

Coal vs. Renewable Energy: A Debate of False Choices

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Over the past year, there has been a vigorous debate arguing the merits of coal as the power generation fuel of choice and questioning why the CEB should be purchasing power from non-conventional renewable energy (NCRE). These arguments have been put forth by key Government officials as well as eminent energy experts. Principal argument put forth is that the cost to CEB of coal power is less than from NCRE, and that more NCRE electricity will increase electricity tariffs. The contrary is true – more NCRE electricity will reduce electricity costs, as this article explains.

NCRE refers to electricity supplied from indigenous renewable energy resources such as mini-hydro, biomass (dendro and agricultural waste), wind, and solar.

Electricity Generation Mix in 2012

In 2012, electricity generated was 11,543 GWh from several sources: (a) 42 percent from private oil thermal, (b) 23 percent from CEB hydro, (c) 17 percent from CEB oil thermal, (d) 12 percent from Norochchalai coal, and (e) 6 percent from NCRE (Figure 1).

The figure also shows the share of costs to CEB of electricity from various sources. Most importantly, the share of costs from hydro, coal and NCRE is less than their generation share. Whereas the cost shares from CEB and privately-owned oil thermal plants are greater than their share of electricity supplied. Thus the primary cause of high electricity tariffs is the continued reliance on high cost electricity from oil fired power plants.

Mahinda Chinthana: Vision for the Future

Policy Direction

Diversification of energy resources used in the country will be encouraged and the future energy mix will be rationalized to minimize fuel fired power generation. Management and operation of energy supply systems of the country will be made ensuring efficient utilization and conservation of energy.

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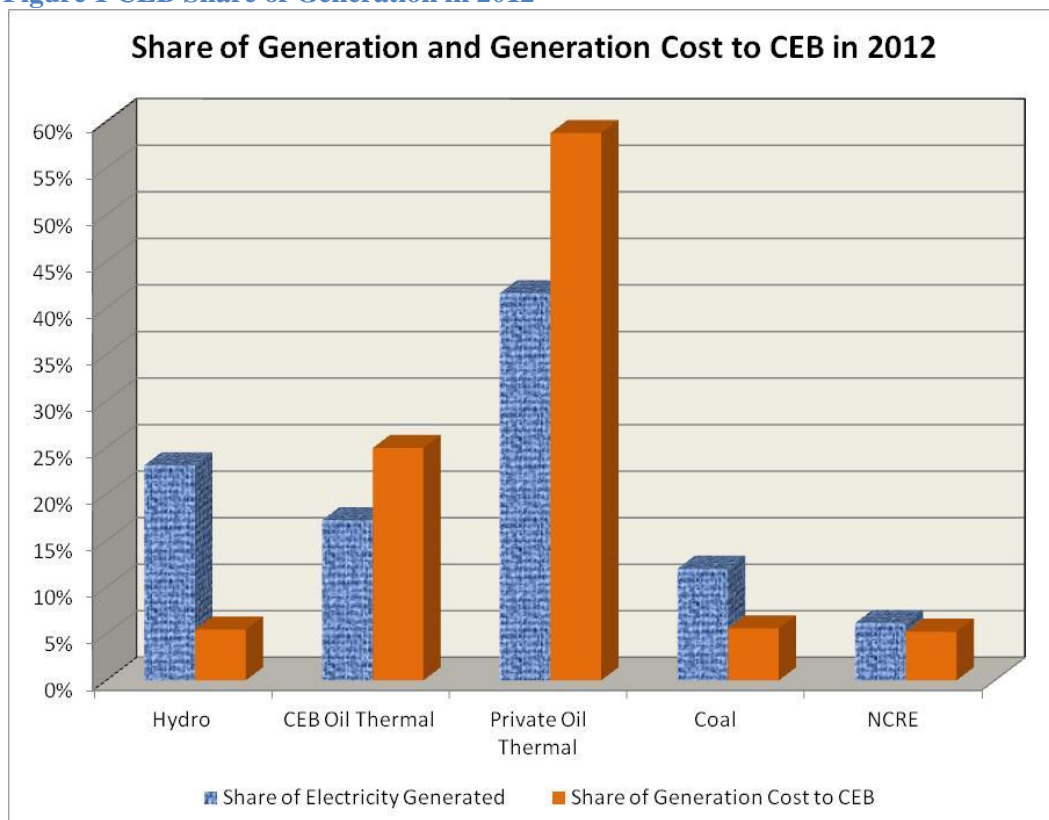
Renewable Energy Development

By 2020, about 20 percent of electricity supply is expected to be generated by the renewable energy. For this purpose, sufficient investment will be made on development of renewable energy sector with wind, dendro, solar and mini hydro power plants.

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Ministry of Finance and Planning, Department of National Planning, *Mahinda Chinthana: Development Policy Framework, Government of Sri Lanka, 2010*

Figure 1 CEB Share of Generation in 2012



Inappropriate Comparison of Coal vs NCRE Generation

On a purely financial basis for CEB, generating power from coal at Norochchalaï is less costly *today* than buying electricity from NCRE. The Public Utilities Commission of Sri Lanka (PUCSL) report on 2012 Generation Costs, noted the electricity cost to CEB from Norochchalaï was Rs. 7.43 per kWh (for coal and operating expenses, and excluding capacity charges (PUCSL estimates that in 2013 it would add Rs. 1.29/kWh). NCRE electricity cost to CEB in 2012 was Rs.13.51 per kWh (including debt service, equity returns and all operating costs).

However, is this right comparison? It is not – when electricity from several sources is generated or purchased, it is logical to get electricity from a less expensive source first before buying electricity from a more expensive source, assuming there are no technical constraints.

Let's compare the cost of electricity from these different plants. Figure 2 shows the electricity cost to CEB for all the plants that supplied electricity in 2012. It shows that the cheapest was electricity from most of the CEB hydro plants, and Norochchalaï. The next cheapest at an average cost of Rs. 13.51 per kWh were NCRE. Beyond that the oil thermal plants supply electricity at higher costs ranging from Rs. 17.9 to 52.6 per kWh.

Nearly 60 percent of the electricity generated or purchased by CEB in 2012 which was principally oil thermal electricity, was more expensive than electricity from NCRE (Table 1).

Table 1 Share of CEB Electricity Supplies in 2012 by Generation Cost

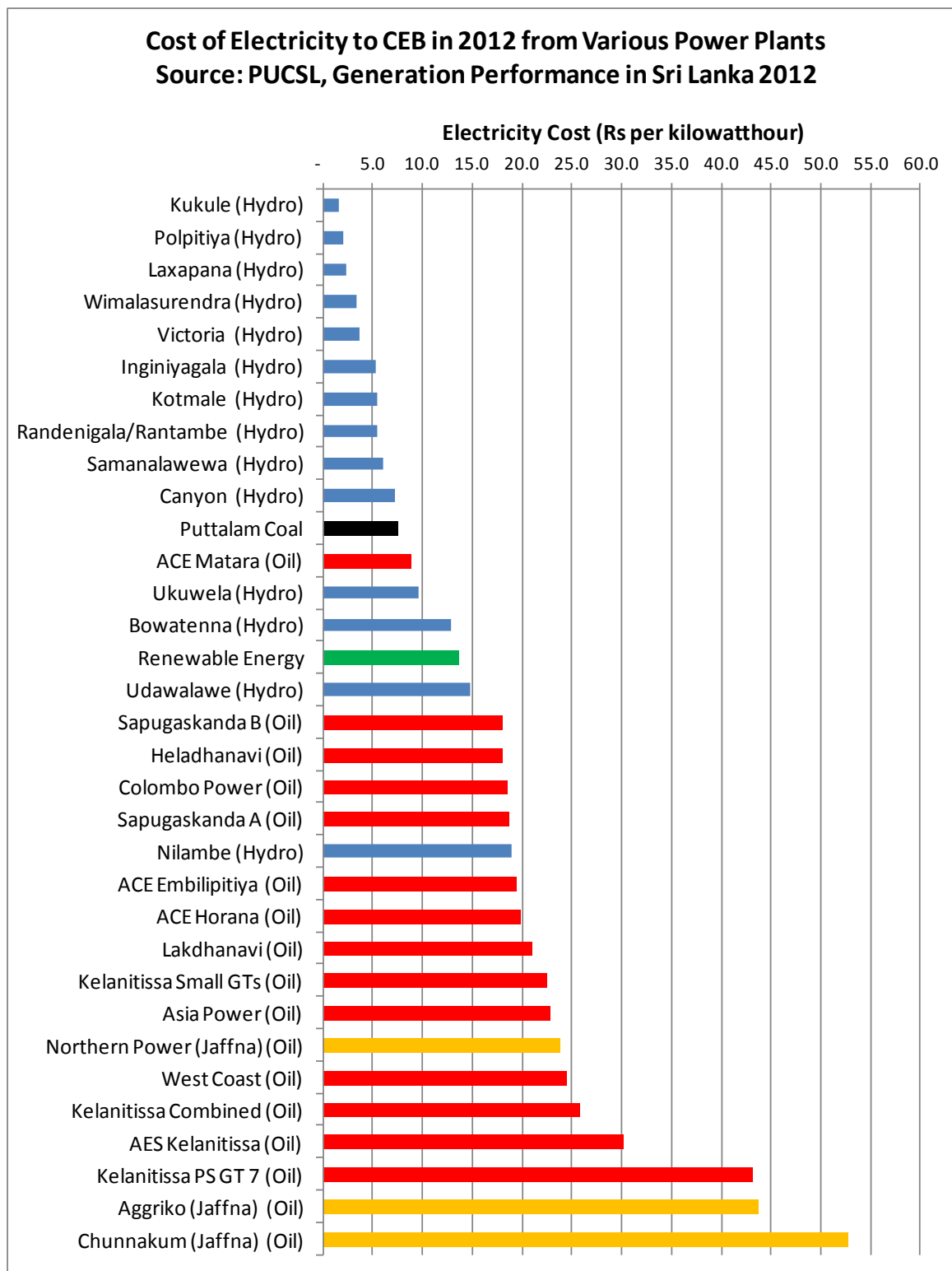
	Generated Electricity (GWh)	Percent of Total Generated
Generation less costly than from NCRE	3,955	34%
Generation from NCRE	728	6%
Generation more costly than NCRE	6,860	59%
Total Generation	11,543	100%

It is therefore logical that when electricity is available from NCRE that more expensive oil electricity should be displaced. This is good business practice, as it is good utility practice. **Therefore, rather than increasing the overall cost of electricity to consumers, NCRE reduces electricity supply cost as it offsets more expensive oil electricity.**

Both CEB in its merit order dispatch scheduling, and energy experts acknowledge that when cheaper power is generated, it is the more expensive generation that is curtailed. Referring to the Norochchalaï first stage then under construction in 2009, Dr. Tilak Siyambalapitiya wrote in the Daily News of July 1 that year, "The [Norochchalaï] power plant would help Sri Lanka reduce the use of the most expensive power plants on its system: CEB system has four power plants burning auto diesel, adding up to 600 MW. They will be the first to be curtailed. Then the next group of power plants using fuel oil will be curtailed". Shouldn't the same rules apply for NCRE electricity? So, why compare NCRE electricity cost with coal power?

Some may argue that when the second and third stage of Norochchalaï start functioning later this year or next year, CEB can dispense with oil thermal power and therefore the comparison of NCRE must be with coal. But this argument is false. When 900 MW of Norochchalaï coal power plants are operating, it could deliver 5,760 GWh per year. Let us also assume that hydropower output, thanks to the bountiful rains, is double the 2012 output. Therefore, total coal and hydro may be as high as 10,700 GWh (compared to about 4,000 GWh in 2012). This is still below electricity demand expected in 2013 and beyond, and so oil thermal plants will be needed, in addition to NCRE. Thus the justification of comparing NCRE electricity cost against oil thermal electricity cost is still valid.

Figure 2 Cost of Electricity to CEB in 2012 from Various Sources

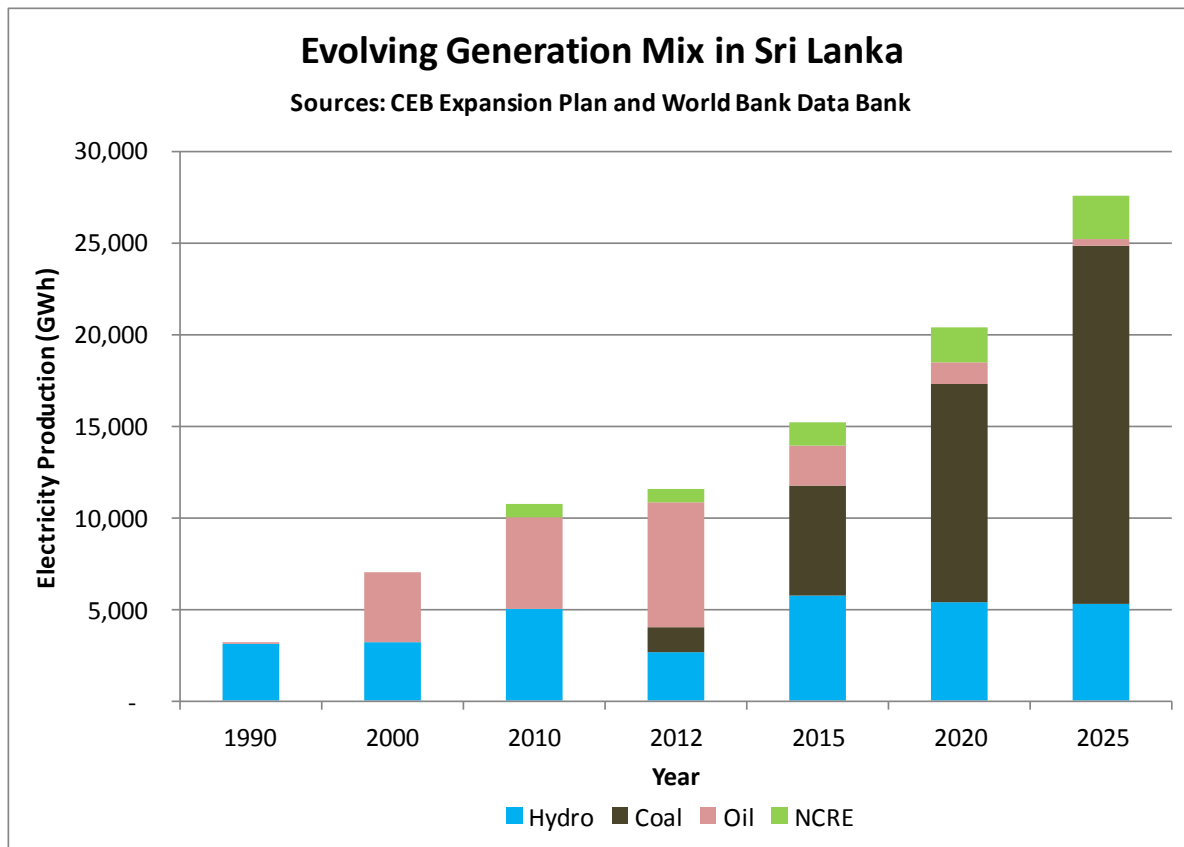


Essential Need for Supply Diversification

No investors would place all their funds in one stock or in one financial instrument however high a return is promised. This is too risky. Diversification of an investment portfolio is good practice and diversification across financial instruments whose performances are not correlated is also sound practice. The same principle, when technically feasible, applies to power systems planning. Sri Lanka has experienced the negative effects of not having a diversified power system in the past, and it appears that history may repeat itself.

From the 1970s to the latter half of the 1990s, Sri Lanka depended almost wholly on hydropower (Figure 4). Extended periods of drought, coal power delays, and electricity demand increases led to power shortages. The CEB had to invest in oil-fired generation and contract for private oil thermal power as these were the plants that could be brought on line the quickest. By the year 2000, about half the generation capacity was oil-based. Then, oil prices started rising and cost of electricity started rising sharply. By 2012, the Norochchalai coal plant started and the second and third phases are nearing completion. Eventually, the 500 MW Sampur coal plant will supply electricity (reportedly, it will be more expensive than electricity from Norochchalai). Then in the early 2020s, additional coal power plants are planned to meet rising demand. By 2020 nearly 60 percent of the electricity generated is expected to be from coal.

Figure 3 Generation Mix from 1990-2025



The net result is a power system that was first hydro dominated, and then oil dominated, soon will be coal dominated. Though Mahinda Chinthana committed to 20 percent NCRE electricity by 2020, the CEB expansion plan assumes only 10 percent by 2020.

Sri Lanka has experienced the consequences of over-dependence on just a few energy sources:

- Hydropower is subject to vagaries of weather, and increasingly weather patterns are becoming unpredictable.
- Oil is subjected to price shocks and, due to political instability and international embargoes there are supply reliability concerns.
- Coal too is subject to price rises as the four-fold price rise between 2005 and 2008 demonstrated.

Equally importantly, coal and oil prices are highly correlated; when oil prices rise, do so coal prices. So diversification using other energy sources that are not linked to coal and oil price is important.

Sri Lanka faces another complicating risk – currency depreciation. Coal and oil are usually traded in US dollars and the Sri Lanka rupee has exhibited continued depreciation against the dollar in time. The Central Bank is now attempting to maintain the rupee at a predictable level of no more than 7 percent annual depreciation against the US

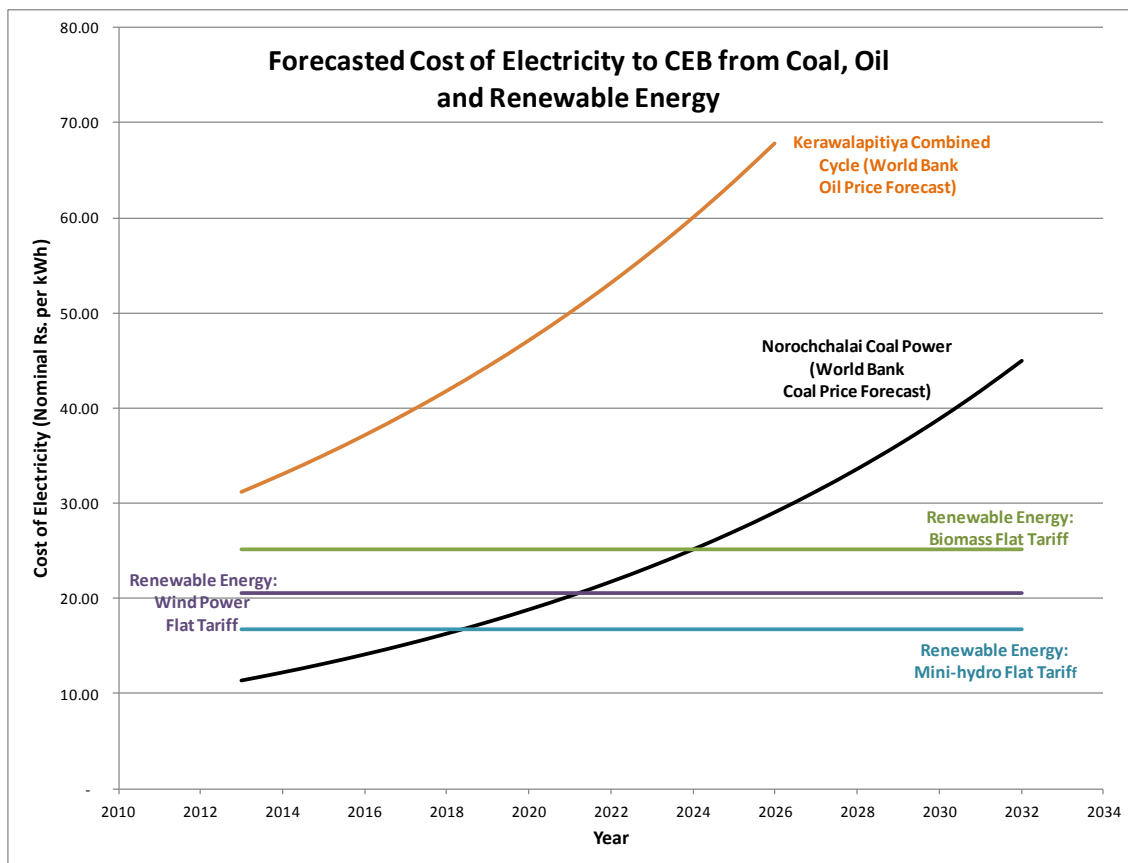
dollar. If this be the case, even if global fuel prices remain steady in US dollar terms, in rupee terms we can expect a 7 percent increase in coal and oil prices annually.

Dr. Siyambalapitiya noted this effect in his 2009 article in the Daily News of July 1st: “Owing to the concessionary 20-year loan, the actual cost of production of Norochchhalai at the present [2009] price of coal would be Rs. 7.83 per unit. Yes, it is more than the approximate price of Rs. 4.00 per unit stated in the late 1990s. Why? The rupee has depreciated from 70 to 115 Rs to the USD, coal prices have increased from 47 to 100 USD to be delivered to Norochchhalai, the investment has increased from USD 900 to USD 1,340”.

With the cost of coal and oil principally driving the cost of electricity from these sources, over dependence on these sources will increase the risk of an overall electricity price rise. When electricity costs rise, either the costs have to be passed through to the consumer, which is politically unpalatable, or the Government would need to absorb some of the costs; which too has serious negative budgetary and macro-economic consequences. **Therefore diversification of supply sources is extremely important.**

Now that much of our hydro resources are already in use, diversification using NCRE must be made a priority. From an electricity cost viewpoint, diversification has a moderating influence on overall electricity price. Figure 4 shows projected cost of electricity from oil, coal and NCRE. The oil and coal price forecasts in US dollars were from the World Bank. It conservatively expects FOB coal price to rise to US\$ 100 per ton by 2025 and FOB crude oil prices to remain unchanged through 2025. Therefore much of the price increase is due to the Sri Lanka rupee depreciation, assumed at 7 percent per annum. For presentational simplicity, for NCRE options, only the flat rate tariffs ordered by PUCSL for 2012-13 are shown.

Figure 4 Forecasted Cost of Electricity from Coal, Oil and NCRE



The figure shows that electricity from NCRE (wind, mini-hydro and dendro power) is less costly than from oil today and will remain so for the future. By about 2018-2024, electricity from NCRE could be also less costly than from coal so that when the oil use in the power sector eases, NCRE will still be a low cost option compared to coal.

This chart shows the fallacious arguments of several energy experts that claim NCRE electricity will increase the cost of electricity. This chart gives a sense of the need to aggressively pursue a course to diversify away from oil. NCRE must be one option.

Conclusion

The incorrect debate over the choice of coal vs. NCRE must be set aside. Sri Lanka must benefit from its indigenous renewable resources, and move away from oil power generation. By investing in NCRE, electricity cost to the consumer is lowered as the share of oil generation is reduced. NCRE electricity has added benefits of improving balance of payments, adding to GDP and in the case of biomass power, increases rural incomes and diversifies agriculture. Coal does have an important place in Sri Lanka's energy mix, by offering lower costs, and when blended with other generation sources, adds robustness to the power system and helps reduce price shocks.

Therefore, let's follow the policy guidance given in Mahinda Chinthana which encouraged diversification of energy sources and rationalizing the future energy mix to minimize fuel fired power generation. The renewable energy development goal articulated in Mahinda Chinthana remains rational, credible and achievable – if there is the will to do so.

About the Author: ANIL CABRAAL is a co-founder and Director of KMRI Lanka, a renewable energy power development company, and an independent consultant in renewable and rural energy. Previously, during his 15 years at the World Bank he was responsible for rural and renewable energy development, including guiding the World Bank Group renewable energy and energy efficiency scale up strategy. His investment projects include grid-connected and off-grid renewable energy in Asia and Africa with projects currently in the Maldives, Bangladesh, Indonesia, Sri Lanka, Tanzania, and Liberia. He serves on the boards GVEP International a sustainable energy NGO and the Sri Lanka Energy Forum. He has a PhD Agricultural Engineering from the University of Maryland, USA and B.Sc. in Mechanical Engineering from University of Ceylon, Peradeniya.