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Myth of cheap coal power

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There have been several articles published recently in the print media claiming that coal power is the cheapest, and urging the government to commence early the work on the proposed coal power plant at Norochcholai. The Institution of Engineers, Sri Lanka is the latest to have come out in support of coal power (Daily News, 29.06.2001), quoting that the all inclusive unit electricity price (UEP) from coal is only US 4.0 cts, compared to over 5.6 cts from other fuels.

The IESL has, apparently taken the figure of 4.0 cts from the CEB's Long Term Generation Expansion Plan of 1999, which has worked out this value as 3.97 cts/kWh. However, a careful examination of the data used by CEB in arriving at this cost, in the light of information available in international literature, shows that this figure is a gross underestimate.

The unit price of electricity generated from a power plant is calculated by summing up the annual capital cost, annual fixed operating cost, annual variable operating costs and the annual fuel cost. The annual capital cost depends on the plant capital cost, interest during construction (TDC), and the annuity factor which in turn depends on the discount rate (assumed to be 10%) and the plant life time (assumed to be 30 years). All these values are given in the CEB report for different power plants that are being planned, but these data need to be re-examined.

In CEB's report, the capital cost for a coal power plant on the west coast is given as \$ 1071.5 per kW. The CEB itself has been quoting even a higher price as early as 1993 for a coal plant in Trincomalee (\$ 1111 per kW). The Inter-Governmental Panel on Climate Change (IPCC) in its 1995 Working Group II Report on mitigation of climate change quotes an overnight value of \$ 1,300 per kW for a coal power plant built in Northern Europe, which is equivalent to an initial capital cost of \$ 1,120 per kW (in 1995). There are several points to be taken note of the capital cost value used by CEB.

Firstly, the CEB's capital cost has to be updated by at least six years. It is very unlikely that these costs will remain the same over such a long period. Hence, to bring the capital cost up to current price level, at least 10% will have to be added, which brings this value to \$ 1,178.65 per kW. This results in the UEP increasing to 4.15 cts.

Secondly, the above prices were quoted for domestic markets, either in USA or in Europe. For Sri Lanka, the freight has to be added, which should be at least another 10% bringing the capital cost to \$ 1,296.5 per kW and the UEP to 4.36 cts.

Thirdly, both in Trincomalee and Europe, coal is to be delivered direct to the plant. These do not need a 4 km motorable jetty and a mid-sea anchoring facility, which are required for the west coast plant. Hence, another 10% has to be added to cover the cost of these facilities, which brings the capital cost to \$ 1,426.2 per kW and the UEP to 4.59 cts.

Fourthly, according to the CEB 1999 report, the costs of flue gas treatment are not included in the costing as only low sulphur coal and low NOx burners are to be used. However, it is essential to install electronics precipitators (ESP) to prevent around 300 tonnes of fly ash from being released into air per day from a 300 MW plant. Because of the poor conductivity of low sulphur coal, special type of ESPs need to be installed, and this would add another 10% to the plant cost, bringing the plant cost up to \$ 1,569 per kW, and the UEP to 4.84 cts.

There are also other factors such as the heat value of coal, price of coal, overall plant efficiency, plant factor, construction period and the environmental costs that need to be examined.

The CEB uses a heat value of 6,300 kcal/kg. However, the average heat values of both Australian and South African coal as given in the 1996 IPCC Guidelines for National Greenhouse Gas Inventories, are 6,000 kcal/kg. With this value, the UEP increases to 4.93 cts. Even in the EIA report, the design value is given as 6,000 kcal/kg.

Next, considering the coal price, it is unlikely that it will stay steady all the time as claimed, either due to changes in the fob price or in freight costs as

happened recently. In the event the landed coal price increases by \$ 4/t, the UEP will increase to 5.08 cts.

The overall plant efficiency used in the CEB costing is 37.5%. However, the plant efficiency quoted in literature for sub-critical steam plant operation is 35.38%. Hence, a reduction of the efficiency to a more realistic value of 35% will increase the UEP to 5.22 cts. Though supercritical operation would increase the efficiency, it will increase the capital costs too.

The plant factor assumed in the report is 80%. The plant factor drops when the plant has to be shut down for regular maintenance or due to any unexpected breakdown. According to the North American Electricity Rehabilitation Council, the average plant factor for coal plants operating in the USA during 1990-94, has been around 60%. Hence, in Sri Lanka, this value cannot be better than 70%. With this value, the UEP will increase to 5.62 cts.

The estimated 3.5 year construction period for the coal plant is a gross underestimate. In their 1993 report, CEB has estimated the construction time for the Trincomalee plant as six years. Considering the additional work involved for construction on the coast, and the progress of some of the on-going projects undertaken by CEB, a more realistic construction period would be 5 years. This will increase the IDC from 16% to 23.8% and the UEP to 5.84 cts. Though the construction time is made shorter in other countries, it is very unlikely that the same will apply in Sri Lanka.

It is well-known that a coal plant is the worst polluter among power plants, emitting many pollutants; gaseous, liquids and solids. Their collection and disposal will cost extra money. Also, it is necessary to closely monitor the ambient air quality and the ground water quality at a number of sites to ensure proper operation of the pollutant control mechanisms. All these will add to the cost of operation of the plant. Furthermore, there will be some residual pollution getting into the environment, despite whatever mitigation measures are in place. These will add to the health-care of the affected people. It is absolutely incorrect, as done by the

IESL, to consider only the cost of electricity generation without including externality factors such as the cost of mitigating environmental damage and health costs.

In a study made by a team in the Netherlands reported in the web, the extra unit cost due to externalities of electricity production from coal, such as cost of environmental damage and human health could be as high as 0.49 - 0.58 US cts. per kWh. These correspond only to the damage caused by Sox, NOx, and particulate emissions, excluding CO2 factor. A similar value for the cost of environmental damage has also been reported in a World Bank study. If an average value of 0.5 cts. per kWh is assumed to cover these costs, the UEP will increase to 6.34 cts.

Let us now look at some figures quoted elsewhere for the UEP from coal plants. The IPCC report referred to earlier gives the UEP for coal plants operating in Northern Europe with domestic coal, as 5.3-5.7 cts, exclusive of environmental costs. The Secretary to the Ministry of Power in India, in a presentation made to the World Energy Council in 1998, quotes the UEP in India, where coal is available domestically, as US cts 6.43. The National Renewable Energy Laboratory in Colorado, has estimated UEP from coal applicable in North America using domestic coal, as US cts. 5.36 per kWh, excluding any environmental costs. Even a rule-of-thumb price for electricity from coal quoted in literature such as the latest IPCC report is 5 cts, for domestic coal excluding environmental costs.

From the foregoing, it becomes clear that the cost of electricity from coal could be high as US 6 cts. (Rs. 5.40) per kWh or even more as applicable to the proposed site, instead of the US 4 cts (Rs. 3.60) claimed by CEB.

The policy-makers should therefore be cautious in considering any of the "recommendations" based on the theory of cheap coal power, which is a total myth.