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Market-Based Mechanisms to Promote Renewable Energy in Asia

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Abstract: *Market-based instruments such as Renewable Energy Certificate (REC) are increasingly favoured as an alternative to command-and-control legislation to increase the uptake of renewable energy. Focusing on the renewable energy industry and policy situation in Asia, this paper analysed the strengths and weaknesses of market-based approaches in the long-term interest of developing Asia. It found that approaches such as REC are disadvantaged by a lack of both market acceptance and a strong institutional and programme support. To identify gaps in the REC system in India, a comparative analysis with the United Kingdom (UK) model was made. This revealed some fundamental issues around market-based approaches in Asia, underscoring the need for a policy design to address the concerns of buyers and sellers in the market.*

Keywords: Market-based Mechanisms, Renewable Energy, Renewable Obligation, Regulatory Intervention
JEL Classification: Q41, Q42, Q48

1. Introduction

Market-based policy instruments aim to modify the behaviour of economic entities by changing the financial incentives and disincentives they face. They typically operate by adjusting relative prices or creating markets that did not previously exist. A wide range of policies can be considered market-based, including the imposition or elimination of taxes, fees, or subsidies, and the use of energy trading systems. Market-based policies construct systems to incorporate the costs associated with but not normally reflected in market prices, into an entity's decision-making process.

Market-based instruments are attractive alternatives to traditional command-and-control regulatory programmes, particularly for renewable energy uptake and energy efficiency improvement. They provide firms greater flexibility to cost-effectively achieve the required renewable energy uptake, allowing them to meet the national objectives and targets at a lower overall cost. In addition, well-designed market-based policies can also provide greater incentive for innovation compared with command-and-control programmes.

Market-based instruments are being adopted in several parts of Asia. In India, the Renewable Energy Certificate (REC) mechanism was introduced with a lot of promise for the promotion of renewable energy in general, and wind and solar energy in particular. For energy efficiency improvements, Performance Evaluate Transfer (PET) is used as a mechanism to address *inter-alia* the problems of these two segments of industry---i.e., the problems arising from their infirm nature and constraints in terms of inter-state transfer of power from renewable energy (RE) sources. Today, however, this mechanism faces real challenges that seem to be vitiating the investment climate in RE and energy efficiency sector in general, and wind and solar segments in particular.

This paper seeks to identify various issues and options that will enable market-based mechanisms to facilitate large-scale RE capacity addition, particularly wind and solar, in the long run. It also seeks to review the experiences gained by other

countries with the tradable renewable energy certificate system, especially the Renewable Obligation Certificate (ROC) scheme of the United Kingdom (UK).

Renewable Obligation (RO) has played a major role in harnessing RE sources in the United Kingdom. It has contributed effectively to widen the UK's energy and climate change goals, including Greenhouse Gas (GHG) emission reductions, de-carbonizing of the UK grid and energy security. The ROC mechanism has unique features such as banding, banking, buyout price as a penalty for non-fulfilment, inbuilt incentive mechanism for the obligated entities to fulfil their renewable purchase obligation (RPO), secondary and forward market mechanisms, and others. These features are not available in the current market-based mechanisms in Asia.

This paper therefore attempts to highlight the possible steps for an effective policy on an REC system in Asia in general and India in particular. As such, a comparison has been done with the UK's ROC model so as to identify the gaps in the REC system in Asia. This has revealed some fundamental issues around the REC framework, underscoring the need for a policy design that can take care of the concerns of market players. Recommendations in terms of policy and regulatory interventions here aim to address the critical issues.

2. Types of Market-Based Policy Instruments in Asia

Many countries deploy market-based instruments to promote investment RE technology as well as to improve energy efficiency and combat climate change. The European Union's Emissions Trading System (ETS) is a large and well-established cap-and-trade system. In 2011, Australia introduced its own carbon pricing mechanism that will also transition to a cap-and-trade system. A growing number of developing countries employ market-based policy instruments to reduce energy consumption as well as to jumpstart investments in clean energy are also being witnessed.

For the purpose of this paper, a market-based policy instrument is defined as one that provides financial incentives for consumers and/or producers who are responsible for adopting RE technologies or energy efficiency improvements.

Policies being practiced in Asia, for that purpose fall under three broad categories: taxes, subsidies, and trading systems.

Taxes set a price per unit of energy either directly on emissions or on goods or services that are carbon intensive such as coal. Meanwhile, subsidies are broadly defined as payments to encourage a particular economic action. Subsidies are therefore the opposite of a tax. They include tax incentives and preferential loans.

Finally, trading systems set a limit on quantities on a specific type of energy, but allow emitters to buy and sell emissions rights, letting the market determine the price rather than setting it directly as a tax does. Examples include cap-and-trade and baseline-and-credit emissions trading programmes. Trading systems may also be used to meet energy savings or RE targets. These alternative policy approaches are further defined in the glossary while **Table 1** lists specific examples.

Table 1: Overview of Market-based Policy Instruments used in Emerging Economies of Asia

Type of Instrument	**Example**
Subsidies	
Tax incentives	Korea, India - Tax exemptions for biofuel
Feed-in tariffs	India, China - Feed-in tariffs for electricity from RE sources
Preferential financing	Indonesia - National Development Bank; financing for electricity production from RES and ethanol
Credit guarantees	Malaysia - Credit Guarantee Funds for green technologies
Taxes	
Emission tax	Japan - Tax on high CO_2-emitting vehicles and electricity from non-RE
Reduction or removal of high carbon taxes and subsidies	Korea and India - Removal of price support for anthracite coal production
Differentiated pricing	China - Higher industrial electricity

	prices for more energy-intensive enterprises
Trading Systems	
Energy efficiency and renewable energy target-based	India - Energy intensity-based cap and trade for industries and tradable renewable energy certificates
Cap and trade	Korea - Emission trading legislation; China - pilot emission trading systems
Baseline and credit	Korea - Voluntary emission reduction programme

Taxes, subsides, and trading programmes have corresponding pros and cons. The appropriateness of each must be weighed within the specific policy and political context of each jurisdiction. Economic, political and cost considerations as well as the environmental outcome and the ease with which a programme can be designed and implemented must all be taken into account for their relative advantages and disadvantages.

3. Emphasis on Renewable Energy and Energy Efficiency by Market-Based Instruments

For most countries in the Asia-Pacific region---*viz*, Japan, Korea, Australia, China, and India--- renewable energy development and deployment is a major goal of market-based policies. In China, which already has vast hydropower resources, the major drivers are the diversification of energy supply sources (i.e., as it is still in need of more energy) and industrial development. Also, reducing fossil fuel consumption has significant pollution and health co-benefits, while RE technology is seen as a strategic economic growth sector in the country. Similarly, India is striving to meet its fast-growing energy needs by developing all of its energy sources, including renewables. South Korea and Japan, which have fewer renewable resources than the others, still support renewable energy as a means of reducing their

significant dependence on imported energy. Finally, countries such as Indonesia and Malaysia are seeking to expand and diversify their energy sources so as to meet their growing energy demand.

Several emerging economies in Asia have formally pledged under the United Nations Framework Convention on Climate Change (UNFCCC) to a quantified national-level or economy-wide objective to limit the growth of GHG emissions. For China and India, this objective is intensity-based, expressed in carbon dioxide (CO_2) emissions per unit of gross domestic product (GDP). Both aim to reduce their economy's CO_2 intensity below the 2005 level by 2020 although both express their goal as a range: A 40 percent to 45 percent reduction in China, and a 20 percent to 25 percent reduction in India. By contrast, Indonesia, South Korea, and Malaysia set goals against business-as-usual emission projections in 2020 (i.e., GHG emissions as they are expected to be in the absence of a new policy).

4. Renewable Energy Certificate (REC) Mechanism in India

In India, the generation of RE sources has been encouraged traditionally through various financial and fiscal incentives, followed by preferential tariff, and renewable purchase obligation (RPO) as determined by the electricity regulation generators. Wind energy constitutes the largest share of RE generation in India. Solar has a huge potential, and present policy and regulatory interventions are aimed at increasing the share of solar in the RE generation portfolio. However, both solar and wind as sources are infirm in nature. They also bear higher costs. Moreover, inter-state transfer of power generated from such RE sources is difficult. All these explain why buyers are generally reluctant to contract such sources for power generation. These inherent disadvantages thus require support for wind and solar energy sources. To address these challenges, a new instrument called Renewable Energy Certificate (REC) mechanism was introduced in 2010.

The introduction of REC is an attempt by regulators to address the problem arising from the gap between availability of and demand for RE resources to fulfil the RPO. Under the REC framework, an RE generator can sell electricity

components, say, to the local distribution company at its average pooled power purchase cost (APPC) as well as associated environmental attributes in the form of RECs to obligated entities or voluntary purchasers.

The Central Electricity Regulatory Commission (CERC) defines the terms and conditions for the issuance of RECs. India has had the experience of REC transactions for over four years now, and has seen important milestones in the trading sessions for non-solar and solar RECs. A total of 4,022MW of RE generators have been accredited for REC, out of which 3,632 MW of capacity had been registered as of 1 July 2014 (REC Registry, 2014).

After the introduction of the REC mechanism on 14 January 2010, nearly 7,500 MW of renewable energy capacity had been commissioned as of March 2013. Out of this, 2,256 MW of new generation capacity commissioned after 14 January 2010 were registered under the REC scheme as shown in **Table 2**.

Table 2: Status of REC Registered Projects as of March 2014

Energy Source	Old Projects (commissioned before 14/01/2010 and registered under REC)		New Projects (commissioned before 14/01/2010 and registered under REC)		Total	
	No. of Projects	Capacity	No. of Projects	Capacity	No. of REC-registered Projects	Capacity
Wind	117	281.08	391	1,632.92	508	1,914
Bio-Cogeneration	46	532.68	24	150.32	70	683
Small Hydro	5	47.5	17	140	22	187.5
Biomass	29	293.60	29	269.4	58	563
Solar PV			20	62	20	62
Others			1	1.7	1	1.7
Total	197	1,155	482	2,256	679	3,411

Source: Processed data from REC Registry.

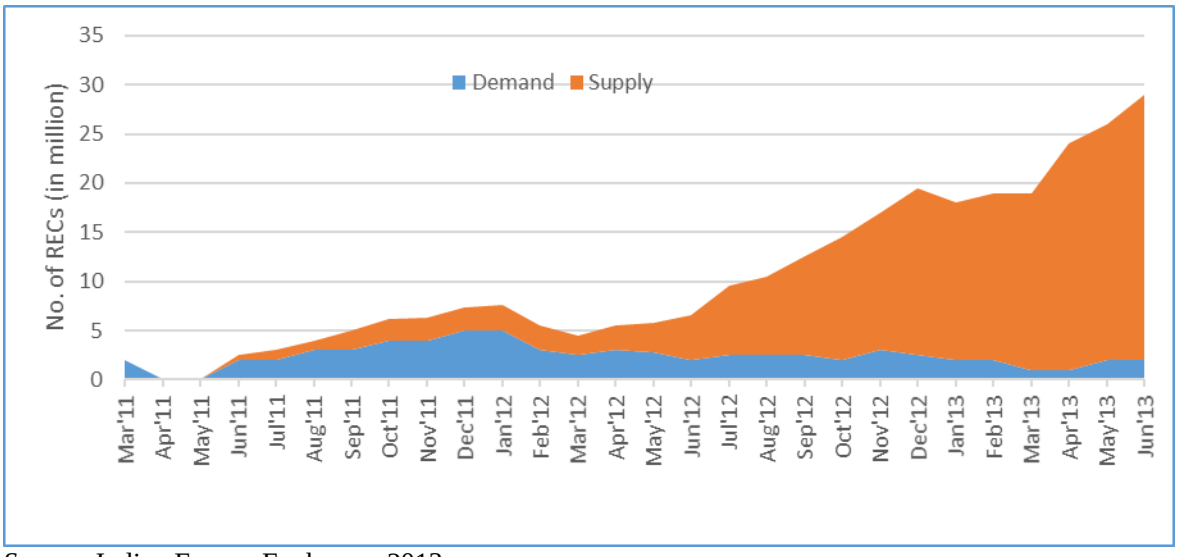
4.2. REC Demand and Supply Scenarios

Even as the registrations are substantial and the initial volume growth has been encouraging, the trend in terms of volume and price of RECs over the period presents a not-so-promising future for such instrument in India. In August 2013, a total of 488,824 non-solar RECs were issued. Combined with the non-solar RECs of 2,709,391 that remained unredeemed in the month of July 2013, a total of 3,359,617 non-solar RECs were available for trading in the month of August 2013. However, only 40,889 non-solar RECs were sold/redeemed and an inventory of 3,157,326 non-solar RECs remained unsold. Of the total non-solar RECs offered for trading, about 1.37 percent were redeemed. This clearly indicates that there is poor demand for non-solar RECs.

The trend analysis of RECs is presented in **Figure 1.** In the June 2013 trading session, only 73,965 RECs were traded/cleared out of the total sale bid volume of 2.394 million RECs. This demand-supply gap has remained a major issue in the REC market in India, especially in the non-solar REC category since June 2012.

This is also evident from **Figure 2,** which shows the non-solar REC market clearing price. In the month of August of 2013, a total of 32,541 solar RECs were available for trading. However, only 2,359 solar RECs were sold/redeemed, leaving an inventory of 30,182 solar RECs unsold as of August 2013. Of the total solar RECs offered for trading, about 7.83 percent were redeemed.

Figure 1: Demand and supply of RECs in India

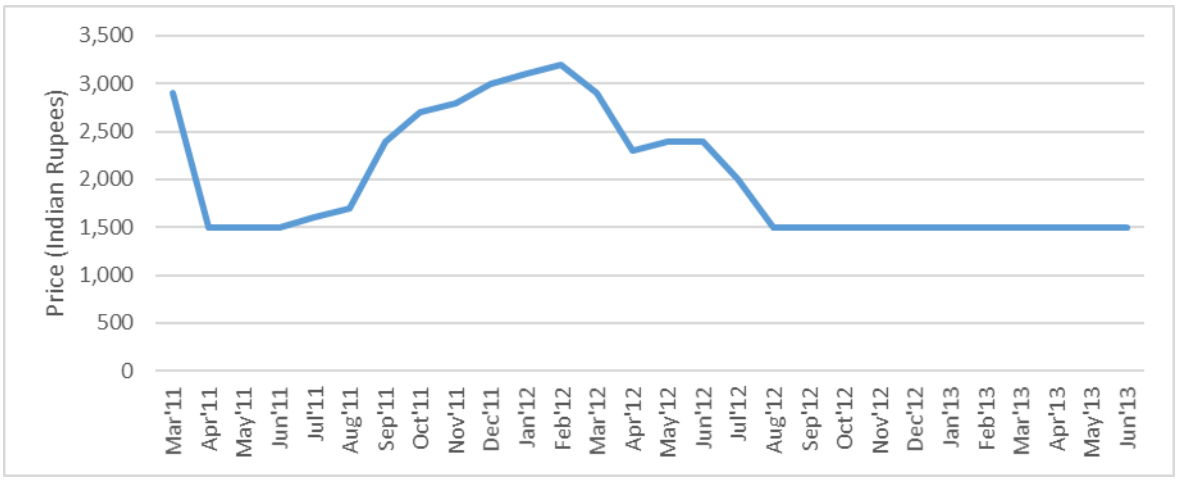


Source: Indian Energy Exchange, 2013.

In June 2012, the clearing ratios in the Indian Energy Exchange (IEX) and the Power Exchange Of India Limited (PXIL), respectively, were 2.57 percent and 3.67 percent. Market clearing prices for non-solar RECs remained at the floor level (Rs 1,500/REC or US$24.17) consistently, as shown in **Figure 2**.

The above figures indicate a very low demand for as well as low prices of RECs. This leads one to wonder what the reasons are for such slow uptake in REC markets.

Figure 2: Price fluctuations in REC



Source: Power exchange of India Ltd, 2014.

4.2 Market analysis of RECs in India

4.2.1. Possible factors influencing the market trends

Figures 1 and 2 indicate that the current REC market is characterised by low demand. Since the demand for REC is created by the RPO for obligated entities, it is obvious then that the low demand stems from the fact that the obligated entities are not coming forward to buy RECs. This is also borne out by the data **in Table 3**. Only two distribution companies were reported to have bought RECs in June 2014 to meet their RPO partly. Moreover, of the total RECs traded, distribution companies' share in the total REC purchased was less than 50 percent.

Table 3:REC Buyers Market in India

Name of the Buyer	Type of obligated entity	No. of RECs purchased	%
Electricity Department, Chandigarh	Distribution licence	2,000	3
Tata Power, Maharashtra	Distribution licence	30,200	41
Others – 464 entities	Open Access and Captive users	41,765	56
Total RECs		73,965	100

Source: REC Registry, 2014.

Why obligated entities are not participating in the REC market were analysed through a questionnaire survey. The responses and available data reveal two possible reasons.

At one level, the low demand is due to the lack of RPO compliance as well as weak enforcement by state electricity regulators, as indicated in **Table 4.** Table 5 demonstrates that RPO compliance in most states (except the states of Tamil Nadu, Orissa, Jharkhand, Himachal Pradesh, and Goa) fall short of the target set.

Table 4: Renewable Portfolio Obligation Compliance

State	Total Procurement (MU)	Total RE Procured (MU)	RPO Compliance	RPO Target % FY2012
Andhra Pradesh	87,381	2,934	3.36%	4.75%
Assam	6,211	7	0.12	2.80
Bihar	11,676	144	1.23	2.50
Chhattisgarh	22,603	737	3.26	5.00
Delhi	26,674			
Goa	3,740	119	3.18	1.70
Gujarat	77,864	2,833	3.70	5.00
Haryana	37,298	28	0.08	1.00
Himachal Pradesh	7,085	1,494	2109	10
Jharkhand	7,085	244	3.44	2.50
Karnataka	60,611	5,149	8.49	9.75
Kerala	18,535	65	0.35	3.05
Madhya Pradesh	38,060	42	0.11	2.10
Maharashtra	118,094	5,441	4.61	6.75
Manipur	499	-	0.00	2.75
Megahalaya	1,066	-	0.00	0.45
Mizoram	483	-	0.00	5.75
Nagaland	439	-	0.00	6.75
Orissa	23,489	300	1.28	1.20
Punjab	43,792	237	0.54	2.37
Rajasthan	50,672	2,558	5.05	5.5
Tamilnadu	69,653	6,976	10.02	8.95
Uttar Pradesh	73,962	3,174	4.29	4.50
Uttarkhand	9423	384	4.08	4.50

Source: State Electricity Regulation Commission, 2013.

As per regulations in most states, when the obligated entity does not meet its RPO targets during a year, the State Electricity Regulatory Commission (SERC) may instruct the obligated entity to pay into a fund an amount equivalent to the shortfall in quantum of RPO equivalent of energy multiplied by the forbearance price of REC. However, the enforcement of these provisions is weak. Most state commissions fail to conduct checks and audits to ensure that the obligated entities are complying with the regulations and duly purchasing RECs to meet their obligations. For example, in its order dated 18 June 2013, the Chhattisgarh State Electricity Regulatory Commission (CSERC) assessed the distribution companies' level of RPO compliance for the year 2010-2011. Although the CSERC in its order had noted that the overall RPO met by the state was around 4.3 percent against the target of 4.75 percent (non-solar), and 0 percent for solar, it did not impose any penalties and merely asked all the three distribution companies to share the burden. In states such as Maharashtra, Punjab, and Gujarat, the shortfall in RPO have been carried forward to future years. In the absence of a strict RPO enforcement, the obligated entities have the least interest to participate in the REC market. This seems to have shattered the confidence of investors in the REC scheme, as evident from **Table 5.**

Table 5: Status of Accreditation and Registration

Period	RE Projects Accredited (MW)	No. of Projects Accredited	RE Projects Registered (MW)	No of Projects Registered
FY 2011 (1/2010 -3/2011)	172	46	109	14
FY 2012 (4/2011 -3/2012)	2,328	400	2,108	346
FY2013 (4/2012 – 3/2013)	1,345	301	1,273	325
FY 2014 (4/2013-3/2014)	1,527	275	1,475	305
Total	5,372	1,016	3,508	990

Source: REC Registry, 2013.

The above table shows the declining trend in the accreditation and registration of RE projects under the REC mechanism, especially since April 2012. The MW capacity accredited during 2012-2013 is almost half the capacity accredited during 2011-2012. So is the case with registration: Only 1,273 MW was registered during 2012-2013 as against the capacity of 2,108 MW registered in 2011-2012. These data indicate that the initial enthusiasm of investors for projects through the REC route is waning in India.

On the other hand, worldwide experience shows that (i) a stable and long-term RPO trajectory and (ii) strong deterrent against non-compliance of RPOs have both been used as important interventions for the promotion of renewable energy (Sonneborn, 2004; Dulal et al., 2011; Vogstd, 2002: Martinot, 2007; Holt, 2007; Martin, 2008; Midttun, 2007; Cunha, 2012; Zhou, 2010). These are the elements that India lacks. Thus, the Central Electricity Regulatory Commission has advise the Ministry of Power that: (i) The national electricity policy and tariff policy should provide long-term RPO trajectory of five years to 10 years; (ii) The Electricity Act 2003 should require SERCs to fix the RPO as per the provisions of the national electricity policy and the tariff policy; and (iii) SERCs should be empowered to impose penalties in addition to the provisions made in section 142 of the Act. The Ministry of Power has accordingly constituted a committee to accelerate the development of RE through legislative and policy changes.

The above analysis clearly discloses that absence of proper enforcement of RPO is one of the major factors responsible for non-participation of distribution companies in the REC market. This, however, is not the only reason.

Other reasons for non-participation as culled from the questionnaire survey include:

i. Poor financial health of distribution companies
ii. The REC not being a viable option for resource-rich states
iii. The REC provides only electronic certificates and not energy
iv. Poor financial health of distribution companies
v. Reluctance due to infirm nature

4.2.2. Poor financial health of distribution licensees

According to the report on the financial health of distribution utilities, electricity distribution licensees incurred losses of about Rs 700 million in 2010-2011 (Shrimali, 2012). Such poor financial health restricts distribution companies' ability to purchase the desired quantum of power or, for that matter, the otherwise expensive power from RE source for the RECs. Quite often, they resort to load shedding to avoid the purchase of power. This issue has to be addressed to improve the viability of the power sector in general as well to bring the distribution companies back into the REC market and rev up the demand for them.

4.2.3. REC not a viable option especially for RE resource-rich states

For the resource-rich states, the cost of fulfilment of RPO through Feed-In-Tariff (FIT) route and REC route constitutes overlapping components. **Table 6** compares the costs of RPO compliance under ROC and FIT routes for the resource-rich state Karnataka.

Table 6: RPO Compliance-cost economics comparison for Karnataka (Rs/KWh)

	APPC including Transmission Loss	Transmission cost	Total APCC Cost (A)	REC Price (B)	Energy Cost (FIT) Including transmission and balancing Cost (C)	A+B-C
REC @ Floor Price	3.46	0.5	3.97	1.5	4.59	0.87
REC@Avg Price	3.46	0.5	3.97	2.4	4.59	1.77
REC @forebearance Price	3.46	0.5	3.97	3.3	4.59	2.67

Source: Forum of Regulators, 2012.

From the above table, it appears that the cost of RPO compliance by procuring power at FIT is cheaper than the cost of RPO compliance by purchasing REC. Therefore, distribution companies in the resource-rich state may not necessarily come to the REC market for RPO compliance.

4.2.4. REC viable option especially for RE resource-deficit states only at floor price

A similar comparison of RPO compliance costs has been done for the resource-deficit state of Delhi as shown in **Table 7**.

Table 7. Cost comparison for resource-deficit state of Delhi under IPCC+REC Route Vs FIT Route

	IPCC+REC Rs/Kwh (A)	FIT Rs/Kwh (B)
IPCC	3.34	-
REC (Floor Price)	1.50	-
FIT		4.63
Transmission Cost	0.10	0.23
Transmission Loss	0.04	0.14
Sub-Total	4.98	5.00
Balancing Energy Cost		0.33
Total Cost	4.98	5.33
Difference		
REC at Floor price (1.50)		0.33 – 0.58
REC at Ave. Price (2.55)		0.55
REC at Forbearance (3.40)		1.45

Source: Forum of Regulators, 2012.

From the cost comparison, one can say that the REC route is attractive for resource-deficit states only if RECs are available at floor prices. Therefore, such states may prefer to fulfil their RPO target by procuring power through the FIT route instead of the REC scheme the moment REC price exceeds the floor price.

Since renewable energy is intermittent in nature and perceived to be a costly source of energy, both resource-rich and resource-deficit states are generally

unwilling to increase their RPO obligation beyond current limits, as RPO compliance would result in:

- Additional cost to be incurred by the host state's utility in procuring balancing power because of the variable nature of renewable energy sources.
- Additional expenditure in establishing transmission infrastructure for new renewable energy capacity.

4.2.5. REC: Only an electronic certificate without physical electricity

Renewable Energy Certificates are sold in the form of electronic certificates without the electricity itself. Since there is a shortage of power supply, the purchase of RECs does not meet the need of the distribution companies in terms of power procurement. They are, therefore, generally reluctant to buy RECs, which are not accompanied by physical energy. Instead, they would be willing to pay for electricity that is produced on their behalf using cleaner, renewable sources of generation. As such, they often prefer to procure renewable energy via the FIT route than through RECs to meet the RPO.

4.3 Risk Analysis from REC from the generator perspective

In the preceding section, the REC market data were analysed from the perspective of the buyers. In this section, analysis is done from the RE generators' perspective. It attempts to find out how RE generators view REC as an option for investment.

4.3.1. Bankability and Financing Risk

In most part of Asia as well as India, there is a real concern about the bankability of RE projects under the REC route because of high risks as perceived by financiers. The key constraint identified is the lack of visibility of pricing and regularity of cash flows. In India's REC case, there is a shorter visibility of the REC price band as the current floor and forbearance price determined by the central commission are valid only until FY 2016-2017. Thus, there is uncertainty over the REC revenue after FY 2017.

Another revenue source under the REC mechanism is the sale of electricity component to local distribution licensees at the Average Power Purchase Cost (APPC). The CERC regulations provide that the electricity component can be

purchased by the local licensee at a price not exceeding the APPC, other could be a viability gap for the RE projects, especially in the event of the REC price discovered in the power

4.3.2. Mitigating the institutional, economic and financial risks

Both RECs in India and ROCs in the United Kingdom represent the green attributes of electricity generated from RE sources. In order to identify various risks associated with the Indian REC, a comparative analysis on key attributes is made and presented in **Table 8.**

Table 8. Comparison of RE Promotion Market-Based Instruments of REC Framework in India and ROC in the United Kingdom

Parameter	REC India	ROC UK
Coexistence with RiT	Developers have a choice between both schemes---i.e., REC or FIT	Micro-generation technologies with production less than 50 kw of electricity are eligible only for FIT. Others get ROC Credits.
Institutions involved	Central Electricity Regulatory Commission that specifies REC framework; State Electricity Regulatory Commission that recognises REC as valid instrument for RPO compliance; State Accreditation Agencies and Central Agency for issuance of REC	Office of the Gas and Electricity Markets (OFGEM) administers the following functions: Accreditation, Issuing and revocation of ROCs; establishment and maintenance of RECs; monitoring compliance; annual calculation of buying price; Receipt of buyout payments and redistribution of the buyout funds.
Sunset clause and long-term viability	There is no specific sunset clause specified for which RECs are issued.	ROC cannot be issued beyond 31 March 2037; RE generating company can be issued an ROC for 20 years only
RE Purchase Obligation target	Each state commission specifies RPO target for its own state; No national level target specified in the Act; RPO is fixed based on the resources available in the state; RPO across the country varies from 1.5% – 10%; RPO	The obligation size is set by a series of fixed annual targets that increase linearly to 15.4% in 2016. The end date of RO is extended up to 2037 for new projects so as to provide long-term certainty for

	is specified for a minimum of five years only; no long-term certainty for investors.	investors and to ensure continued deployment of renewables to meet UK`s 2020 target and beyond; Under the current RO mechanism, obligation is capped at 20% of electricity supplied.
Eligibility	A company engaged in generation of electricity from renewable sources and not having PPA under FIT is eligible for REC.	ROC is issued to an accredited generator, making the latter eligible to generate renewable electricity within the UK, which is then supplied to consumers by licenced electricity suppliers
Categorisation	Non-Solar RE Technology: Wind, small hydro, biomass, Biofuel-based co-generation; Municipal solid waste; Solar technology (Solar PV and solar thermal)	Hydro-electric, onshore wind, offshore wind, wave, tidal stream, solar PV, geo-thermal, geo-pressure, landfill gas, anaerobic digestion, Co-firing of biomass, energy crops
Banding/Multiplier	RECs are divided into two categories solar: RECs and non-solar RECs. No technology-specific banding is provided.	Various REC technologies categorised under four bands. Technologies in the established band will receive 0.25 REC/MWh; Reference band, 1 ROC/Mwh; Post demonstration band, 1.5 ROC/Mwh; Emerging technologies, 2 ROCs/MWh.
Pricing	The price of one ROC is set by the market and to be	The price of the ROC is set by the market and

	traded between the floor and forbearance price; Central commissions specify floor and forbearance price for solar and non-solar RECs. The floor and forbearance price is set for five years up to FY2017. There is no price visibility beyond that.	reflects the size of the difference between the percentage of RE electricity generated in the UK and the RO percentage. The ROC buyout price was set at 30 Euro in 2002 and adjusted every year.
Trading	RECs are traded separately from electricity. They can be traded only through power exchange. Voluntary market is negligible.	ROCs can be sold directly to suppliers. These can also be traded separately from electricity. REC market is characterised by obligatory market and voluntary market.
Monitoring and Compliance	State commission specifies RPO for obligated entities. RPO is administered by state commission. Regulations provide that if the obligated entities do not meet their RPO targets, which may create shortfall in the units of RPO, the commission may instruct the obligated entity to pay an amount equivalent to the shortfall in quantum of RPO multiplied by the forbearance price of REC.	The RO order places a mandatory requirement on licenced electricity suppliers---supply electricity from eligible RE sources or pay a penalty---and obligates suppliers to meet their obligation on or before 1 September ____. The order allows suppliers to meet their RO by either presenting ROCs or paying an equivalent amount into the buyout fund; All buyouts are redistributed to suppliers who have presented ROCs against their obligation proportionate to the number of ROCs that each has

		presented. Late payments can be made by the suppliers up to 31 October.

Sources: CERC RE Tariff Regulations-2012, CERC REC Regulations 2010, RO Order 2002, OFGEM.

These features are:

- Currently, the REC framework in India does not specify a sunset clause, which is present in the ROC framework of the United Kingdom up to 2037. The REC mechanism in India has no long-term visibility. That is, it does not have any long-term, national-level RPO. In contrast, the United Kingdom has a clear mandate in its law to achieve the 20 percent RPO target by year 2020.
- India's REC mechanism categorises its RECs as either solar or non-solar. Such dichotomy potentially reduces liquidity and trade in the two separate markets as compared to a common market in the case of ROCs. The United Kingdom's unified market of ROCs uses a multiplier for different sources. The objective is to provide greater support to emerging technologies using a higher multiplier than for matured technologies. The value is gradually reduced in line with their cost competitiveness. For the RECs, a pre-specified schedule of declining multipliers provides a benchmark for cost reductions to aim for so as to remain viable in the changing environment for a particular technology.
- Currently, trade in RECs is allowed only at the exchange platform in India. In the United Kingdom, the forward market allows bilateral over-the-counter trade to take place. Sellers and buyers agree to trade ROCs. Buyers could be obligated entities, market makers and traders. Such provides liquidity in the market.
- The REC regulations in India specify that RECs are valid for 365 days from the date of issue. There is no safeguard in case of oversupply of RECs. In the case of the United Kingdom, its ROC mechanism facilitates banking of certificates. This can be an aspect India can look into for its RECs as banking of certificates could also be an economic solution to reduce the volatility in the REC prices.
- In India, if the obligated entity fails to fulfil its obligation, it has to pay a penalty at the rate of the forbearance price. Funds collected in this process can be used to buy the RECs from the open market. In the United Kingdom, an obligated entity that fails to fulfil its obligation has to pay the regulator a penalty in the form of a buyout price. This fund collected is then redistributed back to the other entities that have fulfilled their obligation. Such mechanism of redistributing the funds encourages more participation as it acts as an incentive to those entities that abide by their renewable obligations.
- The buyout price in the United Kingdom was fixed in 2001 and linked to the retail price index, which has had an increasing trend. In India, the forbearance price is the highest difference between the cost of generation/RE tariff and the APPC.

- India currently offers two alternate revenue schemes for investors in RE projects: (i) the FIT scheme; and (ii) the REC scheme. The present REC scheme does not allow certificates to be issued to projects registered under the FIT mechanism. On the other hand, the United Kingdom's ROC is the primary instrument for fulfilment of RPO.
- In India's current mechanism, RECs are required to be traded between a determined floor price and forbearance price. There are no floor and forbearance prices in the UK's case.
- In the United Kingdom, the buyout price is set as the difference between the electricity cost and the anticipated value of marginal cost.

5. Government's Role in Promoting the Uptake of RE Under Market-based Approaches

The contrast between the United Kingdom's ROC model and India's REC framework underscores the need for a policy design to take care of the concerns of buyers as well as sellers. As the first level of intervention, incentives should be provided to induce buyers to come to the REC market. Analyses have revealed that one of the reasons for buyers' reluctance to come forward is that the REC in its present form is not a viable proposition for them. As mentioned earlier, in the case of the United Kingdom, the obligated suppliers meet their renewables obligation by either presenting ROCs or paying an equivalent amount into the buyout fund as penalty. All such buyout payments are redistributed to suppliers who have presented ROCs against their obligation, in proportion to their number of ROCs. This serves as incentive for those who have fulfilled the RPO targets. In a developing country context, there should be an incentive to encourage states to set and fulfil higher RPO target. The incentive level for RE resource-deficit states should differ from that for RE resource-rich states. That is, incentive for resource-deficit states should be designed to take care of the higher cost of compliance, while that for resource-rich states should aim to help create transmission infrastructure and to set up a flexible energy generation so as to balance the variability of RE resources.

Traditionally, incentives in developing countries have been targeted towards investors only. This study does not imply that incentives are not required by investors, but it suggests that the irritants from the buyers' point of view should be recognised and

corrective policy decisions taken to address these. Incentivising and inducing the buyers would, in turn, also help investors in the long run. For example, RE generation facility can come up only in the states rich in RE resources. But higher penetration of RE generation, especially in wind and solar---which are variable and uncertain in nature---brings with it challenges for the host state in terms of managing grids and arranging balancing power to match the variability of the infirm RE sources. This causes operational and financial stress on the distribution companies---i.e., the buyers of the host state. Such stress, on top of their present weak financial health, leads them to develop a resistance against RE generation. Unless these issues are addressed through suitable policy interventions such as incentive schemes, the promotion of RE in general, and sustainability of the REC framework as well as the wind and solar industry in particular, would not be attained.

Incentive is a short-term measure; in the long run, there is a need for a policy framework to make REC a win-win proposition for buyers as well as sellers. A framework should be designed whereby REC is credited to every unit of RE generation irrespective of whether the said generation has been sold through preferential tariff /regulated tariff or otherwise. Buyers of RE generation through preferential tariff could earn REC credit along with the energy. The RECs earned by the buyers in this manner can be used to meet RPO and any of their surplus RECs can be sold in the market to mitigate their high RE purchase cost. This framework would, however, imply a paradigm shift in the existing policy design for the promotion of RE in general and REC in particular.

This suggested model is based on lessons from other nations but customised to meet the specific needs of Asian countries. In the United Kingdom, RE generators participate in the power market for the sale of electricity components and then get credit in the form of ROCs for every one megawatt hour of electricity generated. For India, the first part is not recommended---that is, it is not suggested that the wind and solar plants be made to compete with conventional sources in the power market for the sale of electricity components. Long-term contracting, either through cost plus regulated regime or through competitive bidding, can continue as at present for these RE sources. This is considered necessary for investment certainty in such infirm sources of power over the longer term. However, the second component of the UK ROC system is recommended for India. All RE generation should get the REC credit and in the event that a buyer contracts such RE generation, the REC credit, along with the energy, should be transferred to the buyer. At the same time, the energy generation company shall have the liberty to sell its electricity in either bundled or unbundled form.

Once an REC framework that presents a win-win proposition for buyers as well as sellers has been developed, it would be desirable to set appropriate levels of RPO to generate the demand for RE generation and consumption. At the same time, regulators should ensure that all obligated entities comply with the RPO. It should be made clear to all that non-compliance of RPO will entail penalties. In addition, compliance should also be ensured through appropriate commercial mechanisms such as imposing non-compliance charges on an obligated entity that fails to meet the desired level of RPO. In the UK, the compliance with the RPO is strictly monitored by the regulator, and the penalty framework of buyout price has turned out to be an effective deterrent against non-compliance of RPO.

It is equally important that there is clarity and policy certainty over the long-term sustainability of the REC framework and visibility of revenue . In UK, the Renewable Obligation (RO) Order initially set the RPO target at 3 percent for the period 2002-2003, with the aim to further raise it to 15.4 percent by 2015-2016. On 1 April 2010, the scheme's time period was extended from 2027 to 2037. Similarly, in India, the Electricity Act of 2003 and National Electricity Policy and the Tariff Policy should clearly stipulate that they are empowering the CERC to decide the time frame for the continuation of REC. The CERC should specify in its regulations that the REC will be issued to eligible RE generators for at least 15 years.

6. An Evolving Policy Landscape of Market-Based Instruments in Asia

Market-based instruments for RE and energy efficiency have evolved significantly over time. In India, for example, renewable energy policies have moved from feed-in-tariff to auctioning of REC mechanisms. Conversely, China transitioned from an auctioning programme for wind power to feed-in-tariffs to a regulatory command-and-control approach that directly imposes renewable obligations. In the area of GHG policies, South Korea encouraged the domestic voluntary market and established mandatory GHG targets for major industries before transitioning to a cap-and-trade programme in 2015. While some of China's pilot trading systems are getting off from the ground, several are still in the process of collecting necessary data, engaging with private sector operators, and developing institutional frameworks.

Market-based instruments can either incentivise or disincentivise behaviours. In the case of nations covered in this study, the mechanisms quite strongly leaned toward the positive outcome. In most emerging economies in Asia, the use of incentives is more extensive than the use of taxes or policies that increase the cost of a given activity. Most incentives aim to remove financial barriers, particularly the higher cost of renewable energy production. These are often integrated into or supportive of energy or climate or industrial development policies. China employs both command-and-control and market-based mechanisms such as by combining policies that support efficient renewable energy purchase and those that increase taxes on fossil fuel use as well as preferential lending to RE industries such as those on solar and wind. As examples of disincentives, India applies levies on coal, while Japan imposes taxes on electricity from non-renewables as well as considering the implementation of an economy-wide energy tax.

7. Conclusions

Considering that there remain policies and market structures that inhibit renewable energy development and energy efficiency improvements, market-based approaches such as RECs have huge potentials. However, they need to address several pre-requisite issues. While energy policy and energy market structures are crucial, there are options that the renewable industry may consider so as to be well placed to take advantage of market-based instruments, including identifying multiple income streams from RE and energy efficiency projects; bundle or pool carbon credits for small projects; streamline certification, verification and monitoring; and promote RE and energy efficiency as a GHG solution.

Renewable electricity projects can potentially create several income streams such as REC credits for national targets – a nominal market value; carbon credits – a range of permit prices; Green power premium – more for RE than standard rates; and Standard price of electricity – to the customers. They should be identified and integrated.

Many RE projects, especially off-grid projects, are often small, making the cost of monitoring the MBI uneconomic and the REC prices fluctuate. A large pool of RE projects could balance off these fluctuations. Certification, verification and the sale of credits from numerous small- to medium-sized RE projects could be bundled and sold without the buyer having to be directly involved in the on-the-ground projects.

Multiple institutions that work without targets and non-standardised approaches can find their cost increasing and effectiveness falling. Thus, to streamline the certification process, monitoring is a must. Correcting existing institutional flaws and providing policy and programme support through legislations are thus elements that can make RE and energy efficiency under market-based approaches succeed.

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