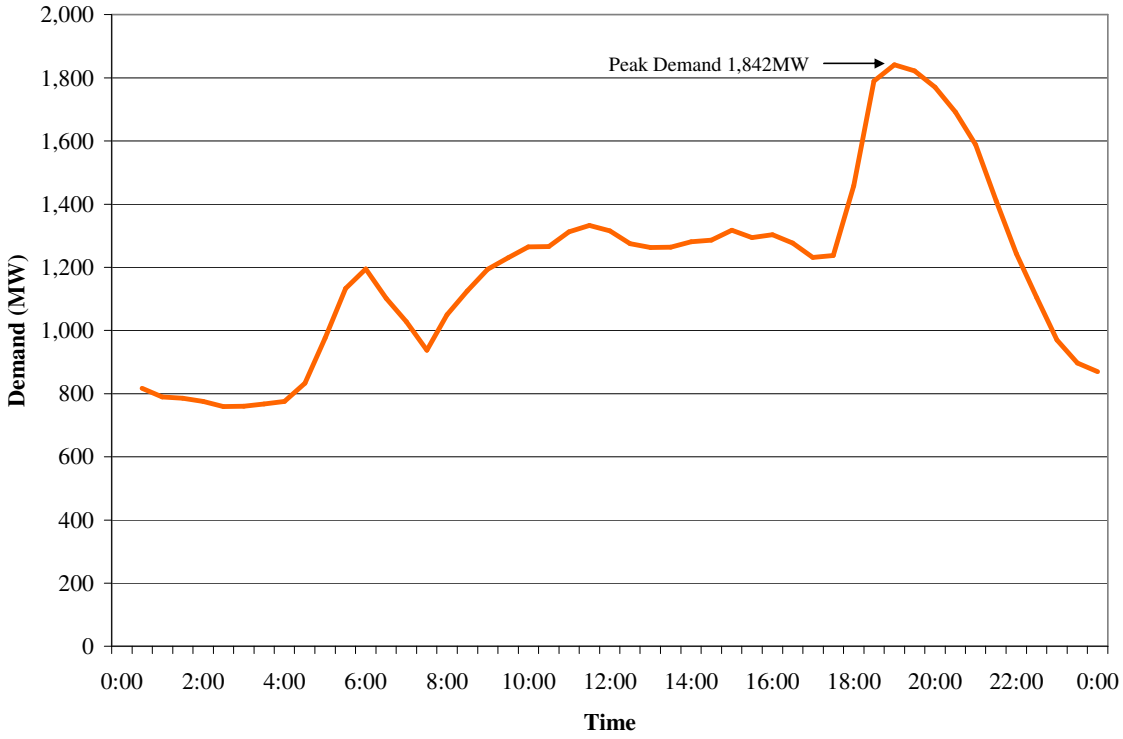


Table 5.1- The Growth in System Capacity and Demand

Year	1980	1990	2000	2001	2002	2003	2004	2005	2006	2007
Gross Generation to CEB Grid (GWh)	1,668.9	3,149.7	6,712.7	6,537.5	6,831.3	7,702.9	8,067.6	8,844.0	9,443.1	9,845.1
Total Grid Connected Capacity (MW)	422.3	1,283.7	1,838.3	1,999.6	2,286.3	2,537.9	2,659.9	2,410.8	2,433.3	2,440.0
System Peak Demand (MW)	368.5	639.6	1,404.7	1,444.2	1,421.8	1,515.6	1,563.4	1,748.2	1,892.5	1,842.0
Reserve Capacity (MW)	53.8	644.0	433.4	555.3	864.5	1,022.3	1,096.4	662.6	540.8	598.0
System Load Factor	51.7%	56.2%	54.6%	51.7%	54.8%	58.0%	58.9%	57.8%	57.0%	61.0%
System Reserve Margin	14.6%	100.7%	30.9%	38.5%	60.8%	67.5%	70.1%	37.9%	28.6%	32.5%

The system load factor of Sri Lankan national grid recorded 61%, the highest figure ever. System load factors in the range 50%-60% are typical of a customer mix dominated by household consumers with a high demand for electricity used for lighting in the evening. A 2.7% reduction in the maximum demand together with the slight increase in the grid connected capacity resulted in an increase in the reserve margin (to 32.5%) in the system. The high portion of hydro in system installed power generation capacity and the low reserve margin are indicators of a looming capacity shortage in the system and a high dependence on rainfall for a reliable power supply.

Figure 5.2 – Development of System Load Factor, Reserve Margin and Peak Demand

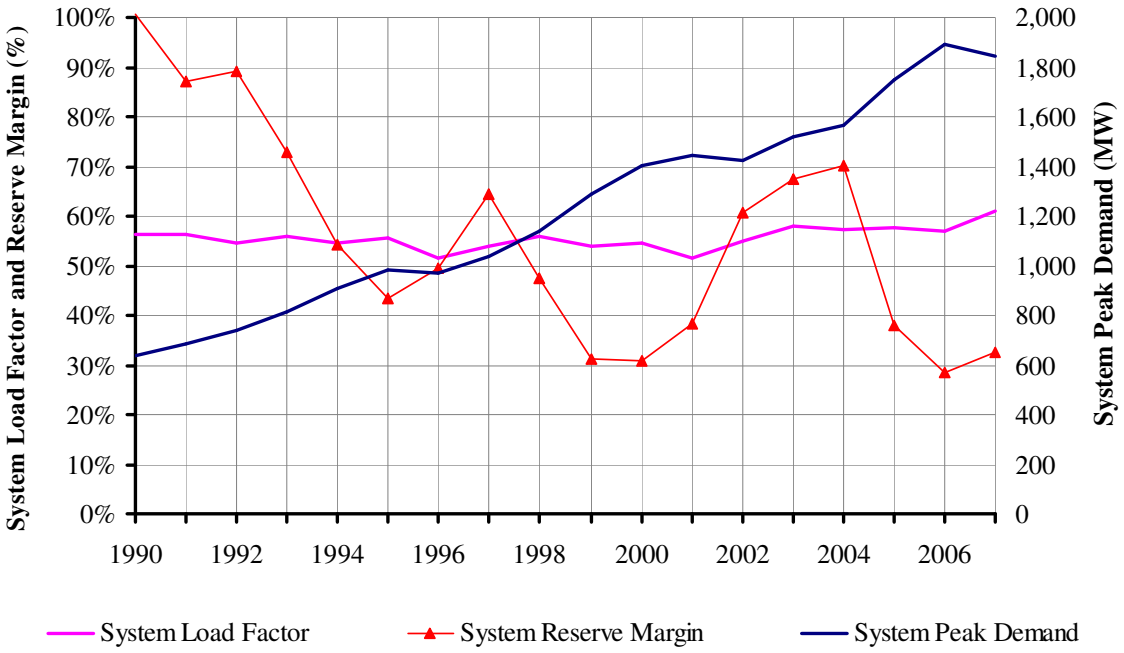
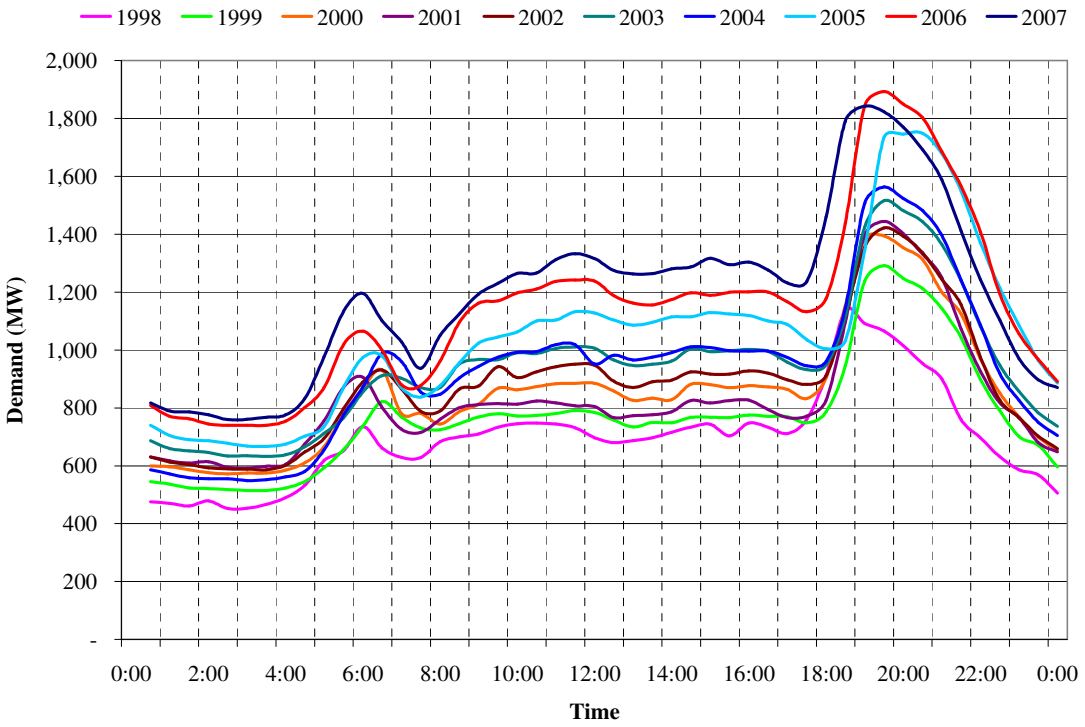


Figure 5.3 - The Growth in System Peak Demand



It is notable that the peak demand has shifted to occur around 7.00 pm during 2007. During 2006 the peak demand occurred around 7.30 pm.

5.1.2 Electricity Demand by Different End Use Categories

Based on the usage type, electricity consumers are categorised into following categories

- Domestic
- Religious purpose
- Industrial
- Commercial
- Street Lighting

Amounts of electricity used by different customer classes are given in Table 5.2, which also includes off-grid electricity generation using conventional and non-conventional sources. Though the electrical energy demand by different end users is established by the use of electricity sales data, individual power demands of different categories cannot be established due to the lack of a proper monitoring system. However, by analysing the typical load profiles of different user categories, it is apparent that the domestic category is most influential in the morning and evening peaks and the consequent low load factor of the system.

Table 5.2 - Electricity Demand by End Use Category

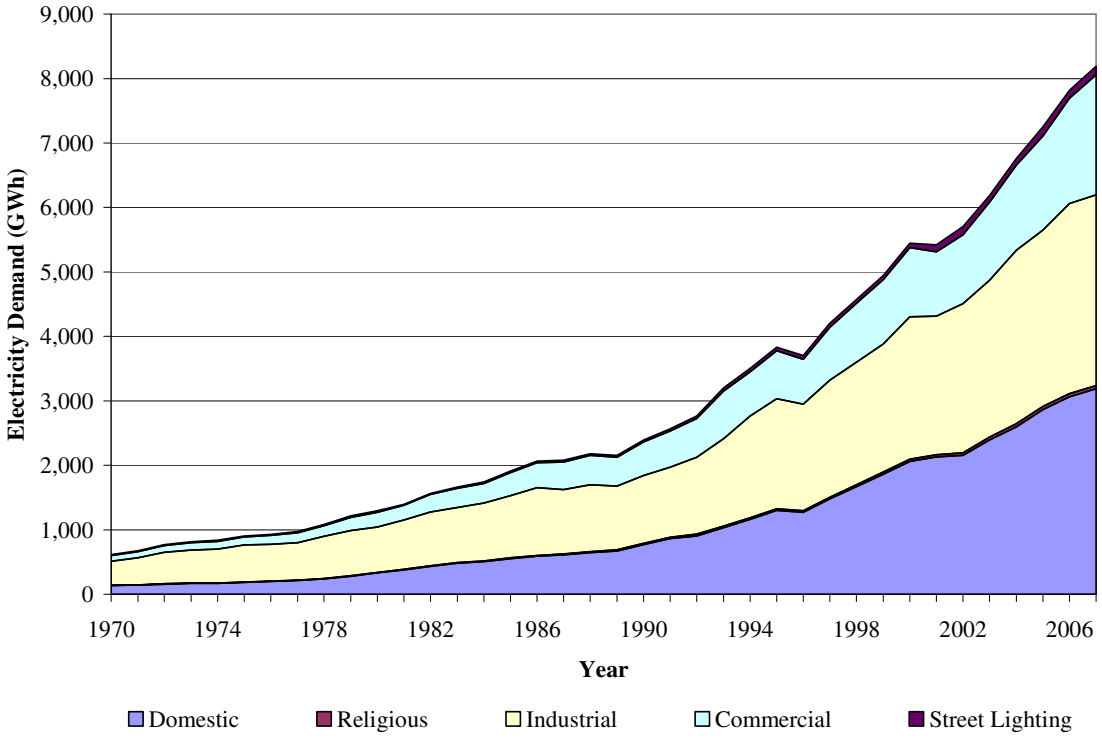
GWh

Year	1980	1990	2000	2001	2002	2003	2004	2005	2006	2007
Domestic	334.1	768.1	2,061.5	2,129.6	2,157.1	2,395.8	2,599.5	2,865.5	3,063.2	3,186.8
Religious	6.6	22.8	37.4	36.8	37.0	42.1	45.2	49.2	50.8	50.1
Industrial	704.0	1,054.3	2,202.6	2,147.9	2,310.6	2,433.9	2,689.0	2,731.8	2,946.7	2,956.6
Commercial	228.4	519.0	1,073.2	999.7	1,069.7	1,211.5	1,322.8	1,465.1	1,633.5	1,863.6
Street Lighting	23.9	30.8	68.1	106.9	133.3	103.3	106.5	141.3	125.1	136.1
Total Electricity Use	**1,297.1**	**2,395.0**	**5,442.8**	**5,420.9**	**5,707.6**	**6,186.6**	**6,763.0**	**7,252.9**	**7,819.3**	**8,193.3**

%

Year	1980	1990	2000	2001	2002	2003	2004	2005	2006	2007
Domestic	25.8	32.0	37.9	39.3	37.8	38.7	38.5	39.5	39.2	38.9
Religious	0.5	1.0	0.7	0.7	0.6	0.7	0.7	0.7	0.6	0.6
Industrial	54.3	44.0	40.4	39.6	40.5	39.3	39.8	37.7	37.7	36.1
Commercial	17.6	21.7	19.8	18.4	18.8	19.6	19.6	20.2	20.9	22.7
Street Lighting	1.8	1.3	1.2	2.0	2.3	1.7	1.6	1.9	1.6	1.7
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Figure 5.4 – Electricity Demand by Consumer Category



5.2 Petroleum Demand

5.2.1 Demand for Different Petroleum Products

As discussed in a previous section, the demand for different petroleum products vastly varies upon their potential application. For instance, auto diesel is more widely used for transportation and power generation, compared with kerosene, which is used only for rural household energy needs, some industrial applications, agriculture and fisheries. Therefore, the demand for auto diesel is higher than for kerosene. The refinery production process is adjusted to produce more of the high demand products while some products are directly imported to bridge the gap between refinery output and the local demand.

The demand for petroleum products increased in the year 2007, compared with 2006. This is due to the increase in consumption in power generation.

Figure 5.5 – Demand for Different Petroleum Products

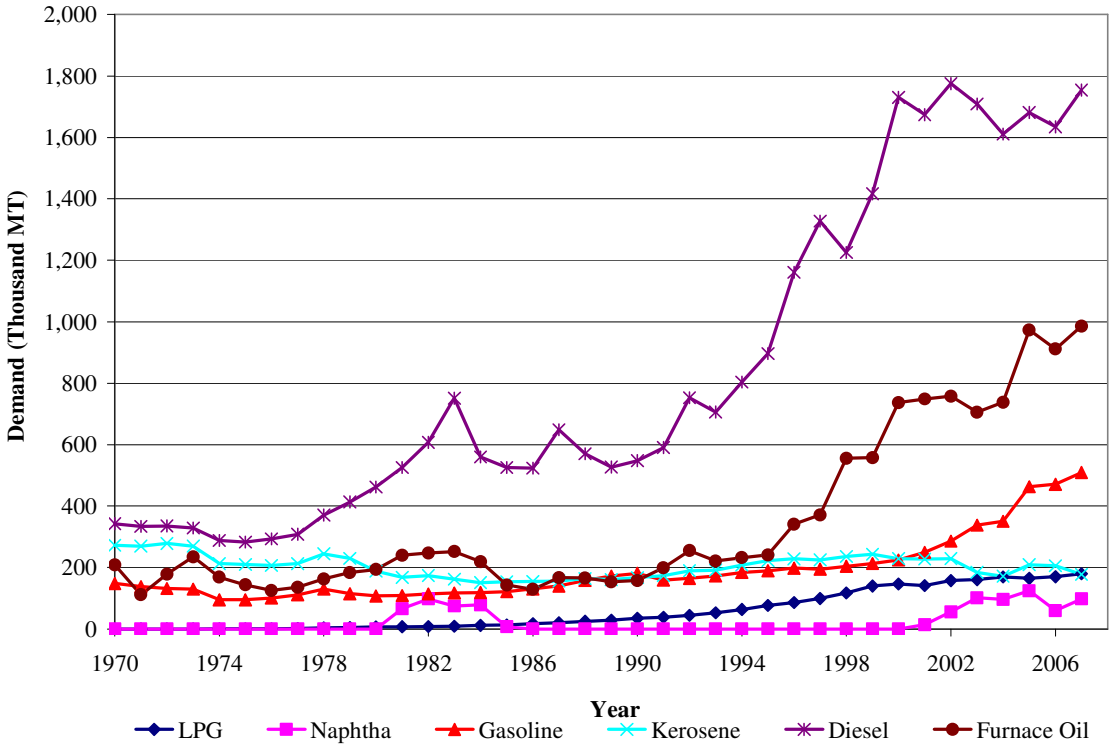


Table 5.3- Demand for Different Petroleum Products

Thousand MT

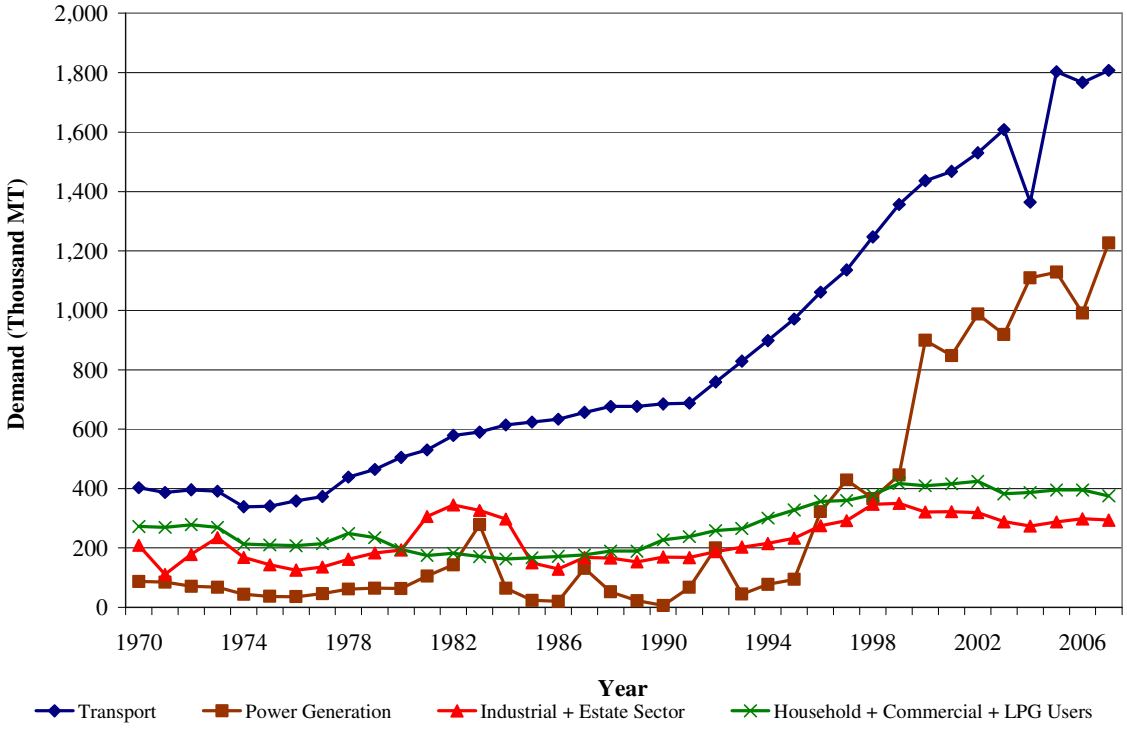
Year	1980	1990	2000	2001	2002	2003	2004	2005	2006	2007
LPG	6.72	34.90	146.00	141.00	157.46	161.00	169.08	165.00	169.76	180.03
Naphtha				14.06	56.07	101.70	96.20	124.92	59.94	97.49
Petrol	107.69	181.12	224.38	249.51	286.10	337.93	350.37	463.0	471.16	509.10
Kerosene	188.29	167.24	229.10	227.80	228.82	184.63	171.88	208.99	206.24	178.12
Diesel	461.66	548.15	1,730.44	1,674.03	1,775.21	1,708.54	1,610.59	1,681.27	1,634.41	1,754.20
Fuel Oil	193.80	157.77	736.71	748.79	757.64	705.18	771.70	972.78	911.15	985.25
Total Demand	**958.16**	**1,089.18**	**3,066.62**	**3,055.19**	**3,261.30**	**3,198.98**	**3,169.82**	**3,615.96**	**3,452.66**	**3,704.19**

5.2.2 Sectoral Petroleum Demand

Petroleum has a wide range of applications as a convenient energy source. Transport, power generation, industrial thermal applications, domestic lighting and cooking are the most common uses of petroleum in Sri Lanka. In addition, due to the strategically important geographic location of Sri Lanka in terms of maritime and aviation movements, foreign bunkering and aviation fuel sales also create a demand for petroleum in the country. Petroleum

demand to meet the non-domestic needs such as bunkering and aviation fuel is discussed separately.

Figure 5.6 – Sectoral Petroleum Demand



5.2.2.1 Transport Sector

As depicted in Figure 5.6, transport is the most important sector as far as petroleum is concerned. Almost all the vehicles in Sri Lanka are powered by either diesel or petrol. Even the rail transport is totally fuelled by diesel. The Internal Combustion (IC) engines in all these vehicles intrinsically introduce considerable energy wastage in terms of conversion efficiency from petroleum energy to motive power. Use of electricity to at least energise the train transportation can be an efficient and economical alternative to burning petroleum fuels in the transport sector.

Though the diesel consumption has not increased in 2007, compared with 2006, the use of petrol has increased effectively increasing the total petroleum consumption of the transport sector.

Figure 5.7 – Different Fuels used in Transport Sector

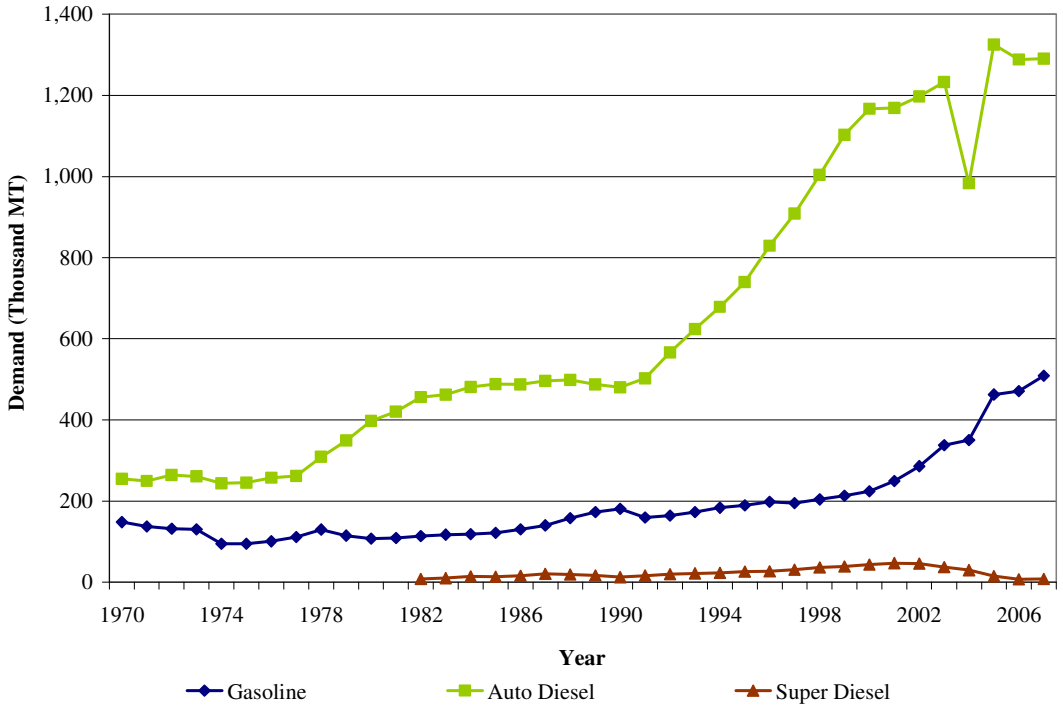
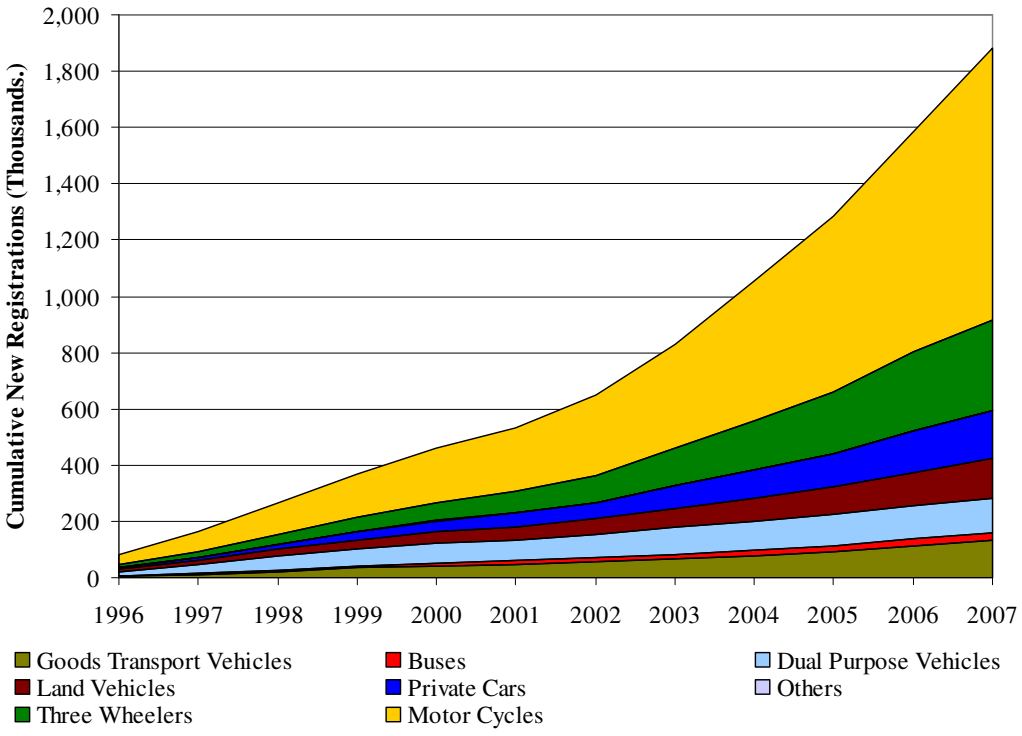


Figure 5.8 - Growth Pattern of Road Vehicle Fleet during the Last Decade



5.2.2.2 Power Sector

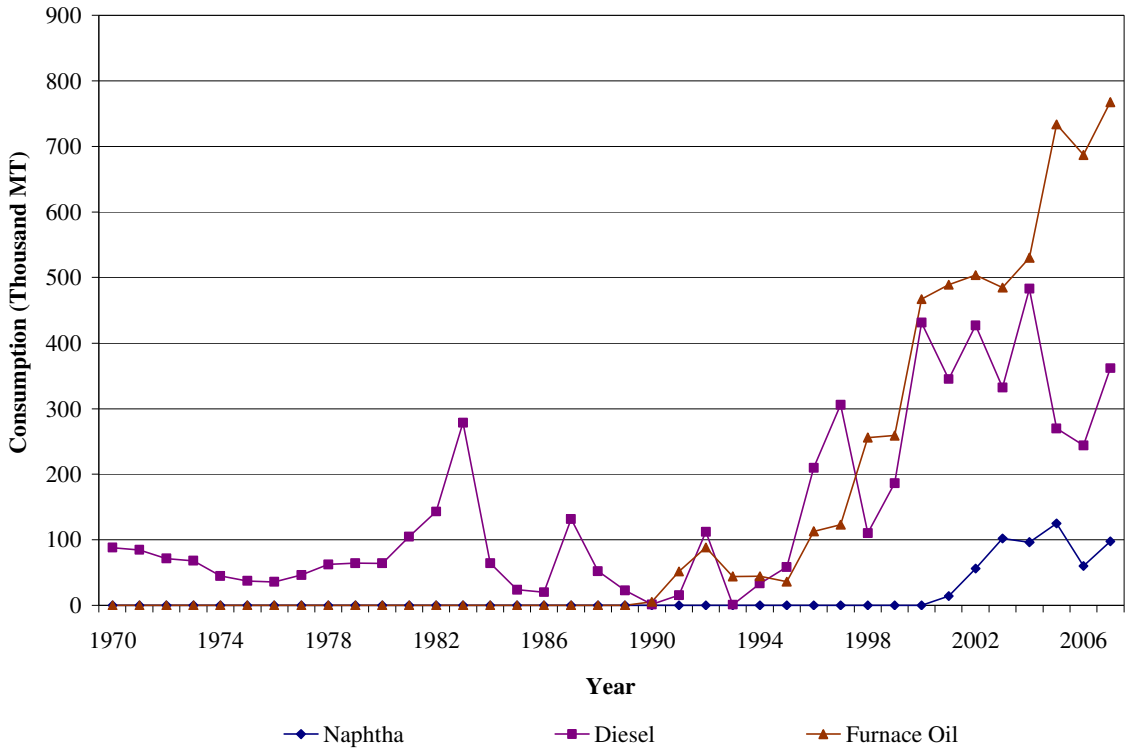
With the saturation of large-scale hydro power potential in Sri Lanka after the mid 1990s, thermal power generation using petroleum fuels became prominent in the Sri Lankan power system. With the presently available mix of power generation technologies in Sri Lanka, it will continue to be a significant component in petroleum consumption in Sri Lanka.

Table 5.4- Petroleum Use in Power Generation

Thousand MT

Year	1980	1990	2000	2001	2002	2003	2004	2005	2006	2007
HFO + Residual Oil	0.00	5.10	467.26	489.08	503.90	484.70	530.40	733.66	687.27	767.85
Diesel	63.95	1.14	431.30	345.11	427.02	332.33	482.92	269.64	243.82	361.69
Naphtha	0.00	0.00	0.00	14.06	56.07	101.70	96.20	124.92	59.94	97.49
Sub Total	***63.95***	***6.24***	***898.56***	***848.25***	***986.99***	***918.73***	***1,109.52***	***1,128.22***	***991.03***	***1,227.03***
National Demand	**958.16**	**1,089.18**	**3,066.62**	**3,055.19**	**3,261.30**	**3,198.98**	**3,169.82**	**3,615.96**	**3,452.66**	**3,704.19**
% of National Demand	6.7%	0.6%	29.3%	27.8%	30.3%	28.7%	35.0%	31.2%	28.7%	33.1%

Figure 5.9 - Fuels Used for Electricity Generation



As given in Table 5.4, power generation accounted for 33.1% of national petroleum demand which is an increase from the previous year's share of 28.7%. All types of fuels used in power

generation have seen an increase of consumption in 2007. This is mainly due to the increase in thermal power generation by the CEB and IPP thermal power plants.

5.2.2.3 Other Sectors

As seen in Figure 5.6, transport and power are the largest petroleum consumer sectors. Domestic sector petroleum consumption is limited to kerosene and LPG. However, with the increased use of LPG especially in urban households for cooking purposes, the demand for petroleum by the domestic sector has also become significant.

Industrial sector petroleum usage is mostly for thermal applications where diesel and fuel oil is used to fuel industrial steam boilers. LPG usage is also increasing in industrial thermal applications where the quality and control of heat generation is important for the industry operation. The LPG fired kilns in the ceramic industry is one such example.

The commercial sector including the service sector organisations such as hotels also contribute to the national petroleum demand, but to a lesser degree than the above-mentioned high consumers.

Agriculture based petroleum demand in Sri Lanka is considerably low, despite the fact that it is broadly an agricultural economy. Estate sector is one division which shows a fair usage of petroleum for drying purposes, but its energy consumption is accounted under industrial usage.

Kerosene used in fisheries is another substantial consumer category with regard to petroleum demand. Engine powered boats commonly used in the fishing industry are fuelled by either diesel or kerosene. It is therefore, important to understand that kerosene, which is a subsidised petroleum product in Sri Lanka, is not entirely used by the poorest segment of the society as reflected in petroleum pricing policies.

5.2.3 Bunkering and Aviation Sales

Local and foreign bunkering and aviation fuel sales are also contributing to the national petroleum demand. Though it is arguable that the real use may not occur within the country, the transaction of purchasing the product happens within the country and therefore, the national petroleum supply needs to cater to this demand as well. However, accurate data on bunkering

fuel sales is not available from year 2005, and therefore, Table 5.5 presents only aviation fuel sales of the last three years.

Table 5.5- Bunkering and Aviation Sales

Thousand MT

Year	1980	1990	2000	2001	2002	2003	2004	2005	2006	2007
Bunkers										
Marine Gas Oil	20.80	29.07	44.88	41.75	44.12	35.41	4.38	DNA	DNA	DNA
Marine Diesel Oil	33.64	23.70	9.31	8.97	0.00	0.00	0.00	DNA	DNA	DNA
Heavy Diesel	0.07	0.00	0.00	0.00	0.00	0.00	0.00	DNA	DNA	DNA
Fuel Oil	319.77	339.49	120.32	103.89	100.89	78.94	33.52	DNA	DNA	DNA
Marine Lubricants	0.82	0.06	0.00	0.00	0.00	0.00	0.00	DNA	DNA	DNA
Sub Total	***375.10***	***392.32***	***174.51***	***154.60***	***145.01***	***114.35***	***37.90***	DNA	DNA	DNA
Aviation										
Aviation Turbine fuel	115.89	118.34	259.40	204.01	211.28	249.13	297.98	300.47	304.61	301.53
Aviation Gasoline	0.62	0.24	0.25	0.27	0.25	0.11	0.10	0.14	0.15	0.16
Aviation Lubricants	0.02	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sub Total	***116.52***	***118.62***	***259.65***	***204.28***	***211.53***	***249.24***	***298.08***	***300.62***	***304.76***	***301.69***

DNA – Data Not Available

5.3 Biomass

As the most significant primary energy supply source in the country, biomass has a widespread demand for both commercial and non-commercial applications. However, the informal nature of supply, mainly through users' own supply chains, has prevented accurate and comprehensive usage data being compiled for biomass. Therefore, estimation methods are used to develop reasonable information based on available data. Mid year population surveys and LPG consumption are used to estimate household fuelwood consumption. Meanwhile, industrial biomass consumption is estimated based on the industrial production data and surveys. Most of the information on biomass presented in this report is based on estimates and sample surveys.

5.3.1 Fuelwood

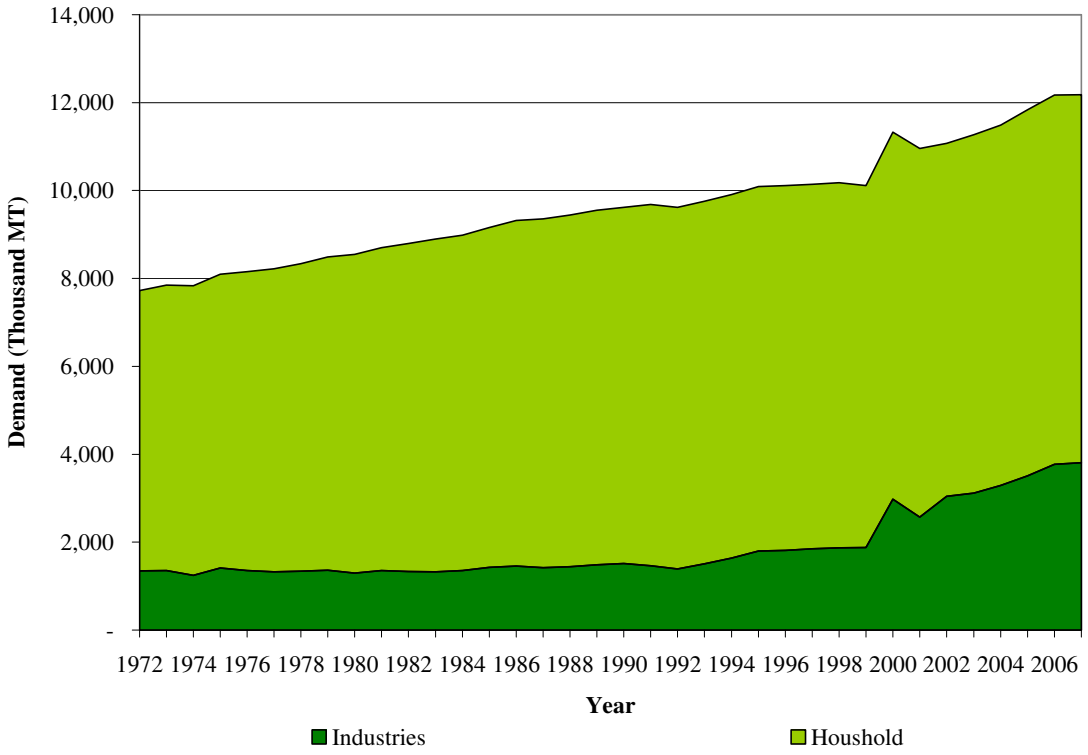
Table 5.6 and Figure 5.10 show the sector-wise consumption of fuelwood over the last three decades. Previous estimates prepared by various agencies have been revised in the estimates given below, using more recent surveys about household fuelwood use. Similarly, estimates for industrial use were also revised.

Table 5.6- Sector-wise Demand for Fuelwood

Thousand MT

Year	1980	1990	2000	2001	2002	2003	2004	2005	2006	2007
Industries	1,292.3	1,511.5	2,978.8	2,569.7	3,043.0	3,116.4	3,293.4	3,505.0	3,774.4	3,807.0
Household, Commercial & Others	7,260.0	8,110.0	8,350.0	8,390.0	8,035.0	8,156.5	8,198.6	8,336.2	8,402.9	8,376.2
Total	**8,552.3**	**9,621.5**	**11,328.8**	**10,959.7**	**11,078.0**	**11,272.9**	**11,492.0**	**11,841.2**	**12,177.2**	**12,183.2**

Figure 5.10 - Sector-wise Demand for Fuelwood



5.3.2 Bagasse and Charcoal

Bagasse is the waste form of sugar cane, which is used in sugar factories for combined heat and power generation. Only two sugar factories were in operation by 2007. These two are the Pelwatte and Sevanagala sugar factories and both the factories use bagasse for power generation and for process thermal requirements.

Charcoal is produced mainly from coconut shell and wood. Wood charcoal production has shown a decrease and coconut shell charcoal production has shown an increase in the recent

years. A major portion of the production of coconut shell charcoal is exported as a non-energy product. Table 5.7 shows the historic and current trends in the Bagasse use and charcoal production.

Table 5.7- Bagasse Use and Charcoal Production

Thousand MT

Year	1980	1990	2000	2001	2002	2003	2004	2005	2006	2007
Bagasse	113.05	377.40	264.80	188.44	128.86	212.71	235.58	210.90	213.10	148.56
Fuel wood Charcoal	33.03	24.10	0.01	0.10	0.21	0.39	0.28	0.12	0.18	0.13
Coconut Shell Charcoal			48.70	48.70	44.50	31.52	32.16	32.16	36.29	40.68
Total	**146.10**	**401.50**	**313.50**	**237.20**	**173.60**	**244.62**	**268.02**	**243.18**	**249.57**	**189.24**

5.4 Total Energy Demand

To summarise the above-presented demand for different energy sources, demand data is presented in a comparable unit of energy (tonnes of oil equivalent-toe) in this section.

Table 5.8- Final Energy Delivered to End-users

Thousand toe

Year	1980	1990	2000	2001	2002	2003	2004	2005	2006	2007
Biomass	3,290.43	3,817.34	4,410.92	4,240.14	4,261.32	4,335.39	4,461.31	4,584.12	4,712.57	4,689.04
Petroleum	978.71	1,203.40	2,365.08	2,404.61	2,435.76	2,606.07	2,941.66	2,807.86	2,764.94	2,849.83
Electricity	111.55	205.97	468.07	466.15	490.19	532.04	581.59	623.76	672.47	704.62
Total	**4,380.69**	**5,226.71**	**7,244.07**	**7,110.90**	**7,187.26**	**7,473.52**	**7,984.57**	**8,015.74**	**8,149.97**	**8,243.49**
										%
Biomass	75.11%	73.04%	60.89%	59.63%	59.29%	58.01%	55.87%	57.19%	57.82%	56.88%
Petroleum	22.34%	23.02%	32.65%	33.82%	33.89%	34.87%	36.84%	35.03%	33.93%	34.57%
Electricity	2.55%	3.94%	6.46%	6.56%	6.82%	7.12%	7.28%	7.78%	8.25%	8.55%

The petroleum demand figures presented in Table 5.8 are only in terms of final energy use and with the petroleum use in electricity generation; the total supply of energy through petroleum would be higher. However, the energy supply portfolio of the country in 2007 did not change much from the previous year.

5.5 Sectoral Consumption

Table 5.9 shows the sectoral consumption and share of consumption of all forms of energy.

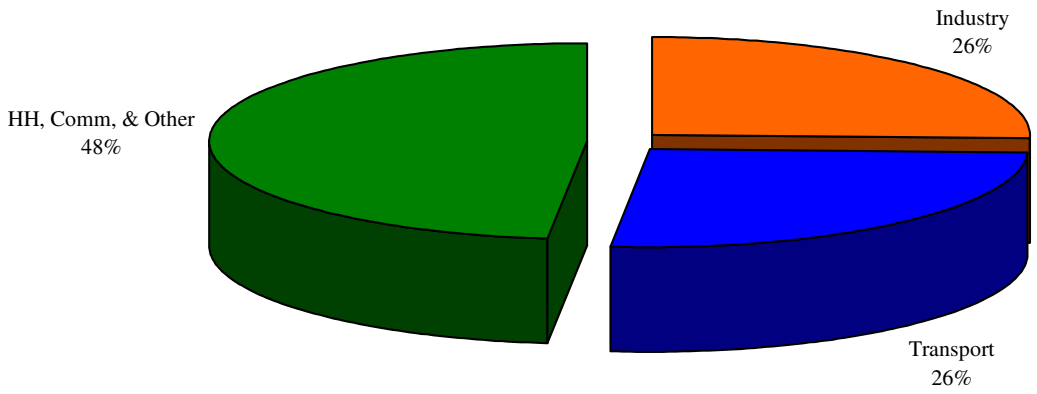
Table 5.9 - Energy Use by Sectors

Year	1980	1990	2000	2001	2002	2003	2004	2005	2006	2007
Industry										
										Thousand toe
Biomass	531.63	725.92	1237.86	1,051.86	1,207.88	1,235.78	1,345.73	1,416.28	1,519.48	1,506.08
Petroleum	199.21	170.13	251.75	271.50	263.59	359.64	263.85	360.01	359.56	350.67
Electricity	60.54	90.67	189.41	184.70	198.10	204.18	231.26	234.93	253.42	254.27
Sub Total	**791.38**	**986.72**	**1,679.01**	**1,508.06**	**1,669.58**	**1,799.61**	**1840.84**	**2,011.22**	**2,132.46**	**2,111.02**
										%

Biomass	67.18	73.57	73.73	69.75	72.35	68.67	73.10	70.42	71.25	71.34%
Petroleum	25.17	17.24	14.99	18.00	15.79	19.98	14.33	17.90	16.86	16.61%
Electricity	7.65	9.19	11.28	12.25	11.87	11.35	12.56	11.68	11.89	12.05%
Transport										
										Thousand toe
Petroleum	577.17	790.04	1,689.64	1,704.70	1,737.91	1,848.73	2,270.99	2,070.40	2,005.12	2,134.21
										%
Petroleum	100	100	100	100	100	100	100	100	100	100
Household, Commercial and others										
										Thousand toe
Biomass	2,758.80	3,091.42	3,173.06	3,188.27	3,053.43	3,099.61	3,115.59	3,167.84	3,193.09	3182.96
Petroleum	202.34	231.44	404.02	414.18	421.50	381.20	389.07	361.55	388.66	354.46
Electricity	51.01	115.30	278.67	281.45	292.09	325.69	350.34	388.83	419.05	450.35
Sub Total	**3,012.14**	**3,438.16**	**3,855.75**	**3,883.90**	**3,767.03**	**3,806.50**	**3,854.99**	**3,918.22**	**4,000.80**	**3,987.77**
										%
Biomass	91.59	89.91	82.29	82.09	81.06	81.49	80.82	80.85	79.81	79.82%
Petroleum	6.72	6.73	10.48	10.66	11.19	10.02	10.09	9.23	9.71	8.89%
Electricity	1.69	3.35	7.23	7.25	7.75	8.48	9.09	9.92	10.48	11.29%
Consumption by Sector										
										Thousand toe
Industry	791.38	986.72	1,679.01	1,508.06	1,681.38	1,804.74	1,840.84	2,011.22	2,132.46	2,111.02
Transport	579.72	790.04	1,689.64	1,704.70	1,737.91	1,848.66	2,270.94	2,070.31	2,005.12	2,134.21
HH, Comm, & Other	3,012.14	3,438.16	3,855.75	3,883.90	3,767.03	3,803.55	3,854.99	3,918.22	4,000.80	3,987.77
Total	**4,383.24**	**5,214.92**	**7,224.40**	**7,096.67**	**7,186.32**	**7,456.95**	**7,966.77**	**7,999.84**	**8,138.38**	**8,233.00**
										%
Industry	18.05	18.92	23.24	21.25	23.40	24.20	23.11	26.34	26.20	25.64
Transport	13.23	15.15	23.39	24.02	24.18	24.79	28.51	25.46	24.64	25.92
HH, Comm, & Other	68.72	65.93	53.37	54.73	52.42	51.01	48.39	48.19	49.16	48.44

In year 2007, Households, Commercial and other sectors consumed about 48% of total energy consumption of the country. This is in contrast to the industrial sector consumption share of 26%. Transport sector also remained a significant energy consumer accounting to 26% of national energy consumption. Compared with year 2006 sector-wise energy consumption figures, both industrial and household/commercial sectors have reduced their energy consumption in absolute terms as well as a share from the national consumption.

Figure 5.11 - Energy Demand by Sectors



6 ENERGY BALANCE

The performance of the entire energy sector is summarised in the National Energy Balance shown in the following pages, in original commodity units as well as in unified toe (Tonnes of Oil Equivalent). The Energy Balance illustrates energy supply, energy conversion, losses and energy consumption (demand) within the year.

6.1 Conversion to Uniform Energy Units

For comparison, energy products expressed in their respective units used for ordinary transactions need to be converted to a common equivalent unit. Similar to most other countries, Sri Lanka has adopted Tons of Oil Equivalent (toe) as the common denominator for this purpose. Table 6.1 shows the conversion factors used for converting each energy product to equivalent toe.

Table 6.1 - Conversion Factors to TOE and Calorific Values

PRIMARY ENERGY	
Bagasse (toe/MT)	0.40
Charcoal (toe/MT)	0.65
Coal (toe/MT)	0.70
Crude Oil (toe/MT)	1.03
Fuel wood (toe/MT)	0.38
Hydroelectricity (thermal equivalent) (toe/GWh)	240
PRODUCTS	
	toe/MT
Aviation Gasoline	1.06
Aviation Turbine Fuel	1.05
Ethane	1.18
Fuel Oil	0.98
Gas Oil /Diesel Oil	1.05
Kerosene	1.05
LPG	1.06
Motor Gasoline (Petrol)	1.09
Naphtha	1.09
Refinery gas	1.15
Residual Oil	0.98
Solvent	0.89
ELECTRICITY	
Electricity (kcal/kWh)	860
Electricity (toe/GWh)	86
FUEL CALORIFIC VALUES	
	Net Calorific Value (kCal/kg)
Fuel Oil	10,104
Coal	6,300
Residual Fuel	10,052
Diesel	10,556
Naphtha	11,259

1 toe = 10 GCal

Table 6.2 –Sri Lanka Energy Balance: 2007 (Thousand toe)

	HYDRO	ELECT.	LPG	GASO.	NAPHTHA	AV. GAS	KERO.	AV. TUR	DIESEL	F. OIL	RESID.	SOLV.	COAL	BAGGASE	F. WOOD	CHAR.	CRUDE	TOTAL
SUPPLY																		
PRIMARY ENERGY	951.60													59.42	4,676.90			5,687.93
IMPORTS			165.56	358.47		0.21	21.78	169.94	1,387.13	187.97			47.50			4.01	1,996.82	4,339.41
DIRECT EXPORTS																-0.85		-0.85
FOREIGN BUNKERS								-107.61										-107.61
STOCK CHANGE			8.07	18.19	6.24	-0.04	53.20	-32.93	-16.34	55.13	7.02	-0.06				-20.45	-40.77	37.25
TOTAL ENERGY REQUIREMENT	951.60		173.63	376.66	6.24	0.17	74.98	29.40	1,370.79	243.10	7.02	-0.06	47.50	59.42	4,676.90	-17.29	1,956.05	9,956.12
ENERGY CONVERSION																		
PETROLEUM REFINERY			17.21	177.99	100.03		102.28	179.60	466.82	489.30	266.93	3.98					-1,956.05	-151.92
POWER PLANTS (HYDRO)	-947.25	339.43																-607.82
POWER PLANTS (THERMAL)		510.40			-106.27				-379.77	-478.54	-273.95							-728.12
POWER PLANTS (WIND)	-0.54	0.20																-0.35
POWER PLANT (DENDRO)		0.09													-1.05			-0.95
OFF-GRID NON-CONVENTIONAL	-3.80	1.36																-2.44
CHARCOAL PRODUCTION															-46.25	26.53		-19.72
OWN USE		-12.65	-0.01				0.00	0.00	-0.27	-38.04								-50.97
LOSSES							-0.36		-0.02	-2.77								-3.14
LOSSES TRANSPORT & DISTRIBUTIO		-134.22																-134.22
CONSUMPTION FOR NON ENERGY USE																-9.14		-9.14
USE																		
FINAL CONSUMPTION (NET SUPPLY)		704.62	190.84	554.65		0.17	177.07	209.00	1,457.56	213.05			47.50	59.42	4,629.61			8,243.49
AGRICULTURE									6.87	3.65								10.52
INDUSTRIES		254.27	26.61	0.63			17.45		75.99	182.49			47.50	59.42	1,446.66			2,111.01
TRANSPORT			4.15	552.67		0.17		209.00	1,368.01	0.20			0.01					2,134.20
ROAD				550.35					1,368.01	0.20								1,918.55
RAIL				0.02									0.01					0.03
AIR				0.49		0.17		209.00										209.65
INLAND & COASTAL WATER WAYS				1.81														1.81
HOUSEHOLD, COMMERCIAL & OTHE		450.35	160.08	1.35			159.62		6.69	26.72					3,182.96			3,987.76

Table 6.3 –Sri Lanka Energy Balance: 2007 (In Original Units)

	HYDRO (GWh)	ELECT (GWh)	LPG/F. GAS (000 MT)	GASO. (000 MT)	NAPHTHA (000 MT)	AV. GAS (000 MT)	KERO. (000 MT)	AVTUR (000 MT)	DIESEL (000 MT)	F. OIL (000 MT)	RESID. (000 MT)	SOLVENTS (000 MT)	COAL (000 MT)	BAGASSE (000 MT)	F. WOOD (000 MT)	CHAR (000 MT)	CRUDE OIL (000 MT)
SUPPLY																	
PRIMARY ENERGY	3,964.99													148.56	12,307.64		
IMPORTS			156.19	328.88		0.20	20.74	161.85	1,321.08	191.81			67.86			6.17	1,938.66
DIRECT EXPORTS																-1.31	
BUNKERS								-102.49									
STOCK CHANGE			7.61	16.69	5.72	-0.04	50.67	-31.37	-15.57	56.25	7.16	-0.07				-31.46	-39.58
TOTAL ENERGY REQUIREMENT	3,964.99		163.81	345.56	5.72	0.16	71.41	28.00	1,305.51	248.06	7.16	-0.07	67.86	148.56	12,307.64	-26.60	1,899.08
ENERGY CONVERSION																	
PETROLEUM REFINERY			16.24	163.29	91.77		97.41	171.04	444.59	499.29	272.38	4.47					-1,899.08
POWER PLANTS (HYDRO)	-3,946.87	3,946.87															
POWER PLANTS (THERMAL)		5,934.88			-97.49				-361.69	-488.30	-279.54						
POWER PLANTS (WIND)	-2.27	2.27															
POWER PLANT DENDRO		1.10													-2.75		
OFF-GRID NON CONVENTIONAL	-15.85	15.85															
CHARCOAL PRODUCTION															-121.70	40.81	
OWN USE		-147.10	-0.01				0.00	0.00	-0.26	-38.82							
LOSSES							-0.34		-0.02	-2.82							
LOSSES TRANSPORT & DISTRIBUTION		-1,560.66															
CONSUMPTION FOR NON ENERGY USE												-4.40				-14.06	
			16.23	163.29	-5.72		97.07	171.04	82.64	-30.66	-7.16	0.07			-124.45	26.75	-1,899.08
USE																	
FINAL CONSUMPTION		8,193.28	180.03	508.85		0.16	168.48	199.04	1,388.15	217.40			67.86	148.56	12,183.19	0.15	
AGRICULTURE									6.54	3.73							
INDUSTRIES		2,956.63	25.10	0.58			16.46		72.38	186.21			67.85	148.56	3,806.99	0.15	
TRANSPORT			3.92	507.04		0.16		199.04	1,302.86	0.20			0.01				
ROAD				504.91					1,302.86	0.20							
RAIL				0.02									0.01				
AIR				0.45		0.16		199.04									
INLAND & COASTAL WATER WAYS				1.67													
HOUSEHOLD, COMMERCIAL & OTHERS		5,236.65	151.02	1.24			152.02		6.37	27.27					8,376.20		

7 ENERGY AND THE ECONOMY

7.1 Financial Performance of the Energy Sector

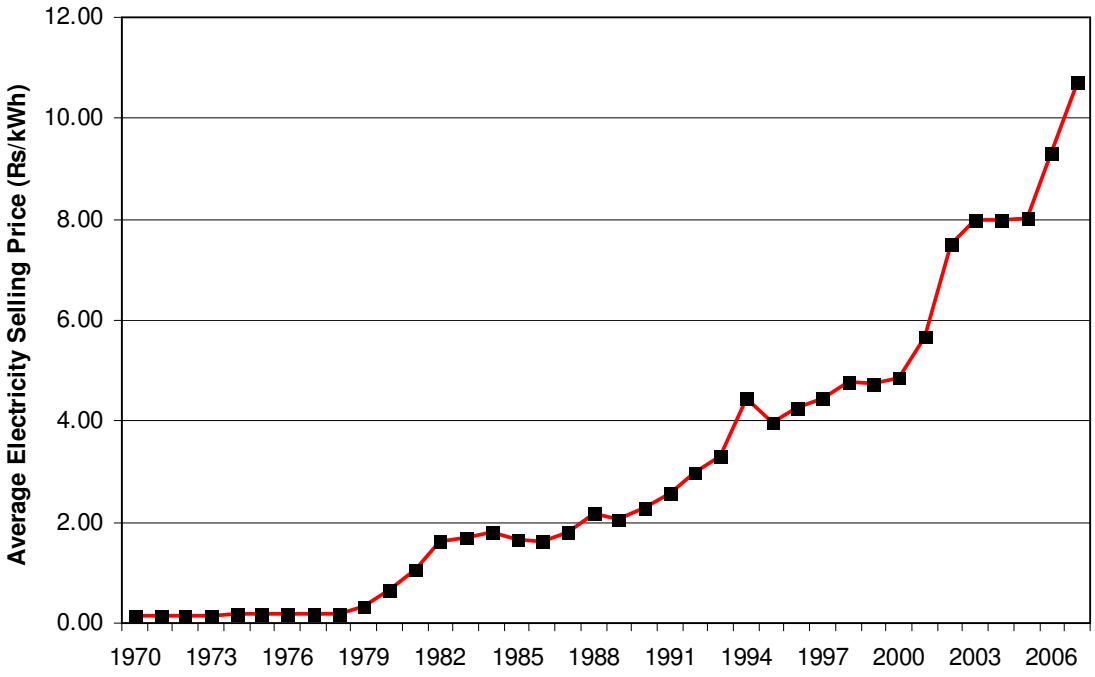
7.1.1 Electricity Sector Financial Performance

The major role in electricity generation is played by CEB while the IPPs and the SPPs play supportive roles. In contrast to the electricity generation, CEB has the monopoly over electricity transmission. The distribution business is shared by CEB and LECO. Therefore, CEB financial performance is relatively significant in analysing the electricity sector financial performance. Being a subsidiary of CEB and having a key presence in electricity sales, LECO financial performance is also important. The financial performance of the IPPs and the SPPs is vital to the financial performance of the sector but it is assured by CEB's buy back tariff. Table 7.1 shows the sales and revenue of the two electricity utilities CEB and LECO, their annual revenue and average selling prices.

Table 7.1 - Average Electricity Sales, Selling Prices and Revenue of CEB and LECO

	1980	1990	2000	2001	2002	2003	2004	2005	2006	2007
CEB										
Sales (GWh)	1,057.00	1,951.00	4,433.43	4,434.77	4,690.89	5,314.10	5,686.08	6,227.73	6,720.25	7,132.00
Revenue from sales(Million Rs)	671.00	4,748.60	21,496.54	25,760.76	35,328.85	42,290.29	45,184.37	49,734.58	62,680.03	76,709.64
Other Revenue (Million Rs)	60.10	630.70	2,209.00	1,734.00	3,837.00	5,733.00	2,518.00	2,518.00	4,443.00	4,863.00
Total revenue (Million Rs)	731.10	5,379.30	23,705.54	27,494.76	39,165.85	48,023.29	47,702.37	52,252.58	67,123.03	81,572.64
Average Selling price (Rs/kWh)	0.63	2.43	4.85	5.81	7.53	7.96	7.95	7.99	9.33	10.76
Local Authorities / LECO										
Sales (GWh)	240.08	443.96	754.30	743.00	763.00	846.00	912.00	973.00	1,046.00	1,007.00
Revenue from sales(Million Rs)	169.00	705.81	3,690.70	3,631.00	5,626.00	6,977.00	7,587.00	8,175.00	9,714.00	10,545.00
Other Revenue (Million Rs)										
Total revenue (Million Rs)	169.00	705.81	3,690.70	3,631.00	5,626.00	6,977.00	7,587.00	8,175.00	9,714.00	10,545.00
Average Selling price (Rs/kWh)	0.70	2.86	4.89	4.89	7.37	8.25	8.31	8.40	9.29	10.47
Sri Lanka										
Average Selling price (Rs/kWh)	0.65	2.28	4.86	5.68	7.51	8.00	8.00	8.04	9.32	10.72

Figure 7.1 – National Average Electricity Selling Price



The average selling price of an electricity unit depends on the imposed tariff and the number of electricity units sold under different consumer categories.

7.1.1.1 Electricity Tariff

The electricity tariff was revised in February 2007. Unit rate of higher slabs of domestic and religious customers saw an increase. Furthermore, the unit rate for supplies to LECO and street lighting were also increased. Tariffs applicable to general purpose customers, industries and hotels remained unchanged.

While both CEB and LECO distribute electricity, only CEB possess generation and transmission facilities. Therefore, LECO has to purchase electricity from CEB to sell to its customers. In other words, LECO is a large customer of CEB and purchases electricity at a special rate, which enables LECO to sell back the electricity at the same price structure offered by CEB to its own customers.

Table 7.2- Electricity Prices in Year 2007

Effective Date: 1st February 2007

Domestic		
	Unit Rate (Rs./Unit)	Fixed Charge (Rs)
Block 1 – First 30 units	3.00	60.00
Block 2 - 31 - 60 units	4.70	90.00
Block 3 - 61 - 90 units	7.50	120.00
Block 4 - 91 - 180 units	14.00	180.00
Block 5 - Above 180 units	19.80	240.00
Religious Purpose		
	Unit Rate (Rs./Unit)	Fixed Charge (Rs)
Block 1 – First 30 units	2.50	60.00
Block 2 - 31 - 90 units	3.70	90.00
Block 3 - 91 - 180 units	6.50	180.00
Block 4 - Above 180 units	10.20	240.00

	General Purpose	**Industrial**	**Industrial (Time of Day)**	**Hotels (General Purpose)**	**Hotels (Industrial)**	**Hotels (Time of Day)**
Supply at 400/230 V Contract Demand<42 kV						
Unit Charge (Rs/unit)	11.90	8.50	16.00 (peak) 7.90 (off peak)	11.90		
Fixed Charge (Rs/month)						
Up to 10 kVA	240.00	240.00	240.00	240.00		
above 10 kVA	500.00	500.00	500.00	500.00		
Supply at 400/230 V Contract Demand>=42 kV						
Unit Charge (Rs/unit)	11.80	8.10	22.00 (peak) 7.50 (off peak)	11.80	8.10	22.00 (peak) 7.50 (off peak)
Demand Charge (Rs/kVA)	480.00	400.00	380.00	480.00	400.00	380.00
Fixed Charge (Rs/month)	3,000.00	3,000.00	3,000.00	3,000.00	3,000.00	3,000.00
Supply at 11/33/132 kV						
Unit Charge (Rs/unit)	11.70	8.00	20.00 (peak) 7.10 (off peak)		8.00	20.00 (peak) 7.10 (off peak)
Demand Charge (Rs/kVA)	460.00	380.00	360.00		380.00	360.00
Fixed Charge (Rs/month)	3,000.00	3,000.00	3,000.00		3,000.00	3,000.00

Bulk Supplies to LECO	Unit Charge (Rs/unit)	Demand Charge (Rs/kVA)
L1 – Supply at 400/230 V	10.80	240.00
L2 – Supply at 11 kV & above	7.50	220.00
Street Lighting	10.00 Rs/unit	

Fuel Adjustment Charge: 20% of unit charge applicable to all customers, except for Domestic & Religious Purpose consumers who consumes less than 90 kWh/month and all industrial consumers.

Peak – from 6.30 p.m. to 9.30 p.m. ; off peak – from 9.30 p.m. to 6.30 p.m. on the following day

As illustrated in Figure 7.1, the average selling price of an electricity unit in Sri Lanka increased over the time. It is expected that the electricity tariff would be increased to match the escalating electricity production cost. However, this does not always happen and the increase of tariff usually lags behind the actual supply side cost increase. For example, only one tariff revision was implemented during the year, while the cost of production and delivery of electricity repeatedly increased in parallel to the petroleum price revisions. Mismatches of this nature leads to adverse financial performance of CEB, while the effect on LECO is marginal with the assured operational margin maintained between its purchase and selling prices. The IPPs are paid by the CEB based on their cost of generation. The SPPs are also paid at an attractive avoided cost based tariff. In other words, CEB is exposed to all the risks in the electricity market while the other supply side stakeholders are shielded from these risks through contracts and guarantees provided by the CEB. As a result of the above business model, year 2007 marked the worst financial performance of the CEB, and the return on assets (ROA) of -4.96% emphasises the financial crisis the CEB is presently experiencing. Table 7.3 illustrates the historic financial performance of CEB and LECO.

Table 7.3- Financial Performance of CEB and LECO

	1980	1990	2000	2001	2002	2003	2004	2005	2006	2007
CEB										
Net assets in Operation (Million Rs)	6,460	65,516	161,856	179,731	190,245	203,125	227,432	256,120	288,213	352,276
Return on assets (%)	8.90	7.60	-2.80	-3.74	-1.74	0.39	-4.9	-1.15	-1.85	-4.96
LECO										
Net assets in Operation (Million Rs)		685	3,750	4,654	4,773	4,914	4,978	5,119	5,436	5,864
Return on assets (%)		11.6	14.0	17.0	6.0	5.0	7.7	9.0	10.3	9.60

Financial performance of LECO (ROA of 9.6%) was attractive in year 2007. However, due to the scale of operations of CEB compared with other organisations in the sector, the poor financial performance of CEB resulted in yet another bad financial year for the sector as a whole.

7.1.2 Petroleum Sector Financial Performance

Ceylon Petroleum Corporation (CPC) dominates the petroleum sector of the country. However, the role of Lanka Indian Oil Company (LIOC) and the LP Gas companies also have a reasonable bearing on the overall sector performance. Several bunkering companies were also active in the petroleum sector.

Petroleum prices in the international market were highly volatile in 2007. As a petroleum importing country, this directly affected the petroleum sector financial performance. However, in contrast to electricity prices, petroleum product prices were more regularly changed to match the international price variations. Therefore, the financial performance of CPC and the petroleum sector as a whole was better than the CEB dominated electricity sector.

As presented in Table 7.4, CPC has been performing well, recording considerable profits after year 2000 with the exception of year 2006. In year 2007, CPC recorded a profit of Rs. 2.9 billion. This is largely due to the cost reflective pricing strategy adopted in the petroleum sector and emphasises the need for similar strategies in the electricity sector.

Table 7.4- CPC Financial Performance

Million LKR

	1980	1990	2000	2001	2002	2003	2004	2005	2006	2007
Total Revenue	8,810.6	21,124.1	76,281.9	95,549.30	105,535.0	112,514.5	153,401.0	177,323.1	212,302.7	255,133.3
Total Cost	8,720.3	21,050.1	92,344.0	93,971.80	99,191.3	107,640.3	149,493.1	169,722.1	213,248.9	252,271.0
B.T.T. Cost	60.0	1,678.2	12,706.6	12,968.60	24,887.9	25,489.7	30,942.4	12,703.3	14,246.3	14,980.0
Income Tax	82.8			0.00			537.0	2,128.9	117.5	821.6
Estimated Tariff Cost	46.4	4,073.2	2,520.6	19.40	8.1	1.6	1.4	31.3	259.8	1,414.1
Crude cost	7,925.8	14,295.9	64,041.5	59,657.70	68,227.5	70,763.2	108,657.9	145,163.2	187,729.2	226,448.5
Estimated other Cost	605.3	1,002.8	13,075.3	21,326.10	6,067.8	11,385.9	9,354.4	9,695.4	10,896.1	8,606.7
Profit (Loss)	90.3	74.0	(16,062.1)	1,577.50	6,343.7	4,874.2	3,907.9	7,601.0	(946.2)	2,862.3

The performance of the petroleum sector depends on the import cost of petroleum and the local selling price. Due to the scale of the financial transactions involved in importing petroleum, the impact of the petroleum import price is felt not only by the sector, but by the whole economy of the country.

7.1.2.1 Import Prices of Crude Oil and Refined Products

Crude oil imports slightly reduced in 2007, compared to 2006. However, the crude oil import expenditure rose sharply within the year due to the increase in crude oil prices and the local currency depreciation against most international currencies. As shown in the Table 7.5, FOB price of crude oil increased by 11% in US dollar terms compared with 2006 and resulted in an increase of 19% percent in Rupee terms. Parallel to the increase of crude oil price, import prices of all finished petroleum products also increased significantly. The average percentage increase of product prices in 2007 is 16% compared with 2006. While the price of Naphtha

imports shows the highest increase of 28%, price of Kerosene imports shows the lowest increase of 8%. Details of costs of crude oil and other product imports are given in Table 7.5.

Table 7.5- Costs of Crude Oil Imports

Year	1980	1990	2000	2001	2002	2003	2004	2005	2006	2007
Crude Imports										
Quantity (Thousand MT)	1,861.20	1,791.30	2,348.90	1,954.90	2,281.00	1,995.7	2,200.7	2,008.4	2157.039	1,938.7
Quantity (Million bbl)	13.6	13.2	17.2	14.4	16.8	14.7	16.1	14.8	15.8	14.2
Crude Imports Unit Price (USD/bbl)										
FOB. Price	30.4	22.8	27.4	27.8	24.4	28.3	35.9	50.6	63.9	71.0
Freight Rate	1.9	0.7	0.9	0.9	0.7	1.0	1.5	1.3	1.2	0.9
C&F Price	32.4	23.6	28.2	28.7	25	29.3	37.4	51.9	65.1	71.9
Crude Imports Unit Price (LKR/bbl)										
FOB Price	547.7	915.9	2,166.00	2,123.50	2,340.00	2,736.2	3,656.0	5,202.7	6,662.3	7,931.8
Freight	34.7	28.8	67.2	84.3	65.2	99.2	150.9	130.1	116.6	94.1
C & F Price	582.3	944.7	2,233.2	2,207.8	2,405.2	2,835.4	3,806.9	5,332.7	6,778.8	8025.8

Year	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Cost of Petroleum Product Imports										
MOGAS 92 UNL (USD/bbl)	16.30	20.20	31.04	52.64	26.83	33.70	46.49	61.08	72.02	81.73
MOGAS 95 UNL (USD/bbl)				27.51	28.75	34.74			72.85	82.82
MOGAS 97 UNL (USD/bbl)				28.88	29.28	35.83				
NAPHTHA (USD/bbl)	14.83	19.37	28.26	23.78	24.89	30.44	41.23	50.74	61.81	79.57
KEROSENE (USD/bbl)	16.36	21.43	34.20	28.30	27.99	33.00	47.43	67.64	80.21	86.77
GAS OIL 0.05% S (USD/bbl)				27.68	28.19	33.37				
GAS OIL 0.25% S (USD/bbl)				27.61	27.86	32.81	46.46		77.49	86.10
GAS OIL 0.5% S (USD/bbl)				27.31	28.09	32.40				
GAS OIL 1.0% S (USD/bbl)	15.46	19.07	32.20	27.20	27.32	32.31	32.31	67.45	67.45	67.45
FO 180CST (USD/MT)	68.89	101.39	158.07	134.10	148.31	170.11	187.12	264.10	322.37	383.99
FO 380CST (USD/MT)	65.34	97.70	152.30	128.75	144.55	165.97	180.41	254.10	329.03	377.88
LPG (USD/MT)	132.55	193.97	294.24	254.95	238.93	290.83	352.00	538.00	683.54	835.53

Source: Platts Singapore Products Assessment.

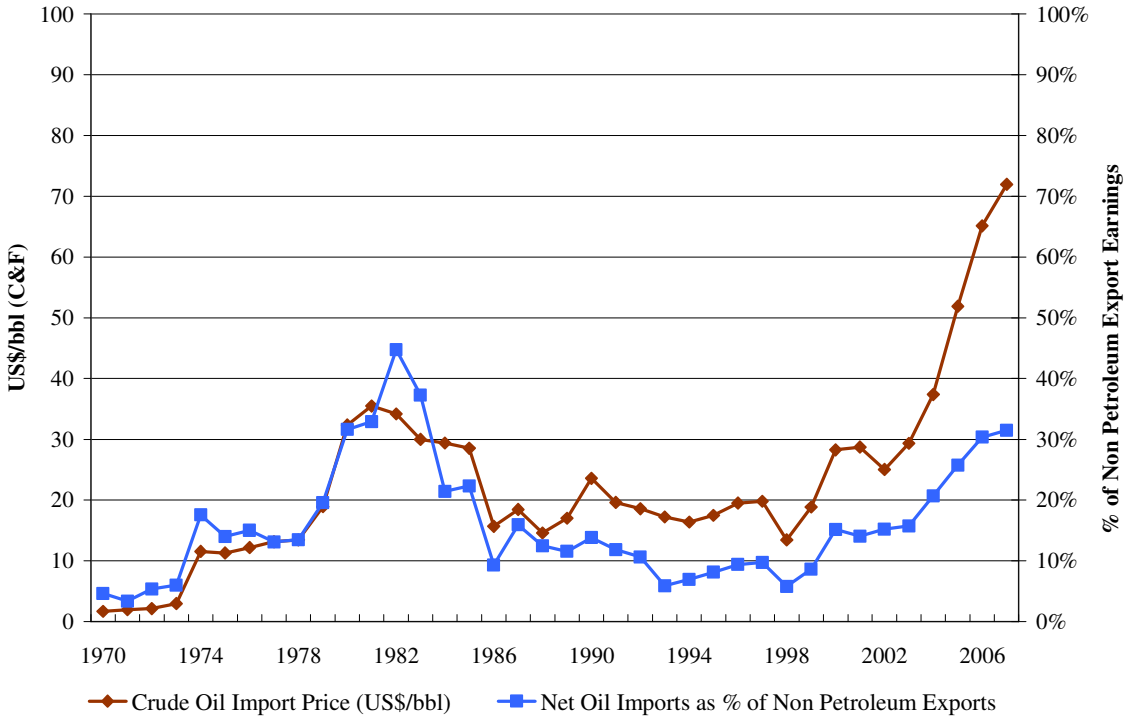
The price of petroleum in the world market increased substantially during year 2007, resulting in a net petroleum import bill of USD 2,414 million which is approximately 31.5% of the country's non petroleum export earnings. Table 7.6 shows the historic trends of the petroleum import costs.

Table 7.6 - Petroleum Import Costs and its Impacts on the Macro Economy

USD Million

Year	1980	1990	2000	2001	2002	2003	2004	2005	2006	2007
Total Exports	1,055	1,978	5,522	4,817	4,699	5,133	5,757	6,347	6,883	7,740
Total Imports	2,051	2,681	7,320	5,974	6,106	6,672	8,000	8,863	10,253	11,301
Petroleum Imports	452	359	897	711	751	838	1,269	1,730	2,164	2,489
Petroleum Re-exports	173	99	71	40	42	36	100	131	107	75
Net Oil Imports	279	259	826	671	709	802	1,169	1,599	2,057	2,414
Non Petroleum Exports	881	1,879	5,451	4,777	4,657	5,097	5,657	6,216	6,776	7,665
Net Oil Imports as % of Non Petroleum Exports	**31.6**	**13.8**	**15.2**	**14.0**	**15.2**	**15.7**	**20.7**	**25.7**	**30.4**	**31.5**

Figure 7.2 - Crude Oil Price Variation and Net Oil Imports as a Percentage of Exports



After 1977, a combination of increased consumption and the doubling of world oil prices resulted in a rapid rise in oil import bill. By 1980, the net oil import bill more than tripled and the proportion of export earnings devoted to importing oil rose sharply from 17.5% to 31.6%. The situation further deteriorated and this figure rose to 44.8% in 1982 but subsequently fell to 9.3% by 1986, mainly due to oil price drop as a consequence of the OPEC oil surplus. Period from 1980 to 1983 can be considered the worst period in terms of the impact of the higher oil prices on foreign exchange earnings and reserves of the country.

The oil price hike of 1973 also had a positive effect on Sri Lanka's transfer account. The economic boom in OPEC countries provided employment opportunities for skilled and unskilled labour in the country. Net private transfers have grown significantly over the years to become the highest single source of net foreign exchange earnings. This coupled with increased volume of export earnings cushioned the impact of oil imports. However, with the demand for petroleum increasing rapidly over the last two years, the oil prices have increased to historic heights and the expenditure on oil imports is consuming a considerable share of the foreign earnings of the country.

7.1.2.2 Customs Duty on Petroleum Products

There were no changes in customs duty rates of common petroleum energy products during 2007. After year 2003, all widely used petroleum products were made free from import duties. However, it should be noted that there were taxes and levies on top of any duties, which effectively govern the actual selling price of petroleum within the country.

7.1.2.3 Petroleum Product Prices

Prices of all common petroleum products changed through twelve price revisions within 2007. Price of LPG changed most often (six occasions). This is due to the flexible pricing formula adopted for the retail sales of LPG. Comparison of end of year prices between 2006 and 2007 indicate that; domestic kerosene experienced the highest percentage increase (i.e. by 42%). Prices of Furnace oil (1500 sec.), Petrol (90 Octane) and Auto Diesel also increased by 37%, 27% and 25% respectively.

Table 7.7- Petroleum Product Price Changes in 2007

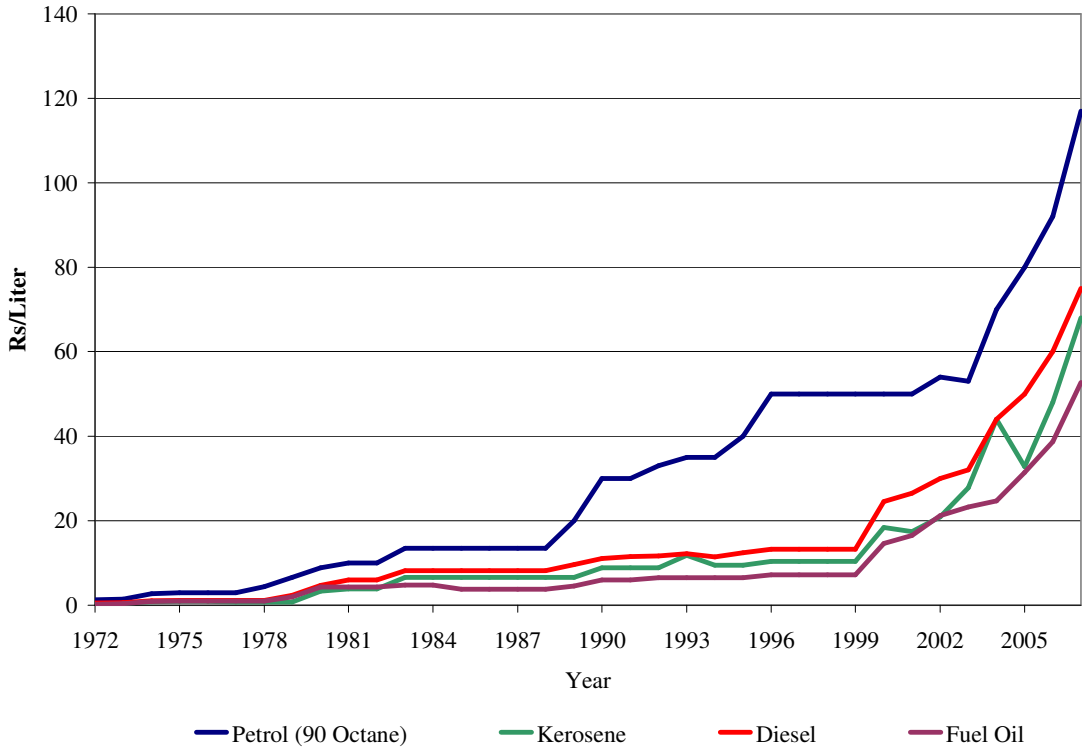
LKR/litre

Product		Beginning of Year Price	Price Revision Date													End of Year Price
			4th Jan	29th Mar	19th Apr	28th Apr	12th May	14th May	15th May	30th June	5th July	29th July	1st Sep	6th Sep	1st Nov	
Petrol	90 Octane	92.00	104.00		105.00		106.00			111.00		117.00				117.00
	95 Octane	95.00	107.00		108.00		109.00			114.00		120.00				120.00
Kerosene	Industrial	50.30		60.30		60.30	61.30			68.00		69.00				69.00
	Domestic	48.00		50.00		50.00	51.00			67.00		68.00				68.00
Diesel	Super	65.30		68.30	70.30	68.30	72.30			76.30		80.30				80.30
	Auto	60.00		63.00	65.00	63.00	67.00			71.00		75.00				75.00
Furnace Oil	200sec	37.70														37.70
	500sec	40.30		43.30		43.30	46.30			50.30		54.30				54.30
	800sec	39.90		42.90		42.90	45.90			49.90		53.90				53.90
	1000sec	38.70		41.70		41.70	44.70			48.70		52.70				52.70
	1500sec	37.70		40.70		40.70	43.70			47.70		51.70				51.70
	2000sec	29.60														29.60
	3500sec	28.00														28.00
Bitumen		26.25														26.25
LPG LKR/kg (Shell)		76.80							79.84	86.80			103.84		105.40	105.04
LPG LKR/kg (Laugfs)		75.12						76.72			84.80			99.84		99.84

Note: LPG price reflects the average price of retail sales

Historical variation of major petroleum product prices in the domestic market is shown in Figure 7.3.

Figure 7.3 – Variation of Year End Petroleum Product Price in the Local Market



7.2 Energy-Economy Indicators

Commercial energy (petroleum and electricity) intensity is an indicator of a country's energy utilisation with respect to the national output (measured in terms of Gross Domestic Product-GDP). Low commercial energy intensity would suggest stringent use of energy for economic activities. In 2007, commercial energy intensity reduced to 13.12 toe/GDP LKR Million from previous year's figure of 13.19 toe/GDP LKR Million, and it is the lowest recorded commercial energy intensity after year 2000. This can be noticed from the improvements of commercial energy intensity index. High energy prices, energy conservation promotion and autonomous energy efficiency improvement can be mentioned as probable reasons for this improvement. The national level energy conservation programs launched in 2006 was continued during the year. The indices discussed above aptly reflect the achievements of these programs.

Table 7.8- Sri Lanka Energy Indices

Year	1982	1990	2000	2001	2002	2003	2004	2005	2006	2007
Petroleum (Thousand toe)	1,115.31	1,203.40	2,428.99	2,452.54	2,469.30	2,603.37	2,937.56	2,769.98	2,704.50	2,815.20
Electricity (Thousand toe)	134.57	205.97	468.07	466.15	490.19	529.88	581.59	801.91	816.98	851.63
Total Commercial Energy (Thousand toe)	1,249.89	1,409.37	2,897.06	2,918.69	2,959.49	3,133.25	3,519.15	3,570.69	3,533.56	3,666.83
GDP at 1982 factor cost (million LKR)	94,679	129,244	214,422	211,206	219,654	232,613	245,175	259,885	279,117	299,771
Commercial Energy Index (base year 1982)	1.00	1.13	2.32	2.34	2.37	2.51	2.82	2.86	2.83	2.93
GDP Index (base year 1982)	1.00	1.37	2.26	2.23	2.32	2.46	2.59	2.74	2.94	3.17
Commercial Energy Intensity (toe/LKR million)	13.20	10.90	13.51	13.82	13.47	13.47	14.35	13.74	12.66	12.23
Commercial Energy Intensity Index (1982=1.0)	1.00	0.83	1.02	1.05	1.02	1.02	1.09	1.04	0.96	0.93

8 ENERGY SECTOR PERFORMANCE AND FUTURE OUTLOOK

With the rapid economic development drive launched by the Sri Lankan government, a parallel growth in energy demand is anticipated. Sri Lanka's economic growth target for year 2008 is 8%. In order to achieve this target, the expected growth rates in Electricity, Petroleum and Gas sectors are 12%, 10% and 8% respectively. Volatile petroleum prices similar to what was experienced in 2007 can occur even in the future and such situations can have significant impacts on the energy sector financial performance. The present trend of increasing energy demand will continue while increasing energy costs and demand side management measures might dampen the rate of growth of energy demand.

8.1 The National Energy Mix

Biomass is expected remain the dominant source of energy, though the share of biomass in overall energy supply portfolio is expected to drop gradually. Despite the possibility of petroleum fuels and hence electricity prices to increase along with crude oil prices in the international market, the present trend of fuel switching from biomass to other sources would continue due to the convenience of use. Use of coal as a primary energy source will remain in the prevailing low level until the first coal power plant starts operations in late 2010. Liquefied Natural Gas (LNG) and Indo-Lanka power transmission are the new energy supply options available for the country in the near future. An increase in contribution from non-conventional energy sources to the electricity generation is anticipated and the necessary policy decisions encouraging the development and use of these sources will be needed with the rising petroleum prices. However, the penetration of wind and solar energy is expected to remain low in the immediate future. It is a desirable condition that the leading energy consuming sector; the household and commercial sector, has a highly diversified energy supply mix compared to other sectors such as transport and industries. However, these sectors are also moving towards new supply sources in the form of electricity in the transport sector and biomass in the industrial sector.

8.2 Electricity Supply Industry

The Gas Turbine section of Kerawalapitya 300MW combined cycle power plant is to be completed in 2008 and its steam cycle is planned to be completed a year later. With the completion of Kerawalapitiya power plant, the risk of system capacity shortages will be

substantially reduced. However, these measures would not be sufficient to arrest the increasing cost of electricity, which is governed by the international oil prices, due to the heavy use of petroleum in power generation. However, with the rising fossil fuel prices, the need for accelerated development of non-conventional renewable energy sources, and the remaining medium/large hydroelectric power plants will be highlighted.

The construction of the first coal-fired power plant (300MW at Norochcholai), which started in 2006, would continue at an accelerated pace to minimise the rising cost of power generation. This will be the major power plant addition to the system after the commissioning of Kerawalpitiya Combined Cycle Power Plant. A second coal power plant (500MW) is being planned to be developed in Trincomalee and its construction will commence shortly. Construction of Upper Kotmale Hydro Power Project (150 MW) is expected to be completed by 2011. Other major hydro projects; Uma Oya (120MW), Moragolla (27MW), Broadlands (35MW) and Gin Ganga (49MW) will advance into the planning stage. An immediate requirement of peaking power has been identified in the system and short term power plants to meet the peaking power requirements would be needed, depending on weather conditions and delays in scheduled generation capacity additions. Capacity expansion of Victoria Hydro Power Station, which is also in the planning stage, would partially relieve the medium term peaking power requirements. However, there is a possibility for these short to medium term system capacity requirements be abated by the reduction of demand growth due to high electricity prices and the ongoing demand side management measures.

Unless economical solutions are developed to meet increasing system demand, CEB will face severe financial problems in supplying electricity at affordable prices to its customers. If the petroleum prices remain at prevailing higher levels, tariff increases and vigorous demand side management activities will be essential.

8.3 Petroleum Supply Industry

Petroleum sector is also a vital sector in achieving the economic targets of the government. As stated earlier, the anticipated growth rate in the petroleum sector for year 2008 is 10%. With the Government's initiatives back in year 2003, Lanka Indian Oil Company (LIOC) commenced the distribution operation adding a competitor to CPC. Lanka Indian Oil Company started expanding its operations throughout the country and expanded its own distribution network by acquiring privately-owned filling stations. Undisturbed operation of these

petroleum sector organisations would be continued in the future. In addition to LIOC, two private LPG distributing companies and several bunkering companies were in business by the end of 2007. However, further structural changes in the petroleum sector are not expected in the near future.

With the continuing growth in the transport sector and increased use of petroleum fuels in power generation, the demand for diesel and fuel oil is expected to increase significantly over the next few years. Commissioning of yet another oil based power plant in Kerawalapitiya Combined Cycle Power Plant would aggravate this situation. The greatest concern will be the rising oil prices, which has a direct bearing on the financial health of the energy sector and as well as the entire economy. Risk transferring mechanisms are being considered as a solution against rapid variations of petroleum prices and such measures could dampen their effect on the economy.

So far, fourteen oil blocks have been identified in the North Western coast of Sri Lanka. Road shows on oil prospects in Sri Lanka were conducted in London, Houston and Kuala Lumpur in 2007. Sri Lankan Government has indicated its desire to award two of these oil block to the governments of India and China for exploration. With the commencement of petroleum exploration within the country, hopes will be high for the energy sector to meet at least part of its petroleum demand through local resources.

8.4 Energy Management

Year 2007 is marked with the establishment of Sri Lanka Sustainable Energy Authority (SEA) as the successor of Energy Conservation Fund (ECF). Responsibility of strengthening energy management activities and promoting alternative energy sources has been assigned to the SEA. By empowering SEA with the authority to approve renewable energy development projects, a rapid growth in renewable energy sector is expected. The ‘cost based tariff’ offered by the SEA through CEB for selected renewable energy technologies including small hydro, wind and biomass would catalyse their development and help some of these technologies to get off the ground. In addition to these specific tasks, the broader need of making strategic decisions and implementing the national energy policy efficiently and effectively is expected to be carried out by the SEA on behalf of the government.

Strengthened by the awareness programmes previously carried out by the CEB and the ECF and presently by the SEA, energy management is already practiced to a certain extent. This is visible through the Sri Lanka energy intensity data of recent years. However, with the increase in energy costs, more emphasis needs to be placed on energy management and efficiency improvement and at times, strict measures would have to be enforced by the relevant authorities to ensure energy is optimally used.

Annex 1

Independent Power Producers (IPPs)

Starting from 1997, many IPPs entered the electricity market, supplying electricity to the national grid. CEB has separate power purchase agreements with these private sector companies.

1. Lakdanavi (Pvt) Ltd
2. Asia Power (Pvt) Ltd
3. Colombo Power (Pvt) Ltd
4. ACE Power Mathara (Pvt) Ltd
5. ACE Power Horana (Pvt) Ltd
6. AES Kelanitissa (Pvt) Ltd
7. Heladhanavi (Pvt) Ltd
8. ACE Power Embilipitiya (Pvt) Ltd
9. Koolair Ventures Power (Pvt) Ltd. [operates on the Jaffna mini-grd]
10. Aggreko (Pvt) Ltd. [operates on the Jaffna mini-grid]

Small Power Producers

Many new small power producers came into existence as a result of the attractive tariffs offered by the CEB and the lending facilities provided by the RERED project. A total of 65 SPPs were operational by the end of 2007. A solar power plant and a Combined Heat and Power (CHP) power plant were among these SPPs. CEB has signed Standardised Small Power Purchase Agreements (SPPAs) with these companies.

List of Small Power Producers

	Name of SPP	Capacity (MW)	Year of Commissioning
1	Dick Oya	0.96	1996
2	Carolina	2.50	1999
3	CHP	0.10	1999
4	Ellapita Ella	0.55	1999
5	Kolonna	0.78	1999
6	Rakwana Ganga	0.76	1999
7	Ritigaha Oya	0.80	1999
8	Seetha Eliya	0.07	1999
9	Solar Power	0.02	1999
10	Talawa Kelle	0.11	1999

	Name of SPP	Capacity (MW)	Year of Commissioning
11	Weddamulla	0.20	1999
12	Delgoda	2.65	2000
13	Glassaugh	2.53	2000
14	Mandagal Oya	1.28	2000
15	Bambarabatu Oya	3.20	2001
16	Galatha Oya	1.20	2001
17	Hapugastenna	6.90	2001
18	Kabaragala	1.50	2001
19	Minuwnella	0.64	2001
20	Belihuloya	2.50	2002
21	Deyianwala	1.50	2002
22	Niriella	3.00	2002
23	Watawala	1.30	2002
24	Hulu Ganga 1	3.00	2003
25	Sanquhar	1.60	2003
26	Alupola	2.52	2004
27	Atabage Oya	2.35	2004
28	Brunswic	0.60	2004
29	Karawila Ganga	0.75	2004
30	Miyanwita Oya	0.60	2004
31	Nakkawita	1.01	2004
32	Rathganga	2.00	2004
33	Sithagala	0.80	2004
34	Walakada	4.21	2004
35	Walapane	1.00	2004
36	Walapane(Dendro)	1.00	2004
37	Waranagala	9.90	2004
38	Way Ganaga	8.93	2004
39	Asupini Ella	1.30	2005
40	Badalgama (Biomass)	1.00	2005
41	Batalagala	0.10	2005
42	Hemingford	0.18	2005
43	Kalupahana	0.80	2005
44	Kotapola	0.60	2005
45	Kumburuteniwela	2.80	2005
46	Radella	0.20	2005
47	Upper Korawaka	1.50	2005
48	Wee Oya	3.00	2005
49	Coolbawan	0.75	2006
50	Delta Estate	1.20	2006
51	Dunsinane	2.70	2006
52	Forest Hill	0.30	2006

	Name of SPP	Capacity (MW)	Year of Commissioning
53	Gomala Oya	1.00	2006
54	Gurugoda Oya	4.50	2006
55	Guruluwana	2.00	2006
56	Henfold	2.60	2006
57	Hulu Ganga 2	1.60	2006
58	Kolapathana	1.10	2006
59	Kuda Oya	1.00	2006
60	Labuwewa	2.00	2006
61	Nilambe oya	0.75	2006
62	Batatota	2.00	2007
63	Kehelgamu oya	3.00	2007
64	Kotankanda	0.15	2007
65	Lower Neluwa	1.45	2007

Shell Gas Lanka (Pvt) Ltd.

Liquefied Petroleum Gas (LPG) industry was privatised in 1995, when Shell Gas purchased a stake in the previously Government-owned Gas Company, under a five-year concession. Over 1995-2000, Shell Gas purchased LPG available in the CPC refinery and also imported LPG, and marketed in Sri Lanka. The monopoly status ended in late 2000. The Company markets LPG to all customer segments, in all provinces of the country.

Lanka Autogas (Pvt) Ltd.

Initially, Lanka Autogas established filling stations and other services to cater to the increasing market for LPG used in motor vehicles. Since the end of the monopoly offered to Shell Gas, Lanka Autogas entered the LPG retail market, initially by marketing the output of the CPC refinery as well as LPG imports, to the domestic LPG users mainly in the Western Province. The Company now imports LPG and has expanded their operations to other provinces.

Lanka Indian Oil Company (LIOC)

LIOC is a subsidiary of Indian Oil Company, which is owned by the government of India. In year 2003, CPC sold 100 out of 300 filling stations to LIOC to improve the distribution network of petroleum products. At the same time, the tank farm at China Bay and the pumping facilities were leased out to LIOC for their petroleum storage requirements. In April 2003, LIOC started to sell Diesel, Petrol and Kerosene only for the retail oil market. Subsequently LIOC acquired many private filling stations to expand their distribution network.