SOLAR ENERGY DEMAND - A FACTOR OF STATE SUPPORT

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ABSTRACT

This paper brings out prime factor for solar demand as a dependent variable based on state support or a comparative status of two or more than two states. There exists a latent requirement to develop more sources of power in power scares country like India. Inspite of such latent natural demand, solar is largely based on state support. Growth trajectory of solar energy deployment can meet the demand of power in the country, where power is limited or area is not electrified but still demand does not naturally comes up until state intervene.

Keywords*: State Support, Solar Energy, Natural Demand, State derived demand.*

Introduction:

State support adds to the "Width" (Shukla and Mali, 2015) of planning variable as a "critical inputs" for supply chain planning in the industry. During the testing of the hypothesis for solar industry, it is assumed that all other supply chain planning variables, mentioned in the literatures (describing "width") are impacting but prime demand driver of solar energy demands in India still remains as a state support. It is attributed to central government supported, Jawaharlal Lal Nehru National Solar Mission (JNNSM), one of the most significant "width" factors has played a major role in triggering demand for solar energy in India. Though demand trend is correlated with the various stages and quantum of state policy support under JNNSM, split into three phases of deployment. Each of the phases is further split into two batches each.

Solar industry worldwide is passing through three phenomenons of excess capacities globally, especially largest supplies from China, falling prices and various state supports influencing the sector. Countries across the world are offering variety of support to grow the solar power to meet their power challenges with clean sources. The primary reason for such state support is renewable nature of solar energy and a clean fuel. In a given country including India, these three factors play a major role to decide on demand. The research objective is to establish specific relationship between state policies and demand. It is hypothesised that major source of solar energy deployment is state support rather than natural demand.

The research papers intended to study the state created and natural demand data for solar sector. Following two alternate hypotheses were posed to establish relationship of state policy support on variables of supply chain demand planning. First hypothesis establishes direct correlation between state support and demand whereas second one test the same hypothesis in reverse order that "Natural demand is comparatively less significant". These hypotheses are stated as below.

HA 01: Solar demand is a function of "state regulations and support", thus an input to supply chain planning.

HA 02: Natural demand factors are less significant than a state support derived demand in solar industry in India.

Body of Research Paper:

Literature Review:

A comparison of state supported demand is not very specifically covered by literature for solar industry. A general literature covering "coordination, "collaboration" and "integration" can be extended to state, as a one of the players required coordination, collaboration and integration. A strong coordination with the state can be established as a probable driver for demand in solar industry.

Solar demand and supply are extremely interrelated, solar supply chain bottlenecks are related to supply demand imbalances. One of the reasons for demand and supply imbalance is unnatural intervention of state. The demand with state factor had many peaks and trough, so as the supplies. For example, Chinese government supported strong solar manufacturing ecosystem that all major world's manufactures are based here. Similarly a demand success story of Europe have pushed country like Germany in which major source of energy is solar.

Initially, supply not being able to ramp up at the same rate as fast increasing demand, some are due to absolute constraints on materials, and some to regulation. While many of these bottlenecks are expected to be felt after 2015, some are already affecting Solar PV sectors today (Lehner, Rastogi, Sengupta, Vuille, Ziem, 2012) [2]. During later years, this trend is completely reversed, with more capacities of solar production than demand globally. This phenomenon shifted various direction of flow of material across countries. A number of countries, solar manufacturing plants are completely shut, whereas some countries excess capacities. Solar PV Boom & Bust PV market Cycle is a decision making uncertainty in PV market which is a major anticipation point for supply chain planners. (Global Solar Supply Chain Strategies: 2010-2015) [3].

An external integration is essential factor in SCM to achieve sustainable competitive advantage (Park, Cho, Kim 2014) [5]. One of such critical information of "state support" mechanism is further studied under one of the hypotheses for solar industry. (Hayes, 2002) [4] Argued that operations management has changed in many ways in the new economy era. The author proposed that operations analysis should consider not only the operating unit, but also a group of independent parts where companies develop on-going relationships with suppliers, customers and complementors. State is playing a role of a major complementor in Indian solar market.

Research Methodology:

The research was intended to bring up a relationship of solar demand and state policy, one of the "width" variable of supply chain, used in industry for "solar project planning" to achieve an optimum result. This research is a combination of analysis of secondary and primary data and insight based on interview responses from solar manufacturing, solar EPC contractor or developer of solar projects.

A small case study was undertaken in one of the solar company operating in all solar segments, to put forward research question and hypothesis. Case study Company chosen is a Bangalore based, Tata Power Solar. Since this company is oldest solar company in India and represent solar operations in all market segments.

Scope of research is to concentrate in area of Bangalore region, to build discussion back up of research work. Bangalore is chosen since five major solar players, manufacturers of solar cells or modules are present in this small geography. These players are Tata Power Solar, EMVEE solar, HHV Solar and Kotak Urja. A few major players were also included in interviews that were not located in Bangalore region but significantly contributing to solar industry in India. These players considered for sampling include Lanco Solar, Indo-solar, Vikram Solar, Moser Baer and some other smaller players.

Under a given solar market environment, a study period between year 2010 to 2015 is a focus of research. To formulate research problem, Limited period of research specifies certain prevalence of specific state policy, market conditions and practice adopted, were required to be studied in relation to each other.

The study is conducted based on 25 semi structured interviews of respondents and secondary published data to test the hypothesis. An interview questionnaire is prepared to research the focused area through hypothesis. This interview questionnaire is designed to capture all the key themes emerging across the industry based on the case study. Each of the interview questions is posed in front of interviewer with the best of language he can understand. A basic premise of the topic is explained to respondents, in the form of sequence of events happened in solar industry between year 2010-15, to bring out relevant images from the interviews. Interview questionnaire was sent in advance to respondents to go through as a pre-read, to minimize the discussion time and bring out more relevant voices and images on questions.

To include "state" view on supply chain planning, we took help of published reports by central and state government (MNRE). Central and state government's senior officials had a limitation on getting appointment for the purpose of academic research. Some government officials, whom we approach, were hesitant to respond on state views.

Analysis, Findings and Discussion:

First alternate hypothesis (HA 01) is formulated to establish the fact that state support is a primary driver for solar energy deployment in India. "HA 01: Solar demand is a function of "state regulations and support", thus an input to supply chain planning". Once the evidences will be established, that solar demand is primarily being derived from state support, it can be modelled into supply chain planning, as an important width variable.

Support and policy for solar deployment can be traced back to year 2006 when National Tariff Policy included 0.25% of solar Renewable Purchase Obligation (RPO) to promote deployment of solar power in the country. As a next promotional step, National Action Plan on Climate Change (NAPCC –

year 2011) increased 0.25% solar RPO to 3% by year 2022. Third significant step to promote increase in solar deployment was in year 2011 when Jawahar Lal Nehru National Solar Mission (JNNSM) Phase-I, batch -I was announced. Batch -II of JNNSM announced immediately next year and it increased quantum of solar deployment to next higher orbit. Between years 2010 to 2013 a strong correlation is being seen in terms of solar installed capacity deployment and promotional policy support by state.

State regulations provides support in the form of regulation like various subsidy based on domestic content requirement, capital support, low or no excise & custom duties and various financing schemes to promote the investment in the sector. These state factors derive demand for solar energy, rather than conventional factors like latent customer demand. Following correlation between demand and various phases of JNNSM and state level schemes showing increase in demand. The chart and relationship indicates that demand volume has grown substantially from year 2010 onward, after state support structure is launched in year 2010. Before the year 2010, when there was no major focused planning from state, demand has remained extremely weak. A strong correlation value suggests that state regulations and support factors are significant one to decide demand in the country.

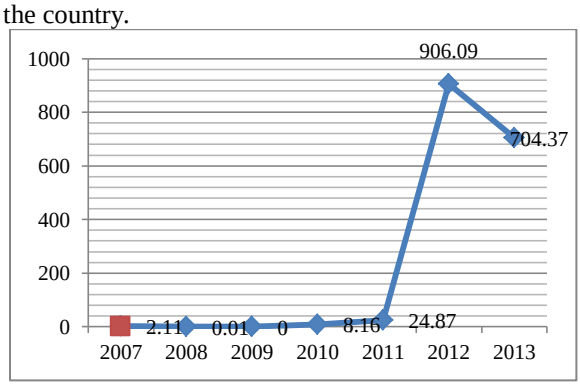

Fig. (I)

Source: Anish De, AF - Mecados EMI, Hyderabad, May 23, 2013 [1]. (Solar power deployment in Mega Watt)

Data depicted above indicate that solar demand peaking is correlated to degree of support extended by state. During year 2011 onward various phases of JNNSM started triggering demand. Prior to this point, from year 2007 till 2010, there was hardly any significant solar demand is visible as state support mechanism was not significant.

Second alternate hypothesis (HA 02) is a support hypothesis to HA 01, which establishes the fact that natural drivers are almost inexistent during the period of study. "HA 02: Natural demand factors are less significant than a state support derived demand in solar industry".

Natural demand signifies demand arising out of latent need of customers. A natural demand factor decides source and type of purchase independently, as derived only by market forces like need derived demand, price, availability, quality and technology. In solar industry the market did not grow till major support is extended in year 2011, after the announcement of JNNSM, Refer Fig (I). During previous years from year 2007 till 2010 natural demand factors were same, since power demand is even more acute, still solar deployment did not pick up. Demand ramped up immediately after the announcement of JNNSM.

JNNSM focuses support to solar plant based on the domestic content requirement. State support was offered if plant was using domestically manufactured solar modules. JNNSM Phase - I excluded thin film solar technology from domestic content requirement. As a consequence, a lot of investment flown into thin film technology, since it was cheaper to import as compare to buying domestically manufactured Crystalline Silicon (C-Si) based solar modules in India. The above correlation between increases in demand of thin film as compare to C-Si, is an indicator that natural demand factors are not so significant. This is cost of solar energy drives the demand. Development of thin film took place during JNNSM in phase-1, despite of lower power generation efficiency of thin film technology based modules. Majority of solar project developers imported thin film modules because they were cheaper than India-made modules of crystalline silicon technology. In addition, developers got low cost project financing from Export- Import (EXIM) bank of the US, which mandated that to avail loan, they will have to import modules from the US. Around 50% of the solar projects, in batch-I of the Phase-I of JNNSM, were of imported thin film technology. The percentage increased to around 70 in batch-II of the Phase-1. On average, about 60% project investment of PV based solar technology took place in thin film based solar technology during phase-1. Contrary to Phase-1, both the technologies, C-Si and thin film were included in Domestic Content Requirement (DCR) resulting in only 4% deployment of thin film based solar modules. Majority portion of investment, 96% went into C-Si base solar projects. A technology neutral solar technology deployment brought down overall thin film deployment to 13.5% in total installed base.

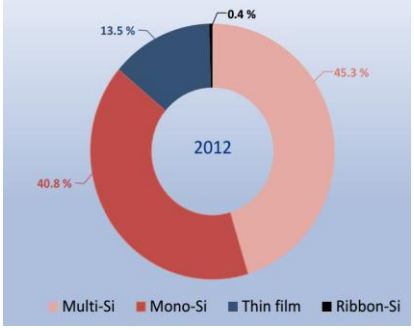

Fig. (II)

Solar Energy Southeast Asia IMPACT Arena, Bangkok, Thailand, 10th Dec, 2013 23, 2013 [5]
Below Chi-Square tabulation comparing development of type of solar technology promotion and difference in approach of support structure by government shows a dependence which further proves that natural factors of demand are relatively less significant than support structure and mechanism extended by state. Even during phase-1 of JNNSM, consequences of support structure played completely opposite result than expected. State revised their policy to further strengthen Indian manufacturer as against import of solar equipment.

Table (I): Thin Film Based and Non-Thin Film Based Deployment during Phase-1 and Phase-2 of JNNSM

	Thin Film % share	**Non-thin film % Share**
Non-inclusive thin film modules in JNNSM Support Phase - I	60	40
Inclusive thin film modules in JNSSM Support Phase - II	4	96

Above discussion and data establishes the relationship that during the period of study, natural demand factors were weaker than the demand causing out of state support in various forms.

Conclusion:

Solar project deployment in the country is strongly related to state support programs, a major width variable for solar supply chain. Solar demand in the country has been directly proportional to the degree of support offered by state. Based on period of study, it is concluded that natural demand factors overpower state support factor in creating demand.

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