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Tradeable Electrical Energy Certificates to Facilitate the Development of Renewable Energy Based Power Plants, Bypassing the Ongoing Financial Crisis

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Abstract: This paper proposes the use of Electrical Energy Certificates (EECs) generated from renewable energy (RE) based power plants to be used as an alternative to payments from the utility to power plants to settle for electricity generated and to give returns to investors to overcome the impasse created due to high cost of capital. Such EECs can be used by the original receivers, or holders (who purchase them from a secondary market), to set off the energy payment part of electricity bills. As the Single Buyer of electricity in Sri Lanka, the certificates are to be issued by the Ceylon Electricity Board (CEB), and hence are honoured by CEB (as the Transmission Licensee) to set off energy consumption portion (kWh part) of any electricity bill. EECs are to be valid for 10 years and can be traded at a secondary exchange if the holder desires. As EECs have an intrinsic value which embody the true utility associated with energy, in the long-term it could be regarded as a trading instrument. CEB (as the Single Buyer) is to pay the power plants with EECs as against LKR for the electricity generated (based on a formula) except the portion for Operations & Maintenance (O&M) cost and cost of finances. Being a non-material commodity, electrical energy can be easily tagged to digital transactions, overcoming the issues faced by the barter trading league in the yesteryear. EECs can provide a medium to raise equity capital for RE projects which has become expensive largely due to the present economic crisis.

Keywords: Electrical energy certificate, Trading, Intrinsic value, Renewable energy, Investment, currency alternative, Financial crisis

1. Introduction

Sri Lanka is currently in a severe economic crisis and the Sri Lanka Rupee (LKR) has got devalued against the US Dollar (USD) by 80% during the ten months from March to September 2022 [1]. Inflation too had reached 69.8% on year on year basis in September 2022 [2], thus bringing down the value of LKR further. In addition, even after the recent electricity tariff increase, the state-owned electricity utility Ceylon Electricity Board (CEB) is expected to face further financial losses in 2022 [3], thus undermining the financial viability of the utility and thereby raising concerns on its ability to assure payments for electricity generated and sold to CEB on time. Raising of project capital too has become extremely difficult as the lending rates have gone past 27% in October 2022[4]. This has caused severe issues for the prospective investors of renewable energy (RE) based power plants to raise finances for future projects. Amidst the present financial crisis, there is a need to ensure continuous investments in the field of renewable energy based generation to ensure continuous supply of electricity to meet demand. As both the means to import fossil fuels to generate from thermal sources and means to raise finances to generate from indigenous energy forms such as solar power and wind have been challenged, there is a requirement to use novel means to overcome this crisis. This paper presents a novel concept of using tradable Electrical Energy Certificates as a medium for payment, exclusively in the field of electricity generation.

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As Sri Lanka faces acute shortage of foreign exchange and dwindling foreign currency reserves held in USD, foreign investors are facing problems in getting a guaranteed return for the investments made, irrespective of whether they are indexed to USD or in LKR. However, despite Sri Lanka's inability to raise reserves in USD, as energy commodities continue to hold an intrinsic value and also has a useful value, this paper suggests using energy as a currency to pay for electricity generated from renewable energy plants. Energy also has the same attribute of a precious metal that it has limited supply and cannot be created or supplied at will.

2. Present Practice

Only CEB, as the holder of the Transmission License (the Transmission Licensee, TL) issued by the Public Utilities Commission of Sri Lanka, is authorised under Sri Lanka Electricity Act No, 20. of 2009 to procure electricity from Generating Licensees (GLs), and sell in bulk to Distribution Licensees (DLs). DLs in turn sell electricity thus purchased from the TL to end users in retail(See Figure 1).

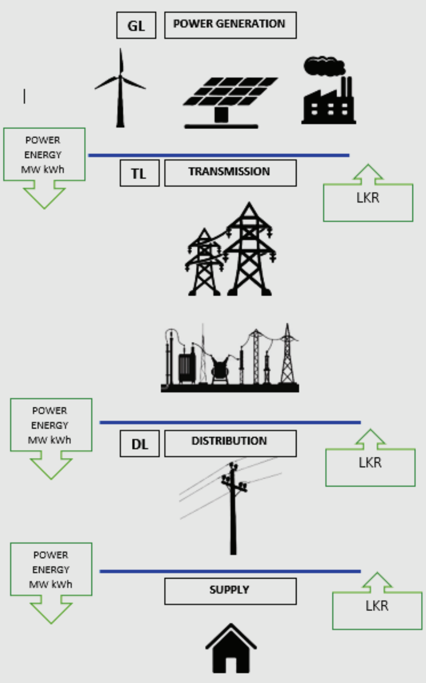

Figure 1
Flow of Electricity and Payments

Figure 1 – Flow of Electricity and Payments

The DLs collect money from end user customers in LKR for electricity sales and pay back to TL for the electricity sold to them by TL. TL pays such money back to GLs in LKR for electricity generated.

In effect, electricity (energy measured in kWh or multiples thereof and power in kW or multiples thereof) is generated at the point of generation (by GLs), purchased and transmitted (by TL), distributed, supplied and sold (by DLs) at the point of sales in terms of kWh and kW.

Supply of electrical energy (kWh) is taking place in the forward direction from generation to end users while the payment for electricity is taking place in the reverse direction, from point of sales back to generation but in LKR currency.

Even though the flow of electricity is from generation to end user customers, with only adjustment in between is for losses, the conversion of electricity to LKR at the point of generation and point of sales is governed by two separate commercial transactions, namely,

(1) The Power Purchase Agreements (PPAs) the TL have with GLs at point of generation.

(2) Power Sales agreement or end user Tariffs applicable for supply of electricity at the point of sales.

As transfer of funds is not a single seamless process, and due to tariff anomalies, there are shortfalls between LKR transactions for sales revenue received from DLs and payments made to GLs in the accounts of the TL, adversely affecting financial viability and cash flow of TLs. This has caused the ability of TL to pay on time for GLs thus affecting the viability of the power generation business. Independent Power Producers (IPPs) who use RE as their energy source are severely affected by delays in payments by the power purchasing utility, considerably affecting the viability of the IPPs. This has also caused severe concerns on the bankability of future PPAs signed with CEB. This, in turn, will make it almost impossible to raise finances for new generation plants.

3. Electrical Energy Certificates

Electricity Certificates per se are not a new tool and are used in other countries. They are known by different names such as Renewable Energy Certificates (RECs), Green tags, Renewable Energy Credits, Renewable

Electricity Certificates, or Tradable Renewable Certificates (TRCs). However, they have a distinct difference to what has been proposed in this paper. Conventional RE Certificates are usually a paper which certify that a certain amount of electricity has been generated from a selected RE resource. These certificates are widely used to provide evidence of compliance with an obligation on electricity producers, suppliers, or consumers to use a known quantity of energy supplied from an RE resource. In certain other instances, these certificates are used by energy users to meet certain mandatory obligations or to offset carbon footprints or to qualify for financial support available for greener ventures. These certificates are not treated as any legal tender at the face value of energy indicated in the certificate.

The Electrical Energy Certificate proposed in this paper is not meant to ensure compliance with any framework or the fulfilment of any other obligation but as a new form of legal tender which can avoid the use of a fiat currency in transactions, exclusively in the field of energy.

4. Generation of Electrical Energy Certificates

This proposal is applicable only to RE based generating plants where only the electricity generated is paid (kWh) and no fixed/capacity payment is involved. When an RE based power plant enters into a PPA with the TL, instead of paying back using LKR at the rate agreed in the PPA for electricity generated (LKR/kWh), a given number of Electrical Energy Certificates (EECs) are to be issued by CEB every month based on actual electricity generation. If the electricity generated in a month is equal to E_m (kWh), the number of EECs issued for the month (EEC_m) is not equal to monthly electricity generation but based on a formula as follows.

$$EEC_m = kE_m$$

The factor k is less than 1 and is determined based on the following:

I. Payment component for O & M expenses that needs to be paid in LKR directly in addition to payment using EECs.

II. Payment of Financial cost that needs to be paid in LKR directly in addition to payment using EECs.

III. Average transmission and distribution losses of the system, as that determines the proportion of electricity generated that had actually reached to end user level and sold at the selling point.
If the plant is connected to 33 kV network, only distribution loss should be considered for this.

IV. An adjustment factor based on the proportion of fixed cost apportioned into the energy component (kWh) of Two-Part Tariff customers.Two Part Tariff customers are those who pay only an energy charge (LKR/kWh) and a monthly fixed charge (LKR/month). They do not pay a demand charge (LKR/kVA) like the three-part customer. This adjustment is to account for the fact that though kWh value indicated on the face of EECs can be directly used to set-off energy (kWh) part of the electricity bill, the energy tariff (LKR/kWh) may have been computed to recover a part of the fixed costs of supply too through energy (kWh) sales. CEB would not be able to recover such fixed cost (built into metered and billed kWh in electricity bills) unless a proportion of kWh generated is set aside to account for such before deciding the face value of EECs .

V. Additional cost incurred by TL as payment for electricity generated from other sources such as flexible generation to provide ancillary services and grid support to integrate generation from RE based power plant.

VI. A wheeling charge by TL for using its network.

For example, if, Annual O & M cost to be directly paid back in LKR, expressed as a percentage of total estimated revenue from electricity generated (based on the estimated tariff) for electricity generated from the plant = $F_{O\&M}$

Annual financial cost to be directly paid back in LKR expressed as a percentage of total estimated revenue from electricity generated (based on the estimated tariff) for electricity generated from the plant = F_{FC}

% System Transmission and Distribution Losses = F_{Loss}

Proportion of fixed cost component (LKR) out of the total fixed cost of electricity (LKR) in the given year that is apportioned to be recovered through the energy charge of two-part tariff customers when expressed as a percentage of total energy cost (LKR) = F_{TP}

Estimated cost of total ancillary services directly attributed to variable renewable energy absorption, expressed as a % of the total cost of electricity generated from all variable RE sources = F_{AS}

The total LKR Wheeling Charge expressed as a percentage of the estimated revenue (based on the estimated tariff) from electricity generated from the plant = F_{WC}

$$k = [1 - (F_{O\&M} + F_{FC} + F_{LOSS} + F_{TP} + F_{AS} + F_{WC})]$$

As an encouragement to implement this novel concept, it is recommended to either use zero, or very small nominal values for F_{AS}, F_{WC} initially. $F_{O\&M}$, F_{FC} would be based on actual values.

5. Use of EECs for Transaction

EECs are issued by the TL (CEB) to the IPP that generates electricity using an RE resource to account for the purchase of electrical energy. The EECs can be in a suitable denomination such as in 100 kWh. As described later, Blockchain Technology or a suitable distributed ledger or inventory technology that can track EECs from its origin until the same has been used to set off an energy bill (at which point the EEC expires), can be used to digitally create EECs. The new revenue to the IPP for electricity generation is now in EECs and not in LKR (other than the O & M cost).

The investors of the IPP can be now serviced with EECs as dividends. As entire O & M cost has been separately accounted for, remaining transaction is pertaining to return on investments, which is in EECs. If investors are prospective electricity consumers, they can use the EECs to directly set off the energy component of their own electricity bill. If investors are those seeking financial returns, the EECs they hold can be sold at secondary market to earn returns. As long as value of EEC at the secondary market (LKR/kWh) is higher than the cost of electricity generated from the plant (LKR/kWh), the most likely case with downward trend in RE based generation, investors are better served with EECs than when paid back with LKR. Holders of EECs have the option to dispose their EECs at the secondary market at times when electricity prices are on the rise, giving them an opportunity that is not available with LKR based return on investments. Settlement of the monthly fixed charge (LKR/month) or kVA charge (LKR/KVA/month) is not possible using EECs as the EECs carry only energy (kWh).

6. Secondary Market for EECs

A secondary market can be created to trade EECs. Anyone should be allowed to buy EECs and be used to set off energy part of the electricity bill (irrespective of the customer category).

When electricity prices are high, the EECs should be able to draw a high price in the secondary market. When energy prices are on the rise, investing on EECs can be a good option. As EECs do not lose their intrinsic value, they can be a safer investment in a turbulent economic context.

EECs are an indirect way of using some other power plant to generate one's own consumption by "Power Wheeling". However, EECs do not require to wheel in real time but allow to bank energy in the grid to be drawn out later. Though appear similar, it is different to net metering scheme as there is no point of common electricity coupling between utility and point of use.

7. Life Time of EECs

EECs issued by CEB create an obligation on the part of the utility to honour them when produced in exchange for electricity supplied. This indirectly is a non-financial liability on the part of the utility. Authors propose to include a finite expiry date to EEC which is proposed as 10 years from the date of creation. However, this figure can be changed upon further research.

8. Use of Blockchain Technology for EECs

By using blockchain technology, every EEC should be easily tracked from the origin. Additional studies are needed to find the suitability of blockchain technology to trade/transact EECs.

9. Potential Use of EECs

EECs now facilitate the utility to pay IPPs without any cashflow issue. Revenue streams of IPPs are better assured as a result. As EECs carry kWh, they lose the risk of devaluation or inflation.

The government could use EECs purchased from secondary market to provide direct electricity subsidies to low-income groups.

10. Conclusion

The law of energy conservation makes energy a commodity which cannot be created or destroyed at will, a characteristic quite similar to a rare metal which provides an intrinsic value to a fiat currency when backed by a such a commodity. The proposed use of EECs will regain the legitimacy of a commodity backed currency, which will communicate the limits of economic growth to the society which at present is contemplating endless economic growth based on fiat currencies with no intrinsic value.

Energy, being a commodity with substantial intrinsic value demanded by all, can use the EEC as a means of attracting investments from the very users of energy, bypassing many intermediaries usually associated in fiat currency transactions. This can directly link the user with suppliers, reducing ultimate cost of energy to users and also reducing cumbersome processes to accelerate the energy transition. Further, electrical energy, being a non-material commodity, can be easily transmitted through networks using only digital transactions, a luxury which was not available for barter traders of yesteryear.

With EECs, all consumers can buy their electricity needs directly by either investing in power plants or from secondary market.

Authors propose to carry out the issue of EECs as a pilot as a proof of concept and expand it to attract investments required for a rapid energy transition. The pilot scale initiative can be taken on a wind plant fully developed to investment ready level by CEB in the Mannar region. Due to EECs, investments to this plant can be broad based with even small players participating in the project. Returns are not based on LKR/kWh but kWh/LKR, which is based on laws of physics and less susceptible to future uncertainties.

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