

Business Dimension of Solar Energy in Pakistan and Economic Development

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Abstract—Business advancement of solar energy matters to insinuate its viability so as to reduce energy shortage and bring economic development. This research evaluates business dimension of solar energy in Pakistan. Structured interview guidelines were made to access the perspectives of businessmen regarding obtainability status and demand of solar energy in the market. The study derives 80% results of business viability of solar energy. This study is advantageous to have better understanding related to the existing market tendencies of solar energy in Pakistan and establish a link between energy independency and business dimension of solar energy for economic development in the country.

Index Terms— Business Dimension; Economic Development; Energy independency; Guided Interviews; Observations; Pakistan; Solar Energy.

1 INTRODUCTION

THE energy generation and utilisation trends signify the status of energy sufficiency. Energy has been the utmost essential aspect that has influenced the structure of society since the industrial revolution. A readily available, obtainable, and inexpensive energy demonstratively impact the attribute of existence, the strength of national economies, the relations between countries, and the constancy of atmosphere. It is proposed that Pakistan needs to accelerate its energy generation capacity by 35% for fulfillment of its energy loads as the indicative Generation Capacity Expansion Plan (IGCEP) currently announced forecasts requisite of 3.3 to 4.6% annualized compound growth rate (ACGR) [1].

The unavailability of sufficient energy is directly relevant to the general populace. Nevertheless, the range of issues the individuals have to face in the absence of energy sufficiency is very long. The review of literature here focuses on the impacts of energy scarcity on individuals, so as to showcase why accomplishment of energy sufficiency in Pakistan is necessary. It begins with a broader perspective of linkage between energy and economic development demonstrating how energy scarcity affects economic development and acts as a reason of declining economic growth.

The Industrial Revolution established the ineluctability of energy for economic growth of societies in the late 18th century, closely followed by jockeying by the major powers for assured uninterrupted access to and, if possible, control over energy resources. There, however, was no sustained debate at academic and, even, at governments level to objectively study the nexus concerning energy consumption and socio-economic progress. Alan M. Strout, then a Research Affiliate with Massachusetts Institute of Technology's Energy Laboratory, while suggesting a strong correlation between per capita energy consumption and per capita income [2], lamented in as late as 1977 the lack of awareness about the interaction concerning energy consumption and economic progress in Central America [3]. A year later, the seminal work of Kraft and Kraft that

highlighted the unidirectional causality from GNP growth to energy consumption [4], as suggested by Strout, stimulated further research.

The research and myriad empirical studies on the energy consumption-growth nexus, however, yielded mixed results, and agreement on the track of causality between electricity consumption and economic progress is elusive till to date. Importantly, electricity in particular, being the most flexible form of energy required to constitute the infrastructure of socio-economic development [5], has been focus of research in developing countries. Some scholars find no important causal linkage between energy consumption and GDP growth [6]. The radical variance in conclusion of the studies is due mainly to the diversity in climate conditions, inconsistent energy consumption trends, the systems and phases of economic progress in a particular country, employment of nonidentical econometric methodologies, the existence of omitted variable bias as well as distinct time horizons of the studies conducted [7].

These, and many other empirical studies with diverse and often conflicting results have thus yielded four mutually exclusive propositions, as synthesised by Apergis and Payne: *The growth proposition* with unidirectional causativeness from energy consumption to economic growth; *the conservation proposition* having unidirectional causality from economic development to energy consumption; *the feedback proposition* postulating bidirectional causativeness between energy utilisation and economic progression; and *the neutrality proposition* suggesting energy consumption and economic growth to be mutually exclusive with no causal relationship between the two [8].

The interdependence of energy and economic development is widely covered in scholarly literature at international and national level. Not only is energy essential for economic progress but is also a quintessential of social development. It means that social development is linked to economic development, which depends on energy. There are certain research studies available from different countries concluding that the bond between energy and economic progression is not significant; however, mainstream literature has proven positive relation between the two.

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Energy thus, along with other factors of production causes economic growth. However if analysis is done in terms of per energy unit consumed, results may vary. Reason for this contrast is that better energy efficiency may have reduced per unit or per capita energy consumption whereas previously due to poor fuel quality more energy was needed to do a simple work. Working efficiency of the machinery and equipment has increased and now they use less energy [9].

Farhani and Ben Rajeb conducted study on 95 countries from 1971-2008. They used four different groups of countries based on different incomes. For the low and high-income countries, the relation is from GDP to energy, meaning GDP growth causes more energy consumption. Whereas for the middle and lower middle countries the flow of impact is bidirectional, meaning both energy and economic growth become cause and effect for each other. Results are different for different countries [10]. Using panel error correction model, Sadowsky analysed 18 emerging market economies and estimates bidirectional causal relationship between economic development and renewable energy utilization [11].

A study on Nigeria conducted by Ighodaro displays that there is unidirectional underlying association between electricity and economic development. It uses data from 1970 to 2005 and uses co-integration technique [12]. Erdal, Erdal, and Esengun conducted research study for Turkey and concluded that there existed bidirectional causal relationship between energy consumption and gross national product [13]. Another study on Turkey by Altinay and Kargol reported positive causality between electricity usage and economic growth, meaning electricity consumption causes economic upturn; the more electricity consumed, greater the economic growth [14].

Siddique and Majeed while working on energy and economic growth in South Asia conclude that energy has a long run relation with growth, financial improvement and trade [15]. Various studies have also been done on Pakistan highlighting impacts of energy on economic development. Aqeel and Butt conclude that energy is fundamental for economic development as electricity consumption can also lead to better economic situation [16]. Siddique while working on Pakistan argues that increased energy supply is linked to higher economic growth whereas its shortage would reduce or slow down economic growth. She also asserts that influence of all energy sources is not necessarily the same. Petroleum and specifically electricity are highly correlated and significantly important for economic growth [17]. Razzaqi, Bilquees and Sherbaz have also highlighted that energy plays significant role for GDP growth and economic development [18].

These studies and conclusions have far-reaching implications. The 8-9% annual GDP growth in Pakistan from 2005 to 2008 came with a corresponding about 8.4% annual increase in commercial energy consumption, the highest increase being in the industrial (12.5%) and commercial sectors (11.3%), followed by 5.7% in residential and agriculture sectors. Electricity consumption experienced an annual increase of 11.6% in commercial activities, 7.4% in the residential, 5.1% in industrial sector, and 7.1% in agriculture [19]. However, Pakistan's energy system as a whole did not witness a corresponding improvement, leading to the worst kind of power crisis and

prolonged power outages, which persist even today. This may explain the steep slowing down of Pakistan's economy post-2008 when power deficit remained 6000 MW on average. With such impacts of energy unavailability, it is truly imperative to center focus on variable renewable energy (VRE) as the most appropriate solution, specifically solar energy due to its abundant availability in Pakistan.

2 METHODOLOGY

The current study entirely centers on business dimension of solar energy utilisation in Pakistan. The obtainable literature presents copious amount on the same subject but this study presents data and the following discussions by using tool of guided interviews of businessmen indulged in to solar energy to have better understanding related to the existing market tendencies of solar energy in Pakistan.

2.1 Variables

The variables in this paper are mentioned below:

1. Solar Energy= Independent variable
2. Economic Development= Dependent variable
3. Business Dimension = Mediating variable

2.2 Methods of Data Collection

In total, 20 businessmen were interviewed to assess the status of availability and demand of solar technology in the field area. Solar Businessmen were selected from different areas of Punjab province of Pakistan.

2.3 Guided Interview for Businessmen

In order to have better understanding related to the existing market tendencies of solar energy in Pakistan, structured interview guidelines were made. Particular questions were asked about price, supply, after sales services and Government's support.

2.4 Observations

Personal observations were further applied on the facts and information gathered through guided interviews.

The *question* of the study; 'What sort of role can business dimension of solar energy play to clinch economic development? The *Purpose* of the study is: The purpose here is to appraise business dimension of solar energy utilisation with respect to economic development in Pakistan.

The *Objectives* of the study is:

1. To accentuate the suitability of solar energy founded on its business dimension.
2. To illustrate business dimension of solar energy in Punjab province of Pakistan.

The *Hypothesis* of the study is:

Economic development might be ensured with augmented trust on solar energy by highlighting its business dimension; thus the evaluation of market competitiveness and Government's support etc. is required.

3 RESULTS AND ANALYSIS

As demonstrated in this document, the numbering for sections upper case Arabic numerals, then upper case Arabic numerals, separated by periods. Initial paragraphs after the section title are not indented. Only the initial, introductory paragraph has a drop cap.

3.1 Price of Solar Energy Appliances

The first question included in the interview guidelines for businessmen was about the affordability of solar panels according to the economic conditions in areas of Punjab. Twenty businessmen replied differently, but the majority of them were of the view that due to technological advancement, the prices of solar panels have decreased for the last five to six years. Some years back prices were really high and were not affordable for the local consumer. Research shows that the current prices are much lower than those in 2016. As a whole 50% decrease in prices is experienced since 2011.

Salesmen and dealers of solar panels say that more decrease in price is required to enhance the sales. Moreover, most of the local consumers are dependent on agriculture; hence their purchasing power is limited. However, concerns were also shown regarding the quality of the product if the same pattern of decrease in prices continues into the future. It is also highlighted that three to four categories of solar panels of varied price brackets are available in the market. Hence, while the customers can choose according to their purchasing power, they have to compromise on quality. Although the prices of Category A and B seem expensive, yet these are not much higher when compared with the expenses of UPS and generator. It is expected that sales will increase with more decrease in prices with the operationalisation of CPEC resulting in lesser transportation costs, as maximum products (PV panels) are brought from China.

3.2 Demand for Solar Panels

The research shows that the demand for solar panels in Punjab is very high due to multiple reasons. First of all, demand is increasing on the basis of a decrease in prices. Secondly, upsurge in demand is seasonal as the region experiences extensive load shedding during summers and even power outages for consecutive two or more days in stormy weather. Thirdly, due to high load-shedding, it is even impossible to charge UPS when energy is gone for several hours or days. It is also observed that in the beginning when prices of solar panels were high, the demand was low and there were very few sellers in the market, but now various competitors have joined the market. Thus, due to expanded market, while the demand factor for an individual seller might have dropped down, yet the overall demand in the market has gone up.

Though the requirement of other electrical appliances is rising day by day, still the most important requirement in rural areas is a fan in the daytime, and for this purpose, the demand of solar panels is high. Another reason is the requirement by farmers in the agricultural field for tube wells. The demand of the solar panels and appliances is low in urban areas. The reason is better energy supply. While in rural areas the demand is high due to loadshedding. Thus, load shedding figures an important factor in the demand for solar energy technology. It indicates that the demand is necessity-driven and there is less

awareness about the user-friendliness, environment friendliness, and cost effectiveness of solar energy.

3.3 Supply of Solar Energy Appliances

Regarding the question asked about the supply of solar technology according to the demand, it is observed that there are no major issues on the supply side. The overall supply is adequate and sufficient enough to meet the local demand. The solar panels are being imported from China, as these are affordable when compared to expensive products by Germany and the USA. Sometimes minor delays in delivery are observed on account of customs clearance process and at times products get damaged as well. However, it is anticipated that these minor delays will also be reduced with the progress on CPEC. However, there is a need to improve the quality of products, as all products are non-branded. While discussing the after-sales services, it is observed that though the facility is being provided to the customers yet the sellers have never received any major complaint regarding solar panels. It is due to the zero maintenance cost of solar panels. The panels usually require only wash when these get dusty.

3.4 Credit/ After-sales Facility

The question was asked about the facility of credit sales and its impacts. More than half of the businessmen are providing facility of credit sales to their customers for a few months. Priority is given to Business customers in comparison to those of households. The product is given on monthly instalments to the customers on certain conditions including post-dated cheque and the presence of one Government employee as a witness. In the case of credit sales facility, approximately 30% increase in the price of solar panels is applied. When the impacts of this facility are discussed, it is calculated that it facilitates both stakeholders simultaneously. It increases the sales of the businessmen and most of the customers in rural areas also prefer to buy a product on easy instalments. Some of the sellers who are not providing this facility agree that if they start providing it to customers, their sales will increase, as the demand for credit sales facility is higher. However, they are not providing this facility because sometimes the recovery of monthly instalments becomes difficult. Consequently, it is advocated that the Government offer interest-free loans in rural areas so as to facilitate those who do not have the financial capacity to purchase solar panels and appliances.

3.5 Hurdles Regarding Solar Technology Business

Solar technology business in Punjab is not facing major hurdles. However, some problems were identified during the survey. Since solar panels available in the market are non-branded, the sellers have to provide warranty on their own behalf. It is required that well-known brands be introduced in the market so that customers can claim warranty as per rules. The issue of non-availability of spare parts is also related to the absence of well-known brands. The Government should also appropriately address the slow process of customs clearing. Lack of skilled labour for installation of large PV panels is also an important issue. It requires a proper institute for formal education to develop skilled labour. Unfair sellers are selling low-quality products at low prices. It affects those who are honest in their business activities. Thus, the local Government must enforce quality control.

3.6 Government 's Support

The Government should provide tax relaxation and subsidy in order to utilise solar technology. The Government is currently providing tax relaxation on imports of solar panels; however, it is necessary to provide tax reduction on solar-related appliances and other equipment such as spare parts as well. The prices of batteries are very high in the market due to which the utilisation of solar technology at the domestic level is low. If the Government reduces import duty and other taxes on batteries, it will help to increase the utilisation of solar technology. Businessmen also require loans on soft conditions and reasonable interest rates. The Government should also regulate the market to keep an eye on price setting trends and quality product. Importers earn more and retailers earn less. If there are proper regulations, prices will be stable and lower. Incentives must be given to the manufacturing companies to start production in Pakistan. It will help not only in managing prices but also in creating jobs. Besides, charges for letter of credit and customs clearing will also be reduced. There is a perception regarding supply and demand of solar technology that if the Government fulfils the energy demand, people will not opt for solar. However, the business community is of the view that the Government should prefer solar as it is the environment-friendly option and does not require any depleting source.

The Business viability of solar technology assessed on the basis of the perspectives of businessmen has been quite encouraging. While the prices of solar panels were exorbitant some six years back, technological advancements in the field and diffusion of the technology have brought these down to affordable rates for common customers. However, Pakistan's society being predominantly agriculture-based with low purchasing power, salesmen and dealers believe the prices are still high by local standards. This feeling is more prevalent in the rural areas.

It is also encouraging that the supply of solar technology vis its demand factor in areas most affected by load shedding and harsh summers, e.g. Punjab, is facing no major issue. The overall supply is adequate and sufficient enough to meet the local demand. Dependence mostly on Chinese products makes these affordable as compared to the expensive products of German and the USA make. This also reduces the shipment time, notwithstanding occasional minor delays in delivery during customs clearance process. Even these hiccups are expected to be addressed with progress in CPEC (China Pakistan Economic Corridor).

Due to low purchasing power in areas of punjab where the demand is more due to prolonged power outages and severe weather conditions, provision of credit sales facility by businessmen to their customers benefit both the dealer as well as the customer. It facilitates the consumer who is unable to purchase the items on lump sum payment while expanding business of the dealer. The dealer also benefits from the arrangement in terms of 30 % increased price of the panels. Arrangement for the credit sales facility is fairly robust being conditioned to receipt of post-dated cheque by the seller and the presence of a Government employee as a witness. However, there have been instances of problems in recovery of the instalments due to which not all sellers extend this facility, even

though they admit extending the same will increase their sales. This, by implication, necessitates Government 's intervention in terms of soft loan to the consumers for promotion of solar technology.

Lastly, although the Government is currently providing tax reduction on imports of solar panels, for optimal promotion of solar technology, it is necessary to provide tax reduction on other solar-related appliances and equipment such as spare parts. Beside huge variation in quality, the prices of batteries are very high in the market due to which the utilisation of solar technology at the domestic level is low. In order to promote clean energy, the Government may reduce import duty and other taxes on batteries to encourage the utilisation of solar technology. Solar technology market also needs to be regulated by the Government to ensure fair price and quality control. This will help stable price while also helping retailers who earn much less than importers. Most importantly, Government must incentivise manufacturing companies to start production in Pakistan. Besides helping manage prices, charges for letter of credit and customs clearing issues, it will also help in creating more jobs.

4 CONCLUSIONS

The Businessmen were questioned about the price, demand and supply, facility of credit sales, hurdles in the way of solar technology business and the support given by Government in this regard. The prices of solar energy related technologies have decreased in the past five to six years despite the increased demand from the general public. The technology is particularly popular in areas that are warmer and face longer intervals of load shedding, e.g. Punjab, where any other individual energy generation appliances like generators or UPS cannot be efficient enough. There are no issues in the supply and credit facilities are also given to the customers on the purchase of these technologies.

5 RECOMMENDATIONS

About eight of the businesses were accessed in Rawalpindi and Islamabad (Capital City of Pakistan). Their response to market price of the solar panels was different. Price of the solar panels and appliances, as compared to local purchasing power, is not high. There is a difference in the income of the residents of both areas, i.e. Punjab and Rawalpindi/Islamabad. This is why the price of panels is considered high in rural parts while fair in urban zones. Hence, it is recommended that the Government must intervene to enhance affordability of solar panels so that people in the rural areas can purchase solar panels easily. Moreover, the support of Government is only limited to tax waiver on the import of solar panels, it needs to be extended to all the related appliances.

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