

EVALUATING THE BARRIERS FOR SOLAR ENERGY APPLICATION TO INDIAN INDUSTRIAL SECTOR

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Abstract - India ranks sixth in the world in total energy consumption and Industrial sector in India alone consumes nearly 45% of the total energy. The balance between demand and supply of power is not being able to achieve, in spite of numerous growth in power generation over the years. With the 'Make in India' initiative of putting manufacturing at the heart of India's development will require a tremendous rise in the energy needed. Industry-based growth will require more energy per unit of value in comparison to the energy needed by the services sector. To meet this demand, the country needs to make a major shift to renewable energy sources. Among the various renewable energy resources, solar energy potential is the highest in the country. Hence, the abundant solar energy in the country will help in improving the energy efficiency levels in the Industries; creating a balance between economic development and environmental sustainability. However, considering solar technology for Industries face a lot of Financial, Social, Informative, Regulatory and Site Barriers, which can be overcome by proposing simple and clear business models for the sector covering all the parameters in detail, so as for smooth operation between solar technology providers and industries.

Keywords - Economic development, Energy Consumption, Industrial Sector, Power Demand, Solar Energy

I. INTRODUCTION

Even though India's share of the world's population is around 18%, its usage of world's energy is a meagre 6%. However, the potential for energy consumption growth in India is enormous, which has already almost doubled since the dawn of new millennium. Indian economy is growing rapidly, becoming the third largest in terms of Purchasing Power Parity (PPP). There are now further policies in place to press ahead with the country's modernization and an expansion of its manufacturing. India has been responsible for almost 10% of the increase in global energy demand since 2000. India's energy demand in this period has almost doubled, pushing the country's share in global demand up to 5.7% in 2013 from 4.4% at the beginning of the century. This upsurge in demand is primarily due to expansion in sectors, which are energy intensive, such as steel production, which has tripled in energy consumption. (Agency, 2015)

Due to fast pace of economic growth, India is among the fastest growing energy markets in the world and is still facing the deficit in energy production compared to energy demands. Over the past years, power tariffs have grown on average by 5% per year and the trend is expected to continue. India's energy policy is focusing on developing alternative sources of energy including solar and wind energy. The government plans to add about 20GW of solar power capacity by 2022. (Meier, 2014). Out of the total commercial energy available in India, about half of it used by the industrial sector. The commercial source of energy are primarily oil, natural gas, coal and lignite. The Indian energy sector is highly energy intensive and efficiency is well below that of other industrialized countries. There are constant efforts to promote conservation of energy as it helps in

reducing the overall cost of production. There is substantial room for increasing the energy efficiencies in industrial involved in textiles, chemicals, iron and steel, cement, fertilizer, pulp and paper, etc. There could be significant reduction in cost of production, if these Industries can promote conservation of energy. (Reddy, 2008)

The Government of India's 'Make in India' initiative of putting manufacturing at the heart of India's growth model aimed at a large rise in the energy needed to fuel India's development. Research indicated that Industry-based growth would require 10-times more energy per unit of value compared with growth led by the services sector. (India, 2014)

Ministry of New and Renewable Energy (MNRE) laid down the actionable plan in 2015 for renewable energy sector under its objective to make a leap ahead on the existing policies laid by the country. MNRE renewable electricity targets have been up scaled to grow from 43 GW in April 2016 to 175 GW by the year 2022, which includes 100 GW from solar power, 60 GW from wind power, 10 GW from bio power and 5 GW from small hydro power. These ambitious targets would make India one of the leading green energy producers in the world. The government intends to achieve 40% cumulative electric power capacity from non-fossil fuel sources by 2030. (Energy, 2016)

The main objective of this research is to identify the potential of solar power application in Industrial Sector. It endeavors to identify policy gaps in the incentives provided by the government, which withholds application of Solar Energy. The barriers to Solar Energy Potential for an Industrial Complex evaluated in order to suggest measures for an increased use of solar energy.

Electricity Consumption in India: The estimated electricity consumption increased at a Compound Annual Growth Rate of 8.72%, from 411887 GWh during 2005-06 to 948328 GWh during 2014-15. The increase in electricity consumption is 8.48% from 2013-14 (874209 GWh) to 2014-15 (948328 GWh). Of the total consumption of electricity in 2014-15, industry sector accounted for the major share (44.11%), followed by domestic (22.93%), agriculture (17.81%) and commercial sectors (8.27%). Following graph (Figure 1) represents the consumption data sector-wise: (INDIA, 2016)

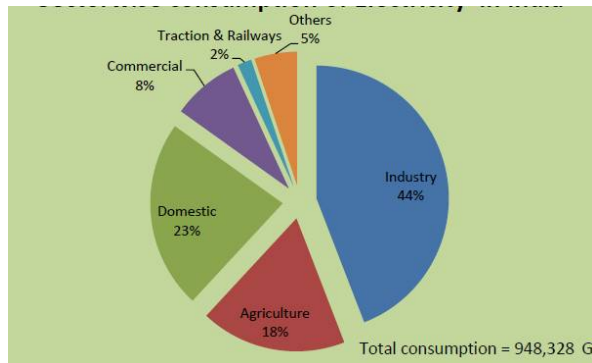


Figure 1: Sectorwise consumption of Electricity in India. Source: Energy Statistics, 2016

Renewable energy sources: The Various renewable energy sources like wind, solar, biomass, hydro and cogeneration bagasse have high potential of energy generation. The total potential for renewable power generation in India until May 2015 was estimated at 896603 MW. Following is the break-up of energy potential: solar power: 748990 MW (83.54%), wind power: 102772 MW (11.46%), SHP (small-hydro power): 19749 MW (2.20%), Biomass power: 17,538 MW (1.96%) and 5000 MW (0.56%) from bagasse-based cogeneration from sugar mills (INDIA, 2016) Refer to Figure 2.

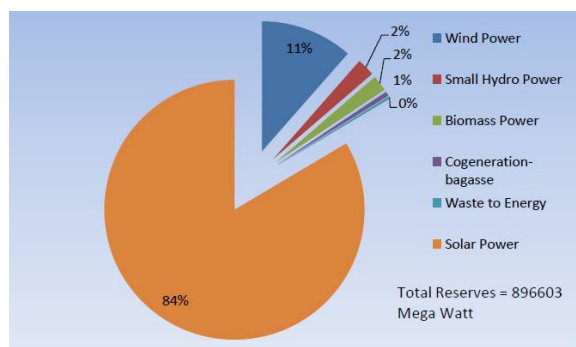


Figure 2: Sourcewise Estimated Potential of Renewable Power in India. Source: Energy Statistics, 2016

Government Level Initiatives: Considering the manufactures as an indicator of industrial development many initiatives are taken at government level, some of which are discussed in the following section.

Make in India: Make in India initiative was launched on September 25, 2014. The primary goal was to encourage both domestic as well as multinational companies to manufacture their products within India thus, making India a global manufacturing hub. Led by the Department of Industrial Policy and Promotion, the primary aim is to raise the contribution of the manufacturing sector from current 16% to 25% by the year 2025. New initiatives like promoting foreign direct investment, implementing intellectual property rights and development of the manufacturing sector were introduced by the Make in India program. (India, 2014)

The Jawaharlal Nehru National Solar Mission (JNNSM): After the launch of the JNNSM, Indian Solar PV market has seen significant growth. Grid connected Solar PV mainly consists of 3 types; ground mounted, rooftop and distribution grid plants. With the setting up of regulatory arrangements, national and local enabling means, and targeted policies, including suitable subsidies and financing arrangements, the total installed capacity rose from 40 MW in 2010 to 2686 MW as on 30 June 2014. JNNSM Phase I installed an average capacity of 1686 MW and Phase II added an additional 100MW under the implementation of the JNNSM policy. The total installed capacity, as on June 2015, of grid connected Solar PV was 4060.65 MW, which includes initiative by central and state governments. In order to meet this target, the government is taking a number of measures, of which applicable to the industrial sector are listed below:

- Provision of Renewable Purchase Obligation (RPO) for solar power in the National Tariff Policy
- Concessional import duty/excise duty exemption for setting up of solar power plants, accelerated depreciation and tax holiday (MNRE, 2015)

II. METHODOLOGY

This research is carried out in two parts: a) descriptive b) Statistical and Cartographic Both primary and secondary data have been used. The primary Empirical data was collected by field survey and an online questionnaire survey. For field survey, a random sample of six Industries has been used, which are located in Sector I of Pithampur Industrial Area, Dhar, Madhya Pradesh. For online survey, questionnaire was sent to over 3000 Industries all over India, out of which 27(0.9 %) responses are received.

Secondary data was collected through various reports, scholarly articles and reference papers. Data has been cartographically represented by means of graphs and

cartograms. Some graphs have been given to justify the descriptive analysis.

III. DATA COLLECTION AND ANALYSIS

The surveyed Industries include sectors such as Automobile, Food-processing, Textile, Metal, Fabrication, Chemicals etc. Basic variables explored included site area, no. Of employees, tenure of the industrial-setup, annual turnover, connected load available, average monthly electricity bill are studied. Survey questions corresponded to awareness on energy consumption, global warming, climate change and optimization of resources. Other variables were the owner’s perceptions regarding solar energy, their willingness to shift to solar energy, the barriers they face as well as economic considerations in terms of their expected return on investment.

The findings of the survey is summarized as follows: Out of the industries that responded, 31% belong to metal & fabrication, 18% to Automobile, 13% to food-processing, 9% to Plastics and rest 18% to others. (Figure 3)

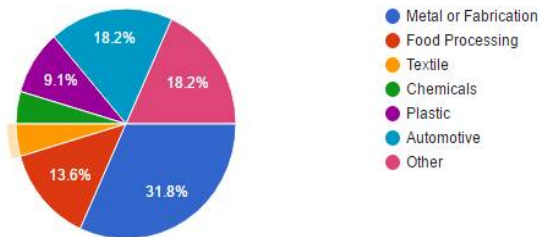


Figure 3: Typology wise break up of Respondents.

Out of the total industries responded, 68% industrial setup are more than 15 years old. Structural feasibility could be a barrier for older established industries. It would therefore be unclear whether these industries could support roof mounted Solar PV systems. (Figure 4)

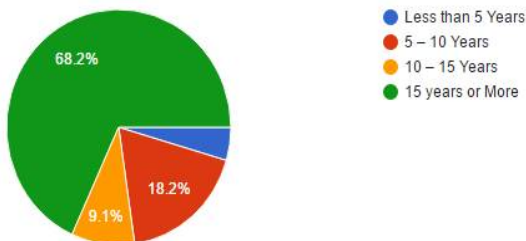


Figure 4: Distribution of Industries based on period of establishment

More than 40% people agreed that optimizing energy in industrial sector would help in solving environmental problems. (Figure 5)

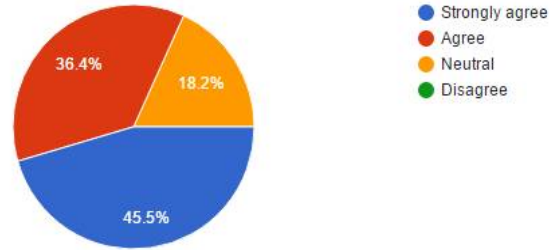


Figure 5: Responses on optimizing energy in industrial sector.

18 % of Industries responded already have solar power installed or using captive power for their set-up, but 81% are yet to shift to solar power to develop a balance between environmental sustainability and economic development. (Figure 6)

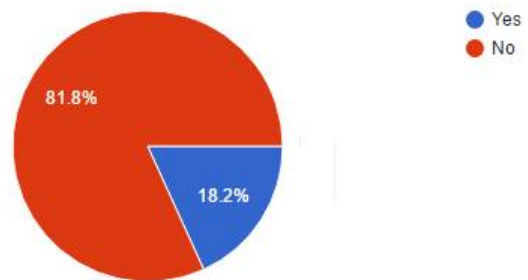


Figure 6: Percentage of Industries running on Solar Power

Secondary Data Collection and Analysis:

Financial analysis of solar energy: Setting up of Solar photovoltaic (PV) technology requires substantial capital expenditures. However, there have been recent developments in Solar PV systems that have dramatically increased the accessibility for its applications. Declining prices for solar PV panels over the past years have largely mitigated this problem. However, high initial investment costs of the systems poses a significant barrier for rapid deployment of solar PV. Nevertheless, if lifetime cost cycle of solar PV is considered, the initial investment can be justified. Many successful pilot projects have illustrated solar PV can provide reliable energy access for various industrial applications. Currently, battery banks for storage of power and charge controllers are often the most costly component in the entire installation; lowering this cost should be a top research priority. (Oluwatola, 2015). Solar PV systems will be considered by large no. of industries when innovative business models and financing schemes for industrial units are easily available. (Meier, 2014)

Following are the prominent incentives for Industrial Sector to switch to solar power:

- Accelerated Depreciation:** Industries can claim 80% depreciation in the first year and 16% depreciation in the second year. This

will provide them huge tax benefit on their existing business revenue.

2. **Renewable Energy Certificate:** The Industries, which invest in solar power plant for captive use on their unit, can acquire these certificates from the government of India. These certificates can be traded off on power exchanges in price ranging from Rs.9.3 per unit to Rs. 13.40 per unit.
3. **Net Metering Incentive:** Excess power generated can be supplied to the grid and these units will be deducted from government tariff.
4. **Tax Holiday for 10 Years:** The industries do not have to pay on revenue earned by selling excess solar power for next 10 years.(GOI, 2011)

IV. FINDINGS

The foremost barrier for implementing solar energy is lack of knowledge according to 41% of the respondents. Whereas, 36% industries surveyed are of the opinion that lack of finance and resources are the key barriers for considering solar power. (Figure 7)

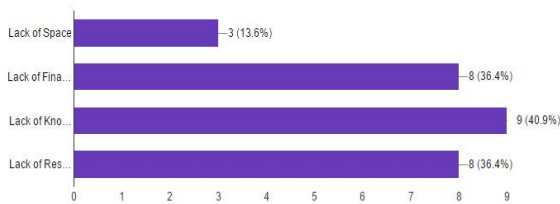


Figure 7: Key barriers for implementing solar energy

Among the respondents, 81% agreed that part load of their industries can be shifted to Solar Energy. However, 9% industry owners were of the view that their industry requires high intensity powers to run their processes, which cannot be shifted to solar power. (Figure 8)

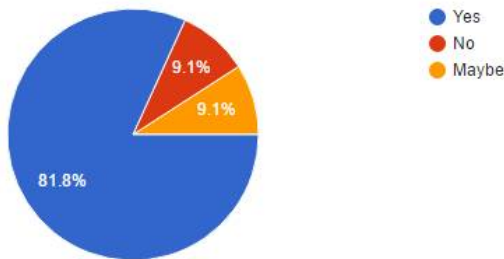


Figure 8: Opinion of Industries on shifting to Solar

If the return of investment in less than 3 years, more than 50% of respondents would shift to solar. However, based on the current feedback from solar panel manufacturers, this goal would be unrealistic. The more realistic period for return on investment would be 5+ years. This would only be acceptable to

5% of respondents. While, 36% respondents would be willing to consider shift to solar energy if they can get return on investment in 3-5 year. (Figure 9)

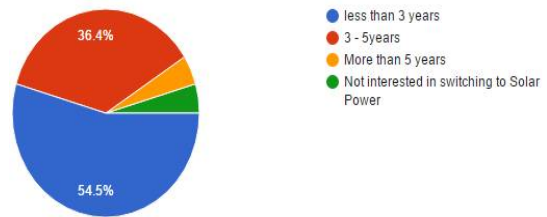


Figure 9: Industries Expected Return on Investment

V. DISCUSSION

The barriers identified by the respondents were lack of knowledge on the solar power technologies and consideration of solar power to be of low intensity, which cannot be applied to high intensive industrial unit. These barriers can be overcome by creating awareness of the technological advancement and application in the industrial sector. A better interface between solar technology providers and industries will build a reliable network for setting up of Solar based power systems for the Industries.

CONCLUSION

This research has identified five prominent barriers in deployment of solar energy in Indian industrial sector. Financial barriers include high – initial investment, expectation for quicker ROI (Return on Investment), and unfavorable financing policies. Informative barriers related to lack of awareness about solar power and lack of knowledge of its implementation. Communication gap between solar technology providers and industries, concern related to operation and maintenance, and low priorities for clean energy are the social barriers identified. Regulatory barriers include lack of enforcement of RECs, lengthy processes of Permits and Land acquisition clearances, Split Incentives in form of Tax depreciation for Industries. Limited availability of free space, Structural limitation for Roof – mounted PV systems are among the site barriers for industrial units.

Development of simple and clear industrial solar finance models based on parameters like site space available, power requirement, finance capacity etc. will help industries to switch to solar energy. Better understanding of solar systems available pertaining to scale and power requirement of the industries. Availability of low interest rate loans in addition to subsidy for solar power technologies.

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