ECONOMICS, BUSINESS ADMINISTRATION, TOURISM AND STATISTICS

PRACTICING OF RENEWABLE ENERGY AUCTION SCHEME — EXPECTED SOCIETAL & ECONOMIC GAINS FOR THE DEVELOPING COUNTRIES

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Abstract: *With the devastating impacts of climate change, it is evident that many polls show a shift in power generation from fossil fuels to renewable energy. To support this transition, flexible and adaptable support mechanisms are required to maintain a stable and attractive environment for investments in the renewable energy sector, while ensuring the reliability and sustainability of the energy system in an economical way. Auctions have gained momentum as a dominant strategy, either solely or in collaboration with supplementary trials, to provide incentives for renewable energy deployment. The auction mechanism has expanded widely, with only six states accepting Renewable Energy Sources (RES) auction in 2005, and at least 84 states adopting this tool by 2017. This study aims to explore the potential of the auction mechanism in promoting renewable energy in the developing countries like Bangladesh, which has yet to add the required capacity to its energy mix due to the lack of a suitable support scheme to achieve its carbon neutrality goal. The research outlines the opportunity to design auctions based on qualitative research along with levelised cost of electricity (LCOE) model as quantitative part, the impact of auctions on energy costs and thus the feasibility of suggested auctioning schemes based on country-specific empirical evidence and benefits to develop an auctioning model for the countries. The potential auction model will add further positive value to the society as well as the both local and national economy. The results indicate that a systematic auctioning scheme with socio-economic development instruments, under a qualification requirement, can ensure various benefits for an emerging state with renewable energy resources.*

Keywords: *Renewable Energy; Auction; Socio-Economic Development; Gains*

JEL Classification: *D44; O13; P28; Q42*

1. Introduction

Electricity has been generated by burning fossil fuels such as coal, gas, and fuel oils for decades. Developed countries have relied on these sources to build their economies and meet their electricity demands. Almost all economic activities require energy as an input, making the development of sustainable energy sources a top priority for most nations. But the energy sector alone accounts for two-thirds of global Green House Gas (GHG) emissions (Matthaus, 2020). The excessive amount of CO2 in the air is the primary cause of global warming and climate change. As the detrimental effects of climate change become more apparent, many countries are calling for a transition away from fossil fuels in power generation and an increased focus on renewable energy sources (RES) to combat this problem. A joint analysis conducted by the International Monetary Fund (IMF) and the International Institute of Applied System Analysis suggests that transforming our energy system is not only a significant challenge, but also a huge opportunity for economic growth and job creation. Zhang et al. (2021) conducted a study using provincial data from China between 2000 and 2017 to investigate the effects of low-emission electricity and found that increasing the ratio of low-emission electricity to total electricity by 1% could increase GDP by 0.16% and decrease CO2 emissions by 0.848%, thereby promoting low-carbon economic development. Similarly, Rennkamp et al. (2017) state that renewable energy policies can reduce CO2 emissions while also promoting socio-economic development.

The increasing adoption of RES across the globe can be attributed to the falling prices of RES, technological advancements, and growing environmental concerns. In addition to reducing the costs, fiscal incentives for RES investments have also been found to reduce the Levelized Cost of Energy (LCOE) by 16-33% in developing countries. This impact of renewable energy (RE) support systems on average prices is supported by evidence (IRENA, 2020; Castillo-Ramirez et al., 2017). Moreover, Hochberg and Poudineh (2018) argue that auctions provide an effective means of distribution for governments and a market-based approach that addresses several objectives such as promoting renewable energy, reducing tariffs, attracting foreign investment, improving reliability, regulating CO2 emissions, and supporting economic development. Energy efficiency and competitive RE programs have been identified as potential areas for cost savings and a win-win situation where economic development and emission reduction can be achieved (Rennkamp et al., 2017; Beg et al., 2002). Additionally, IEA (2021) points out that targets and competitive auctions can facilitate the transition of the electricity sector to wind and solar technologies.

Contrary to global best practices, power projects in Bangladesh (both conventional and renewable energy) are still awarded on an unsolicited basis, such as through Power Purchase Agreements (PPAs) or Requests for Quotations (RFQs), and tariffs are determined through direct negotiation between the Bangladesh Power Development Board (BPDB) and Independent Power Producers (IPPs). This has resulted in higher prices for renewable energy compared to global trends. Cost declination by following auction schemes with modern hands-on methods is a positive sign for global energy generation from renewable energy sources.
The objective of this paper is to examine how the design features of renewable energy auctions influence auction outcomes and the associated societal and economic benefits. To accomplish this, firstly the author conducts a thorough and systematic literature review to provide an overview of auction design features and their effects on auction outcomes. Secondly, the author identifies the design features that may have varying impacts on different technologies and analyzes their effects on the levelized cost of energy (LCOE), which is a measure of cost competitiveness. The paper focuses on two renewable energy technologies: solar PV and on-shore wind.

2. Literature Review

The RE auction/tender process is a method that helps countries to acquire clean and green energy at competitive prices. In this process, the government establishes guidelines and procedures for buyers and suppliers. Renewable energy suppliers compete against each other for contracts to produce power for buyers. The buyers select the offering with the lowest price. The government sets the auction volume that is required in the auction process. Bidders then propose prices and auctioneers make bids. The final price is determined based on either the ranked bids, resulting in a uniform pricing, or the pay-as-bid (PAB) method, where each individual's bid is taken into account (USAID, 2019).
The auction system for renewable energy (RE) projects is often considered economically efficient because the compensation process is competitive, and the cost is usually close to the bidders' actual cost. This system allows for more efficient expansion of capacity. The regulatory body establishes the quantity, and project developers use a bidding system to determine viability (Bichler et al., 2020; Yalili et al., 2020; Mora et al., 2017; del Rio and Linares, 2014; IRENA, 2013). This process is considered a flexible one, and policymakers must adopt it considering a country's specific circumstances to achieve renewable energy volume targets. The auction

scheme has the ability to balance cost and effectiveness (Shrimali et al., 2016). Under the auction scheme, a RE project development follows four steps: planning, winner selection, construction, and operation (Botta, 2019). According to IRENA (2019), the factors that affect the price resulting from auctions are (i) country-specific conditions; (ii) investors' confidence and learning curve; (iii) policies supporting renewables, and (iv) auction design. Kitzing et al. (2019) highlight that when there are budget and volume limitations, RES auctions can be an efficient mechanism for allocating support.

According to del Rio et al. (2017), auctions can be a cost-effective way to support renewable energy projects. The authors found that compared to a feed-in tariff (FiT) or feed-in premium (FiP) support scheme, auctions can reduce support costs by 5% and 23%, respectively, for the EU in 2030. However, the amount of cost savings varies depending on the market scenario, technology, and auction design of a specific country. Botta (2019) suggests that auction design features can lead to prudent improvements in financing costs by lowering the cost of equity by between 0.5% and 1.5%. The auction system has the potential to reduce compensation and avoid overcompensation, but it must be designed and implemented correctly (Bichler et al., 2020; Mora et al., 2017; del Rio and Linares, 2014). This view is supported by AURES II (2020) in achieving the robust deployment of renewable energy and meeting climate targets.

Blazquez et al. (2016) proclaims that successful infiltration of RE could fall victim to its own success in slackened power markets, enhancing the cost of future positioning of renewables and lessening their scalability and the situation in being mentioned as the ‘renewable energy policy paradox’. For overcoming the situation, the authors suggest for auction (more specifically pay-as-bid auction) for alternative price setting mechanisms as of receiving actual bid for each market generator, again up to the uppermost market clearing bid. Further, for local industrial development, RE auction scheme may be seen as an opportunity and for this policy makers need to focus on the localization of production activities (Hansen et al., 2020; Bayer et al., 2018; Hochsteller and Kostka, 2015).

Local content requirement (LCR) has a contributory role in NIMBY syndrome. In this connection, del Rio (2019) urged for the local community support. Botta (2019) argues that for reducing/abolishing the NIMBY syndrome, there is an obligation to offer a fixed percentage of project shares to local residents. This step not only mitigates the risk but also ensures financial gains to promote RE and expands support. Other side, the LCR feature can be linked to a location or site-specific auction, where the government chooses the project site and may partially or fully pre-develop it. The government establishes a target volume for the auction, and bidders compete for the right to construct their projects at the selected site. For example, in Zambia's initial auction round, issues with the government's choice of project sites resulted in additional development work following the award of projects (USAID, 2019). Based on 120 studies and above citied literatures, a list was created that focused on different features of auction design for constructing a feasible auction scheme for the developing countries like Bangladesh (that yet not enters into the auction scheme) in table 3. Policymakers can incorporate these design elements in line with the country's overall goals to maximize the societal and economic benefits of renewable energy deployment (Gephart et al., 2017; IRENA-CEM, 2015).

3. Methodology

3.1 Qualitative Segment

To investigate the appropriate auction design process, a qualitative study was conducted. A systematic literature review was piloted with three objectives in mind: first, to assess the potential of auctions; second, to identify auction design features; and third, to determine the benefits of auctions based on country-specific empirical evidences. Another systematic literature review was conducted to examine the use of auctions in relation to cost-effective renewable energy deployment. This review included a reproducible search and applied explicit criteria for study inclusion and exclusion, as outlined by Sovacool et al. (2018). A semi-structured approach was taken, following the methodology proposed by Petticrew and Roberts (2006). The peer-reviewed literature on renewable energy auction design was searched in the Scopus database using the keyword "renewable energy auction design." A snowball sampling method was used to identify additional articles based on the references cited in the initial articles, following Cooper's (1998) approach. In addition, country-specific policy reports, guidelines, organizational reports, and policy papers were also included to provide a comprehensive overview of the literature on auction design and its benefits. This process yielded a list of 180 studies for further analysis and from there a subset of 120 studies was selected based on their relevance to the link between auction design, benefits, and country-specific evidence. These studies were summarized in Figure 1. The majority of the studies were qualitative in nature. Based on the 120 studies, a compiled list was created that focused on the key features of auction design, such as auction pricing rules, technology and location specificity, auction volume, and auction outcomes. Specifically, the qualitative screening of the studies explored how the systematic integration of socio-economic development instruments and qualification requirements in the auction design could result in diverse benefits.

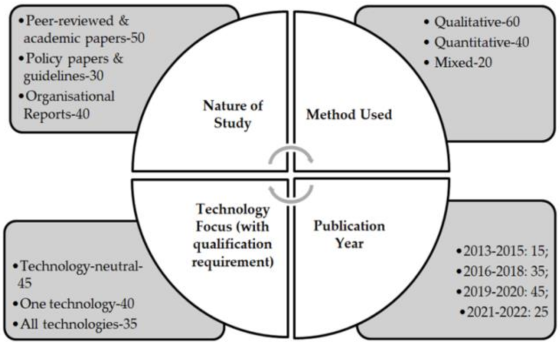

Figure 1: Compressed qualitative summary
Source: Author's creation based on the characteristics of articles

3.2 LCOE Model

Next, the quantitative analysis utilized the Levelized Cost of Electricity (LCOE) model. LCOE measures the average cost of generating one unit of electricity in a given power plant and represents the minimum price at which electricity must be sold to break-even (Reichelstein and Sahoo, 2015). This study focuses on Bangladesh as its sample area. However, LCOE data for Bangladesh is not available in international databases and then it was obtained through personal communication with relevant companies. The data for the other countries were collected from the International Energy Agency (IEA-NEA, 2020) database. LCOE was calculated based on the generation cost of renewable energy from two solar and one on-shore wind power plant that are recently implemented or under implementation under the utility-scale (IPP model). This was done to compare the factual portrayal of energy cost in Bangladesh with countries which are following the RE auction scheme. To calculate LCOE, the total average cost of building and operating the power plant over its entire lifespan was divided by the total electricity production of the plant over its entire lifespan (Equation 1).

$$\mathrm{LCOE} = \frac{\text{Initial Investment} + \sum_{t=1}^{n} \frac{\text{O \& M Expenditure}_t}{(1+\text{CoC})^t}}{\sum_{t=1}^{n} \frac{\text{Electricity Generated}_t}{(1+\text{CoC})^t}} \quad \ldots\ldots\ldots.. (1)$$

where, Initial Investment = the initial cost or capital cost/mega-watt (MW) (CAPEX) at t = 0

O & M Expenditure_t = inflation adjusted operation & maintenance cost/MW and each year (OPEX)

Electricity Generated_t = electricity generated in mega-watt-hours (MWh) per MW each year corresponding to the annual full-load hour (FLH)

n = the lifetime of the plant
t = year
CoC = cost of capital/the discount rate privately

4. Results

4.1 LCOE Analysis

Comparing with some auction scheme practicing countries, the LCOE is higher in Bangladesh and the country has not been implemented auction scheme yet. Thus, the capital costs are higher here; for example, the total capital cost to establish a 7.4 MW solar PV is 44.45 USD/MWh, whereas a total capital cost of 31.91 USD/MWh was required in India to establish a 35 MW plant and in France it required 30.42 USD/MWh to establish 25 MW RE plant (table 1). Both the countries follow auction scheme to establish RE plants (Altenburg and Engelmeier, 2013; IRENA, 2013). Other side, for the case of utility scale on-shore wind plant, India needed 32.19 USD/MWh as capital cost for founding 65 MW plant. Following the unsolicited path, Bangladesh needs 45.92 USD/MWh as capital cost for launching a 55 MW plant (table 2). Another notable segment is CoC/discount rate, 12% CoC was applied for each of the two solar and one on-shore wind plant for Bangladesh, which is higher than the current global trend.

Table 1: LCOE data (for utility-scale solar PV)

Country	Plant size (MW)	Construction costs (USD/MWh)	Refurbish-ment costs (USD/MWh)	Decommis-sioning costs (USD/MWh)	Total capital costs (USD/MWh)	Discount rate	LCOE (USD/MWh)
France	25	30.17	0	0.25	**30.42**	0.07	**33.94**
India	35	31.65	0	0.26	**31.91**	0.07	**35.60**
USA	100	38.55	0	0.32	**38.87**	0.07	**44.25**
Brazil	25	39.17	0	0.33	**39.5**	0.07	**46.02**
China	20	42.4	0	0.35	**42.75**	0.07	**50.77**
Canada	20	55.39	0	0.46	**55.85**	0.07	**62.47**
Bangladesh*	**7.4**	**42.33**	**0**	**2.12**	**44.45**	**0.12**	**45.41**
	50 (IPP model)	**59.61**	**0**	**5.96**	**65.57**	**0.12**	**70.62**

Source: IEA-NEA 2020

*Base data for Bangladesh were collected through author's personal communication

Table 2: LCOE data (for utility-scale on-shore wind)

Country	Plant Size (MW)	Construction costs (USD/MWh)	Refurbish-ment costs (USD/MWh)	Decommis-sioning costs (USD/MWh)	Total capital costs (USD/MWh)	Discount rate	LCOE (USD/MWh)
Brazil	30	27.38	0	0.23	**27.61**	0.07	**33.59**
India	65	31.92	0	0.27	**32.19**	0.07	**35.91**
Netherlands	50	25.42	0.3	0.21	**25.93**	0.07	**41.16**
Finland	30	37.62	0	0.31	**37.93**	0.07	**44.87**
Italy	10	37.65	0	0.31	**37.96**	0.07	**52.87**
	20	49.17	0	0.41	**49.58**	0.07	**59.52**
France	50	38.04	0	0.32	**38.36**	0.07	**56.09**
China	50	44.87	0	0.37	**45.24**	0.07	**58.42**
Bangladesh*	**55 (IPP Model)**	**45.92**	**0**	**0**	**45.92**	**0.12**	**54.19**

Source: IEA-NEA 2020

*Base data for Bangladesh were collected through author's personal communication

Discount rate (CoC) influences the LCOE significantly, because if the rate is high, then the LCOE will be enhanced and vice versa. For instance, if the CoC were 6%, then the LCOE for India's 35 MW solar PV would be 32.92 USD/MWh, i.e. just a reduction of 3.68 USD/MWh for a 1% reduction of CoC (IEA-NEA, 2020). The same scenarios (for both total capital and CoC) are depicted in the on-shore wind energy case. So, RE auction scheme is a helpful tool and will be a helpful toolkit in the RE market to ensure a low-cost energy with other positive returns. But obviously, the auction has to be tailored properly as per the requirement of the country. Further, for reducing the discount rate, the public entities are responsible to initiate different steps for the generators and the investors as it has an impact on launching the targeted amount of renewable energy in any country for hurtling the global net zero aim.

4.2 Renewable Energy Auction Model based on Reviewed Literatures

Based on the literature review, auction design elements can effectively ensure diverse returns both directly and indirectly, as well as competitive, low-cost energy. Auctions have been demonstrated to be a successful means of attracting new participants and aligning supply and demand when competition is desirable and feasible. They have had significant impacts across various economic industries (WBG, 2014). A list was observed based on the 120 studies which focused on the overall features of the auction design (del Rio, 2017; IRENA-CEM, 2015), with special focus on the auction volume (Kitzing et al., 2019; Schmidt et al. 2019), regularity of auctions (Hochberg and Poudinesh, 2018; Mora et al., 2017; Wigand et al., 2016), technology specificity (Mora et al., 2017; del Rio, 2017; Wigand et al., 2016), location specificity (USAID, 2019), auction price rule within which pay-as-bid pricing (Haelg, 2020; Shrimali et al., 2016; IRENA-CEM, 2015), ceiling price allocation process (USAID, 2019; Gephart et al., 2017), award criteria (AURES II,

2021; IRENA, 2016), auction type (GIZ, 2015; IRENA-CEM, 2015; Held et al., 2014; Maurer and Barros, 2011), remuneration type/form of support auctioned (USAID, 2020; del Rio, 2017; Förster and Amazo, 2016; GIZ, 2015), support period (del Rio, 2019; del Rio, 2017; IRENA-CEM, 2015), pre-qualification requirement (AURES II, 2021; Anatolitis and Grundlach, 2020; IRENA-CEM, 2015; IRENA, 2013), penalty (AURES II 2021; Rosenlund and Jaana, 2016; IRENA-CEM, 2015; Held et al., 2014). Moreover, several sources have shed light on how auction design can serve as a tool for socioeconomic development by implementing qualification and local content requirements. These requirements guarantee that bidders possess the necessary financial, technical, and legal expertise to execute the project successfully. Policymakers can introduce these design elements to maximize the socioeconomic advantages of renewable energy deployment, aligning with the nation's overarching objectives (Gephart et al., 2017; IRENA-CEM, 2015).
Table 3 presents an evaluation of the advantages and potential benefits identified in past renewable energy auction's outcomes. A renewable energy auction model proposed (as per table 3) for developing countries like Bangladesh, who are new entrants to the auction scheme, to promote robust deployment of low-cost sustainable energy with lower subsidies by ensuring more competition, high realization rates of the projects with varied technology, balanced grid expansion, and expanded socio-economic gains.

Table 3: Renewable energy auction model for the developing countries like Bangladesh

Category	**Auction Design Features**	**Gains**
AUCTION SCOPE	**Auction Volume:** Capacity (MW/year) [Government's yearly target should be divided into 3 slices as there will be 3 auctions per year]	• supporting high energy growth and fast capacity addition; • attracting more bidders, thus increasing competition and attaining a lower price; • offering guidelines to the bidders due to its simplicity and transparency; • encouraging private investment
	Auction Format: multi-unit auction	• reducing non-compliance risk; • improving cost & deployment effectiveness via boosting competition & differentiating developer-specific risk.
	Lead time to bid: 06 months	• attracting more bidders; • helping to speculate equipment prices;

Category	Auction Design Features	Gains
		• helping bidders to reduce auction uncertainties.
	Technology Specificity: Technology neutral	• promoting diversified energy-mix; • offering more competitive bidding within less expensive technology; • minimizing generation costs; • ensuring compliance with the applicable regulation demands; • ensuring stability and reliability of the grid; • improving the value of energy; • enhancing the dispatchability; • removing incentive by reducing windfall profit
	Location Specificity: Site specific (site/geographical location will be selected and developed by the government)	• allowing better coordination among project construction, required grid expansion and land acquisition; • balancing the electricity expansion areas; • reducing risks and costs (transition costs) for producers; • lessening uncertainty and obtaining good regional development; • faster project execution; • attracting new market entrants.
	Auction Schedule: Regular/systematic auctioning schedule [3 times per year]	• bringing a result of lower WACC; • promoting better guidance for placing the grid infrastructure; • ensuring a continuation of renewable energy project in pipeline; • decreasing risk, increasing investors' confidence and reducing the bid price; • technological progress and reduced technology prices through learning by doing process; • preventing underbidding as other projects are in the pipeline.

<table>
<tr><th>Category</th><th colspan="2">Auction Design Features</th><th>Gains</th></tr>
<tr><td rowspan="3">QUALIFICATION REQUIREMENT</td><td>Prequalification Requirement (financial)</td><td>Bid Bond [amount/ MW]
Performance bond [amount/ MW]</td><td rowspan="2">• confirmation of land ownership and grid connection agreement, lowering the possibility of project's non-realization, meeting contractual obligations and protecting fake bids (by bid bonds);
• sustaining the realization schedule and standard of the project (by performance bond);
• encouraging a high level of competition;
• lenient prequalification requirement lessens the risk for investors.</td></tr>
<tr><td colspan="2">Lenient Prequalification Requirement (material): detail project description, environmental assessment, etc.</td></tr>
<tr><td colspan="2">Local Content Requirement: 30 percent of the local content (like local employment, local labor for civil works, locally manufactured materials, etc. and then the investor will get an specific percent of tax credit by the authority)</td><td>• encouraging innovation and supply chain improvement; reducing local risk (NIMBY syndrome);
• ensuring local industrial development as a socio-economic development instrument;
• creating new employment generation, gearing up empowerment locally and/or nationally;
• facilitating regional economic development.</td></tr>
<tr><td rowspan="2">ALLOCATION PROCESS</td><td colspan="2">Auction Type: Static seal-bid auction</td><td>• straightforward and easy to understand;
• lower participation for the bidders;
• supply and demand are matched here;
• small actors can participate in bidding process;
• less vulnerable to collusion compare to dynamic auction.</td></tr>
<tr><td colspan="2">Pricing Rule: Pay-as-bid (PAB)</td><td>• offers actual bid price for each market generator;
• minimizing the cost of RE by discovering the real demanded price;
• favoring more financially viable projects;
• wider acceptance from a social and political standpoint;</td></tr>
</table>

Category	Auction Design Features	Gains
		• pathway for solving RE policy paradox.
	Award Criteria: Price only	• lowering bid price compare to multi-criteria auction; • preventing underbidding
	Price Limit: Ceiling price (disclosed)	• leading significant lower prices; • preventing excessive prices, collusion & price manipulation, thus giving bidders higher planning security; • attracting more participants even potentially weaker ones; • helping government acknowledge upfront potential risk if the auction scheme may not fulfill its intended role; • giving bidders more planning security and reducing allocation risk.
CONTRACT DESIGN	**Remuneration type/form of support auctioned:** Contract for differences (CfD) [for first 3 years]	• zero premium payment to the generators as RE generators participate in ancillary services and market balancing; • no public subsidy, i.e., savings of public money; • strong signal for value of energy; • RE generators can sell energy directly to the wholesale market that helps the generators to be self-reliant for the future.
	Remuneration type/form of support auctioned: Fixed premium [from the 4th year]	• reducing bid prices for ensuring stable revenues; • stable revenues lessen risk premia and cost of capital (CoC); • encouraging competition by engaging small players
	Support Period: 15 years [may be less or higher depending on the goal and technological maturity of the specific country]	• enhancing the confidence of investors that influence to offer low cost for auction by a long term support period; • reducing LCOE, investment risks and CoC;

Category	Auction Design Features	Gains
		• enhancing competitions
	Realization Time Limit to build: Solar-24 months & Wind-36 months	• reducing risk for paying penalty with realistic realization time; • negotiating with manufacturers for low bid price; • helping to guess technology price
	Penalty: Gradual and proportionate penalty should be imposed based on the commissioning delay of the project	• proving the seriousness of the bidders; • managing underbidding risk; • establishing cost and deployment effectiveness.
OTHER	**Support Level Adjustment:** No adjustment for inflation. Contract will be done in USD	Signing contract in local currency- • increasing bid prices; • reducing the capability of developers for rising debt; • due to exchange rate fluctuation, risk & CoC increased

Source: Author's own creation by the reviewed literatures

5. Discussion and Conclusion

The access to energy is no longer a binary marvel – it is the quality energy access high up on the energy ladder (Burke, 2013) and not the mere quantity that is related to the economic development. In many places, RE technologies have proven valuable and sometimes vital. They play a significant role in sustaining current economic growth and have recently been instrumental in pushing the energy access boundaries around the world. The global scenario is changing rapidly, with the share of renewables in the energy mix increasingly globally. The growing emphasis on environmental issues increases public and private awareness and growing support of the topic. There is increasing pressure on the industry to meet such needs. Fossil fuel-based power generation could also lose its earlier role in the energy mix due to price reductions in constantly increasing power generation from RE. This can be partially explained by the theory of learning curves. Although FF-based power generation may gain price benefits from higher efficiency or smart technologies, the RE market is moving at a much faster pace. Wright (1936) provided a framework for forecasting cost declines due to cumulative production. Moore (1965) referring to the transistor market development – predicted it would double every two years because of time.

Others later explained the cost reductions by economies of scale (Goddard, 1982) or combined the abovementioned factors with each other (Swanson, 2011). Clean technology cost reductions arise from fundamental physics and lower input material costs from scale as well as lower labor costs through manufacturing automation and lower waste driven by higher efficiency. All these cost reductions appear naturally due to manufacturing scale and vertical integration rather from than performance improvements. Thus, the advances in clean technology are a function of experience and production, closely related to “learning by doing.”

Besides the learning curve-indicated technological progress, the new channels of support for RE generation have also contributed to the drastic fall in RE prices, thus improving the accessibility of energy for wider consumer groups. However, finance and sustainability are the most important design criteria for investing in RE. Studies show that significant results can arise from all support channels (Izgec et al., 2017), especially if designed carefully (del Río et al., 2021). The features of cost-effectiveness, enabling real price discovery regarding the project and resulting in a lower support level mean that many countries worldwide are shifting from feed-in tariffs to a competitive auction process (Kreiss et al., 2017). The impacts of the learning curve and the various support channels work together and strengthen each other, enabling lower prices to be the prime motivation for the further espousal of auction schemes globally.

Market based and lower support cost mechanism, i.e., auction scheme ensures the low cost clean energy for the mass people of the developing countries. The LCOE analysis proves that the per MWh energy cost (for both solar and wind) is higher in Bangladesh compare to other countries those practice auction scheme under clean energy policy. When today’s energy cost will be less, then the tomorrow’s investment will be higher in this sector. Being a driving force for every economy, the energy will play a perceive firm impact both in the society and the economy by uplifting the societal productivity, regional economic development, empowerment of the local community, clean energy employment, local industrial promotion, self-sufficiency of the local bidders and last but not the least the global environmental scenario. So, the prime responsibility of the policy makers is to tailor a technology-neutral, location-specific volume auctions, in conjunction with socio-economic development tools and qualification criteria, by which it is possible to achieve diverse benefits for economies with untapped renewable energy potential. Further, it is a recommendation for the policymakers that ‘current or at this moment solution’ concept is not applicable for the energy sector — rather long term planning is linked with the sector.

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