The Energy Crisis in Sri Lanka

Is there an energy crisis in Sri Lanka? Well, when you look round, there are no shortages of fuels, no electricity blackouts, no end of traffic using petrol and diesel. Visit some offices, and you are sure to see empty rooms well lit up and air conditioner operating at full capacity. Streetlights burning in broad daylight, is not an unusual sight. So, when we look round, there is in fact, no visible energy crisis.

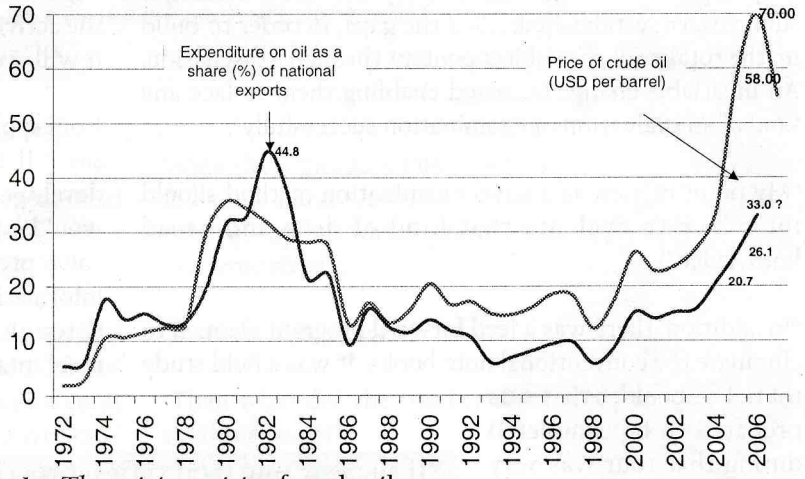

Fig 1. The pricing crisis of crude oil

An energy crisis need not always appear in the form of shortages. If there is a threat of electricity blackouts in the future, that itself is a crisis. If our electricity prices are high, and our electricity supplier has been bankrupt for years, that itself is a crisis. If we are using more and more of personal transport, and if we are reducing the use of more energy efficient public transport for people and reduce rail transport for goods, that itself is a part of the crisis. If we spend over 18% of our export earnings on the import of oil, and if we import 95% of our commercial energy requirements, that itself is a crisis in energy security- And the list goes on.

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That is the energy crisis we have in Sri Lanka. So far, it is not a crisis in the availability, but a threat of future shortages, higher prices, decreasing national energy security and energy supply institutions becoming commercially deteriorated.

The Crisis in Petroleum Fuels

What we now see is a crisis in the pricing of petroleum fuels. There is a pricing crisis in the world market developing since 2002, and reached the most unexpected levels in September 2006. Petroleum supplies have not been curtailed (unlike during the 1973 and 1979 oil crises), but we have a major problem with the amount of money that the country has to pay for petroleum fuel, and the amounts the individuals have to pay for the fuels (Fig 1).

Note: In international trading, crude oil is measured in barrels. One barrel has approximately 159 litres. The above prices are the average for each year, traded in Dubai for spot purchases. A spot purchase is an immediate shipment. Forward purchases for shipping within a month or two is

	1999	2000	2001	2002	2003	2004	2005
LPG	140	146	141	157	161	166	165
Petrol	213	224	250	286	390	437	463
Kerosene	243	229	228	229	207	204	209
Auto Diesel	1,377	1,684	1,625	1,728	1,669	1926	1690
Furnace oil	558	737	749	758	705	758	973

Table 1. Fossil fuel Sales (thousand metric tons) in Sri Lanka

also possible, and that is usually cheaper than spot purchases.

In 2004, Sri Lanka paid 18.7% of our export earnings, to import crude oil and other petroleum products. If the present trend of high oil prices continues, we may spend as much as 25% of our national earnings to import petroleum products in 2007. This situation reminds the severe difficulties the country had during the previous oil crises, and the subsequent periods, where fuels were even rationed to control the demand. Sri Lanka may not face shortages of petroleum products in the near future, owing to longer-term supply agreements with major middle-eastern and Malaysian suppliers, but we would have to pay prices that reflect the current world market prices.

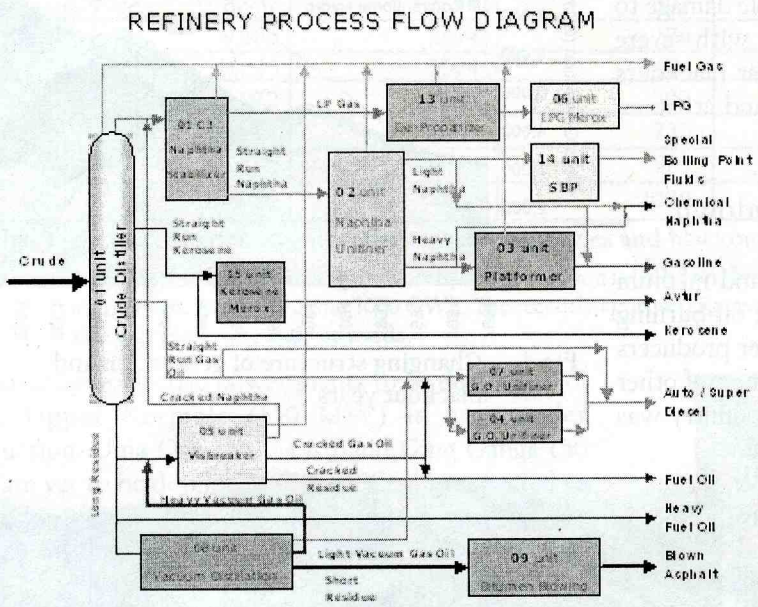


Fig 2. Refinery process - Flow diagram

Sri Lanka also has an abnormal split between different types of fuels (Table 1). Our consumption of diesel is about five times the consumption of petrol, and suddenly increases when electricity generation demands higher quantities of diesel.

A refinery can only produce diesel about three times the quantity of petrol, but we need a quantity equal to six times that of petrol (Fig 2). Therefore, diesel has to be imported directly in refined form, in addition to the production from the refinery. In most situations, producing in the Ceylon Petroleum Corporation (CPC) refinery is cheaper than importing the refined fuel from abroad. However, certain world market conditions cause refinery operations to be too expensive during some periods. The capacity of the only refinery we have is almost fully used. Therefore, the country has a shortage of refining capacity, and there are plans to double the refinery capacity from the present 50,000 barrels/ day, within the next four years. However, this expansion needs a large investment.

The Crisis in the Electricity Supply

The crisis in the petroleum industry is felt directly as price increases, but the crisis in the electricity supply is a lot deeper. A shortage of electricity cannot be resolved overnight, not even in a few months, because establishing power plants take time. Sri Lanka has no electricity connection with other countries. A proposal to connect with India is still at the initial stages.

Electricity generation requirements in Sri Lanka are growing at a long-term average rate of 6.8% per year, but in certain years, the demand growth exceeds 9%. In year 2005, electricity generated into the national grid was 8766 million kWh (8766 GWh). It is expected that the future growth will at least be 8% per year. In the past 15 years, extreme growths in years of no supply curtailments (blackouts) have been 5.1% (lowest in 2004) and 13.3% (highest in 1998). To satisfy this growing demand for electricity, power plants have to be built and they have to be built on time, not too early, not too late. If new power plants are built too early, they will be idling and the investment would be wasted. If they are built too late, the

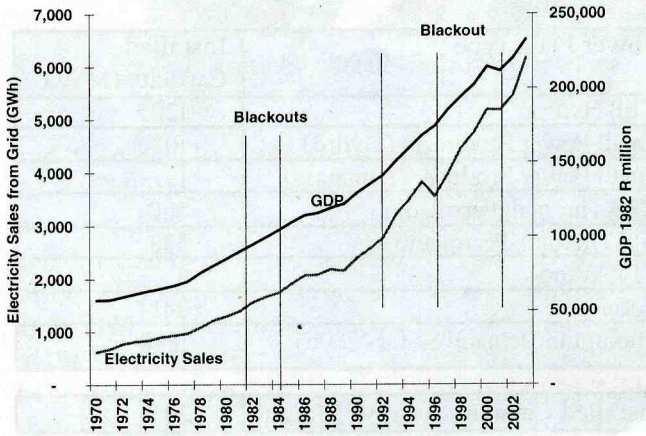


Fig 3. Effects of Blackouts on the economy/GDP

electricity demand may not be satisfied and there can be blackouts.

Owing to generation capacity shortages, there have been rolling blackouts imposed in Sri Lanka in the years 1980-81, 1983-84, 1987, 1992, 1996 and 2001-2. Long periods of 8-hour blackouts were imposed in 1996 and 2001, causing severe hardships to electricity customers and a visible damage to the economy. The Figure-3 shows the years with severe blackouts, and the GDP, clearly showing that blackouts cause the national economy to slow down, and at times, cause a negative growth as well.

Blackouts Cause the Economy to Slowdown

Sri Lanka presently has 1205 MW of large and medium hydroelectric power plants, and 1098 MW of oil-burning thermal power plants. Along with small power producers who provide hydroelectricity and a small amount of other sources, the total generating capacity in the country was 2414 MW by end 2006 (Table 2). The maximum demand recorded in 2006 was 1890 MW (provisional, subject to confirmation). Therefore, the country has a 27% reserve above the demand. In a purely thermal generating system, this reserve margin is adequate, but as 50% of the capacity is hydroelectric, Sri Lanka cannot operate all the power plants all the time. This is an inherent feature of any hydroelectric power plant: the capacity stated in megawatt has no real meaning and what matters is the amount and uniformity of water inflow. In the longer term, hydroelectric power plants are a real benefit, but their capacity contribution is limited and varies randomly. Therefore, in addition to building adequate new generating capacity to meet the growing demand, it is necessary for a generating system to have adequate backup capacity to meet shortfalls in hydroelectric capacity.

Power Plant type	Installed Capacity (MW)
CEB Hydro	1205
Small Power Producers (Hydro)	107
Small Power Producers (Biomass)	1
CEB Thermal: Petroleum	560
IPP Thermal: Petroleum	538
CEB Wind	3
Total	2414
Maximum Demand So far (2006)	1890

Installed Capacity Reserve Margin	28%

Table 2. Generating capacity of power-plants (Status at 2006 Dec.)

In the blackout years of 1996, 2001 and 2002, the country did not have adequate thermal capacity to meet the growing demand (Fig 4). In 1996, it was delay of the Sapugaskanda

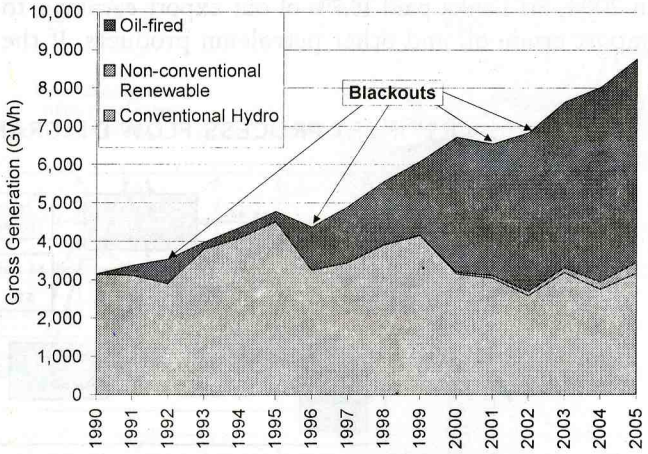


Fig 4. Changing structure of generation and blackout years

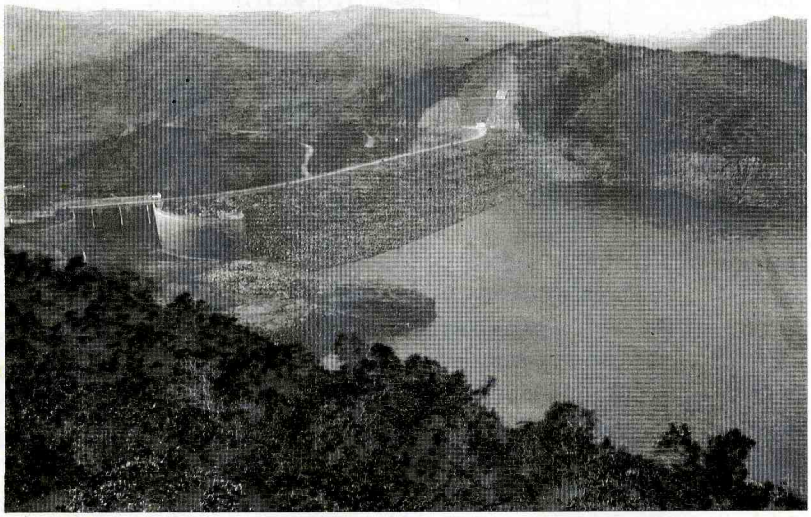


Fig 5. A hydroelectic and water storage reservoir

40 MW power plant that caused the crisis and severe blackouts. In 2001/2002, it was the delay in the coal power development program, that caused the crisis. Even the stop-gap measure of the two thermal power plants at Kelanitissa were not built on time to meet the 2001/2 crisis.

Over the past 15 years, Sri Lanka's electricity generating system has transformed from a predominantly hydroelectric system to a mixed hydro-thermal system, and is now a predominantly thermal generating system. The generation mix is shown in the figure, also showing the demand growth profile.

The transition to a thermal-dominated generating system is expected to continue into the future. There are only a few

Year	Forecast Generation Requirement (GWh)	If the rainfall is at the recent average (2000-2005) level				
		Major Hydroelectric Power Plants (GWh)	Non-conventional Renewable Energy (GWh)	Possible Thermal Generation (GWh)	Surplus (shortage) (GWh)	Estimated Blackouts (hours for the year)
2006	8,937	2894	307	6,646	1,000	
2007	9,565	2894	378	6,646	443	
2008	10,245	2894	474	6,646	-140	120
2009	11,072	2894	599	6,646	-843	667
2010	11,967	2894	730	6,646	-1,607	1,176
2011	12,931	3243	870	8,880	152	
2012	13,970	3243	1020	10,742	1,124	

Table 3. Major electricity generation capacity shortages and blackouts expected during 2008-2010

Note: Major hydroelectric power plant electricity generation is based on the average of the past six years. Historic long-term averages are higher by about 1000 GWh. The recently approved Kerawalapitiya Power Plant is expected to relieve the shortages from late 2008 onwards.

new major hydroelectric power plants to be developed, of which Upper Kotmale (150 MW) is now under construction. Uma Oya (150 MW) and Ging Ganga (50 MW) are yet to be developed (Fig 5). Coal is expected to make a dominant contribution to the grid from year 2010 onwards, with the first 300 MW power plant now under construction in Norochcholai, Puttalam. Non-conventional renewable energy too, is expected to serve 10% of the grid energy by 2015, on the basis of a recent policy decision by the Government.

A Major Hydroelectric Reservoir

There are no blackouts today, but does that mean there is no crisis ? No, there are two crises, both a capacity crisis and a financial crisis. There is a shortage of generating capacity until the two new power plants (Upper Kotmale and Norochcholai) begin producing electricity from mid-2010. While the demand is growing at rates higher than 8% per year, there was not a single new power plant under construction in 2005-6, scheduled to come into operation before 2010. Capacity shortages are likely from late 2007, and would be severe in the period 2008-2009. Construction of the Kerawalapitiya power plant that was scheduled to be operational from 2007, has not even started. The Table-3 shows the major capacity shortages and blackouts that can be expected over 2008-2010, if the Kerawalapitiya power plant is not built immediately.

Fig 6. 1 MW Dendro power plant using fuelwood (Gliricidia) storage area

Picture: Courtesy Lanka Transformers Ltd (LTL)

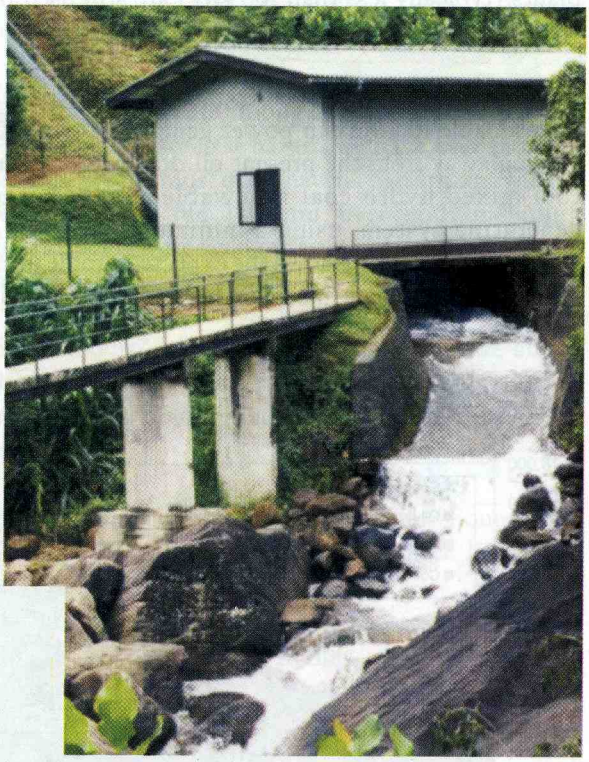


Fig 7. Ellapita Ella Small Hydro Power Plant
Picture: Courtesy of Eco Power (Pvt) Ltd.

Non-conventional Renewable Energy:

A scheme to buy electricity from small hydroelectric power plants into the national grid was established in 1997, through which over 100 MW of capacity has already been developed by the private sector. The Government has also announced incentives for biomass-based electricity generation projects, by way of additional payment over and above the prices paid for sale to the grid, for the first 50 MW of biomass-based power plants. One biomass-based power plant is presently in operation, while several more firewood and rice-husk based power plants are in various stages of development.

Over 300 micro hydropower plants (typically less than 20 kW) are also used to provide basic electricity needs of remote communities. About 50 micro hydropower plants (typically less than 100 kW) are still used by tea/rubber estates to provide power to estate factories.

Through these initiatives, the country expects to reach a reasonable fuel-mix in power generation by 2015, moving away from the present oil-dominated status to a mixed hydro-coal-renewable energy-based generating system, using a minimum of oil-fired generation. Figure-8 shows the expected profile until 2015, and the mechanisms to reach this goal are already in place.

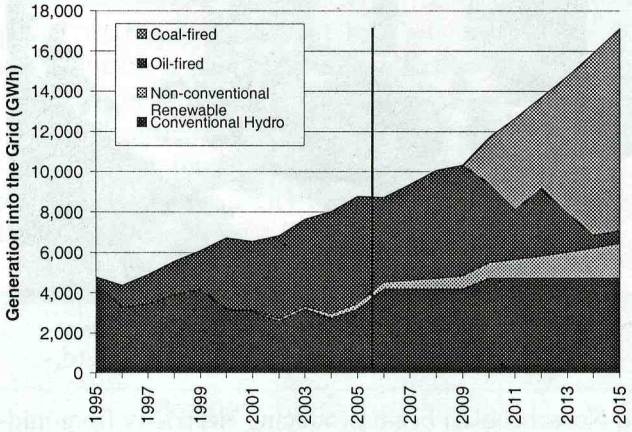


Fig 8. Forecast of energy geneation methods up to 2015

By 2015, the country will achieve a balanced, affordable fuel-mix in generation

Nevertheless, Sri Lanka's electricity costs will remain high for several years to come. In 2005, Sri Lanka produced 61% of electricity using thermal power plants, all burning oil. Because lower cost coal-fired power plant could not be built, high cost oil-burning power plants had to be used to produce electricity. This crisis in electricity costs and prices will continue in the future. Even if the oil prices do not increase beyond the present (January 2007) levels, and if coal prices do not exceed USD 100 per ton delivered, electricity prices can be reduced only by a small amount, when the three major power plants Upper Kotmale, Norochcholai and Trincomalee) begin operation.

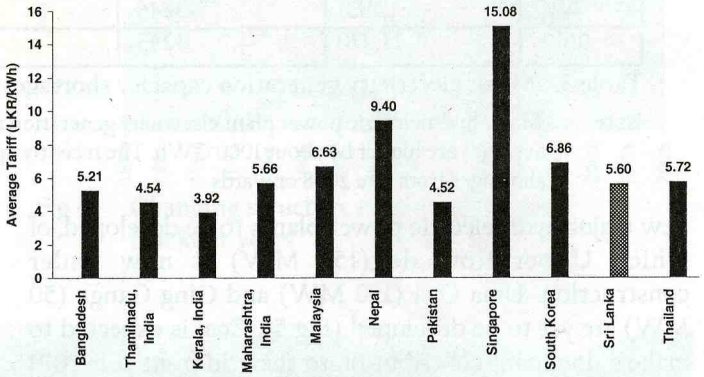


Fig 9. Comparison of electricity prices: Medium households using 90 kWh per month

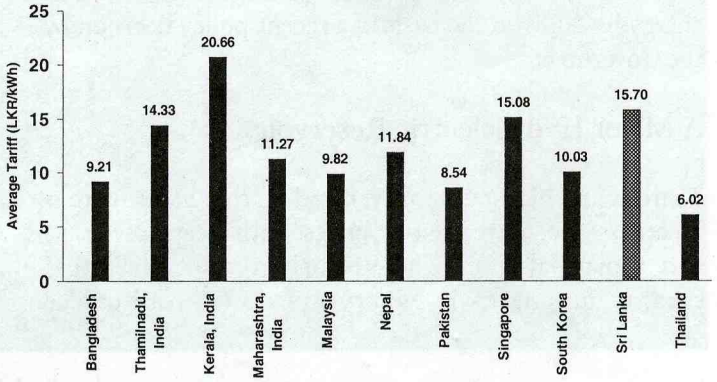


Fig 10. Comparison of electricity prices: Commercial customers using 58,000 kWh per month

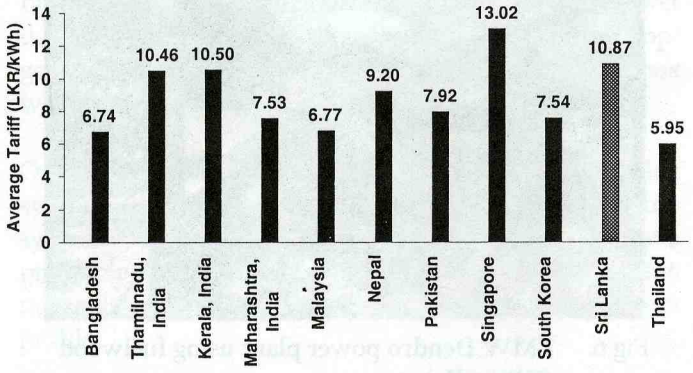


Fig 11. Comparison of electricity prices: Industrial customers using 65,000 kWh per month

However, if the three major power plants are not built, the price of electricity will exceed double the present prices, even if oil prices remain the same as of today. There is no room to increase electricity prices of Sri Lanka much further than the present prices: the graphs (Fig 9 to Fig 11) show the electricity prices in Sri Lanka compared with several countries in the region. Although our prices are not the highest in the world and not the highest in the region, they are high, and are likely to go higher. Therefore, we have a pricing crisis of electricity.

Keeping electricity prices below cost, has caused the main electricity supplier, the Ceylon Electricity Board (CEB) to go bankrupt, with accumulated losses exceeding Rs 50 billion. There is a further Rs 60 billion of long term loans the CEB is unable to pay. This is because, while oil prices and the share of oil-fired electricity were on the increase from 1996 onwards, electricity prices were not allowed to be increased to match the increasing costs.

Although the public does not accept, electricity prices would have to first go up before coming down in real terms. Sooner or later, electricity prices have to be raised to match the costs, and in parallel, implementing projects and programs to reduce costs (Fig 12). The latter is happening, but electricity prices are not yet anywhere near the costs. But the Government is pushing CEB to do exactly the opposite: to reduce electricity prices, which will further aggravate the financial crisis of the sector.

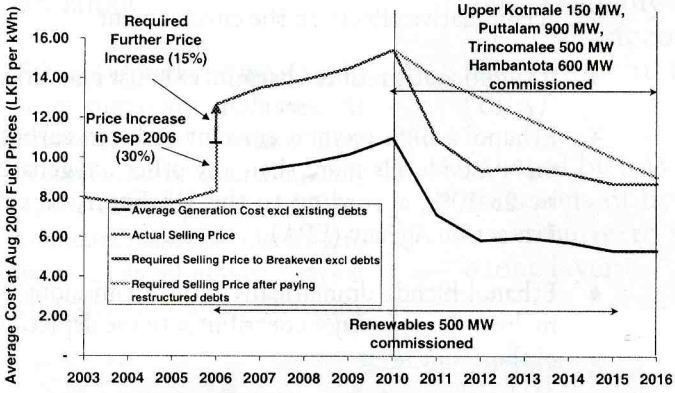
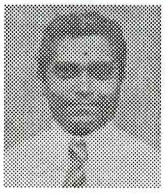


Fig 12. Electricity prices will first go up, and then down



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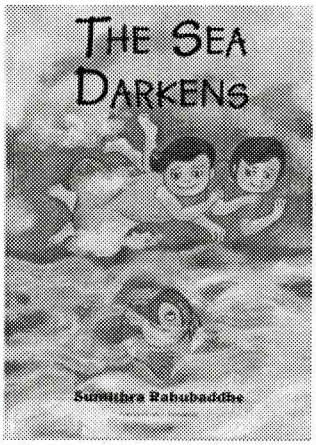

Author : Sumithra Rahubaddha
Illustrator : Sibil Wettasinghe
Published by : The Special Committee on Popularization of Science, National Science Foundation
Price : Rs. 150.00

Very few people who were among us in the year 2004 knew about Tsunami, the greatest hazard we have ever faced in our history. Till then most of us haven't had any knowledge on Tsunami. After the Tsunami, everybody including children and elders were keen on Tsunami, and its scientific background.

"The Sea Darkens" was published at this juncture and it described about Tsunami sea waves to the younger generation by a way of story and beautiful illustration related to the story.

The important thing is that National Science Foundation has published this children story in all three languages (Sinhala, Tamil and English).

The language used here is very simple. This book reveals the scientific background of Tsunami by a story developed between two goddess and a little girl named "Singithi".

This harmonious children story created by the famous author Sumithra Rahubaddha, has become more colourful by the illustrations designed by the famous artist, Sibil Wettasignhe.

This book, won the best Children Story Award for the year 2005 at the National Literary Award Festival. The attempt taken by the NSF Special Committee on Popularization of Science to fulfill a national requirement by addressing the children's mind using a story based on science, should be appreciated.

Thusitha Malalasekera