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Marketing Methodology of Solar PV Power Packs

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Abstract: *Solar photovoltaic (PV) power system is used for both utility as well as building integrated applications that are growing rapidly in India. Solar power plants in India till date are mostly ground-mounted power plants. It is absolutely pure and clean energy source.*

The objective of this study is to present the Marketing feasibility of solar PV power system in India for various applications. The market methodology presented in this study is in specific to building integrated systems. State of art technology of solar PV modules, power electronics with fixing mounts for array attachment is considered. Various options customer owned systems, leased systems, and BOOT model finance were studied in detail. The results of thestudy were discussed, best methods identified and presented. Conclusions were drawn identifying the specific areas of marketing for solar PV power systems
Keywords: *solar power, photovoltaic systems, marketing feasibility*

Abbreviations: PV (Photovoltaic), BOOT (Build own operate transfer), BOO (Build own operate), EPC (Engineering procurement construction), LCOE (Levalised cost of energy).

I. Introduction

In India 80% of the electricity is produced by coal which is a non renewable source. Electricity whatever produced is very less than the need for electricity. By this many of the companies, industries, organizations, common people are facing severe power cuts. Because of this insufficient power supply for the agriculture sector, output of the crop is reducing every year. This scarcity of the power is creating major problems in small scale industries which logistics are totally depended on power.

Supplement the conventional energy source. Solar power is one of the best nonpolluting energy sources. India being at best geographical location receives nearly 300 to 320 days good sunny days. Among the solar power sources, solar Phovoltaic (PV) is one the matured power systems. If the industry develops and spread the Solar PV power packs to be installed at different places especially on buildings (commercial, public and institutional), industries, and also on various barren lands like hilly slopes, and desert areas.

It is easy to implement the Solar PV power pack with power range varying from few watts to multi mega watts on any place, where ever it is needed. It can be purchased and fixed for a reasonable cost, once it is implemented owner can enjoy the free electricity for more than 25 years. Solar PV modules will get a warranty of 25 years which can work more than that period with minimal maintenance cost.

The objective of this paper is to develop the marketing methodology with various options (BOOT, BOO, EPC). The advantages, risks, implement ability and practicality discussed with both Utility scale and stand alone PV power systems. The detailed analysis forms the core of this paper.

II. Solar Photovoltaic power systems

2.1. Grid –connected solar energy

During day time consumer can use solar energy by Grid connected Solar PV system. The system allows them to draw power strait from the Grid. Peak loads can also be exhausted
from grid electricity, which means that solar cells don't necessarily need to be sized for demand, mainly for limited space is an problem, but should be sized for eliminating as much of the base load of electricity bill as possible. Any overload power can be send back to the grid in a form of credit "net metering".

2.2. Stand-alone grid –connected solar energy systems

To an Industry which depends on power totally can implement the GRID System. GRID System with battery will work as independent power supply plant and can provide sufficient power during cloudy seasons also. Residential owners can also implement this to avoid power cuts
Grid connected PV systems provides more power, beyond by the connected load.

Advantages
1. One time truthful Investment.
1. Solar power Grid system comes without noise and pollution.
2. Instead of paying to the bank, pay to thermal.
3. After payback period owner can enjoy absolutely free of cost.
4. For this grid system diesel is not required.

2.3 The off-grid system

An off-grid solar PV power system is the standalone system provides uninterrupted power to the customer when sun is available. Off-grid system requires the battery storage and Inverter to get the AC power. The solar PV power inverter and batteries shall have limited life and suppose to be replaced at fixed intervals say after 10 years.

Advantages
1. One time truthful Investment.
2. Solar power Grid system comes without noise and pollution.
3. Instead of paying to the bank, pay to thermal.
4. After payback period owner can enjoy absolutely free of cost.
5. For this grid system diesel is not required.

III. BOOT model:

Build-own-operate-transfer model is the revolutionary concept in India's renewable Energy industry. It is one of the new models to implement for solar PV power systems. The solar PV power company will manufacture and builds the PV systems at customer's site. The boot model shall be the pre agreement to operate for a particular time line and then transfer to the customer. The company will operate the solar PV power systems and the customer pays the energy charges as agreed for the used energy. Until ownership, the customer will be enjoying the benefits of the system as a leased one from the company under BOOT division. This will be very effective for Indian industry in specific to the captive power users.

Advantages of BOOT model:
1. Cost sharing between customer and the supplier
2. Risks sharing
3. Maintenance and operation will be the responsibility of the power plant builder
4. Good bankability

Disadvantages of BOOT model
1. The service provider should bear the share capital costs.
2. Performance of system operation at end of life conditions.

IV. BOO model

The Build-Own-Operate model is also one of the new models to sell the solar PV systems. As like in the BOOT model the company build, own and operate the PV system. In this model the company doesn't transfer the PV systems to the customers. It is the model which will be used at the areas of less power consumption. The company only operate and supplying the power to the customers. The customer needs to pay the amount which includes the service tax to the company for the long life for the energy used.

Advantages of BOO model:
1. The companies will Installation the power system without capital costs to the customer.
2. Operation and maintenance will be the part of the supplier and no risk for customer.
3. The customer will pay the energy as used at pre defined price, so that the customer knows what is energy charge

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Disadvantages of BOO model:

1. If the system is not performing as per the defined performance level, there is a risk involved for the company.
2. Survival of the company for long time and the repayment of the loans.
3. Bankability and the customer payment isa questionable?

V. EPC model:

The engineering, procurement and construction model is a common form of contracting arrangement within the solar PV industry. Under this model, the company designs, installation, procures the necessary components and materials and builds the solar PV systems on the defined customer location. An agreement shall be made between the solar company (contractor) and owner(customer). There will be various functions involved in this model are.

1. RFP issuance and awarding the contract
2. Designing and Engineering the solar power plant
3. Project management and supply chain management
4. Construction and commissioning

Once the company signs an agreement with the customer, the company becomes liable for completing the project in the stipulated time line. After the completion of the plant, it will be handed over to the owner for agreed performance and price.

Advantages of EPC model:

1. Warranty and guaranty shall be the responsibility of the EPC supplier from end to end activity.
2. Project will have bankability with expertise EPC player
3. Best practices shall be used to complete the project and ensures the good performance for the life.
4. Ensures quality and reduced risk with practical issues.

Disadvantages of EPC model:

1. Changing the debit interest rates puts the project cost at high
2. Delays in implementing the project over runs the time line and also the money
3. Changes in the schedule affect the project cost and liquidity damages.

VI. Results and Analysis:

Present study assumes 100 kW roof top solar power plants with and without battery for storage. The Levelized cost of energy computed for interest rate of 13%.

BOOT Model

Under this model the plant shall be transferred to the customer after 10 years of operation. The LCOE results computed were shown in fig 1&2.

BOO Model

The BOO model assumes the plant operational time will be 25 years and will be used at the areas of less power consumption. It may be the economically feasible for the customer with less risk, since the developer assures the power generation. The results were computed and shown in fig 3&4

EPC Model

The EPC model is the agreement based model within the solar PV industry. EPC model ensures the quality and good performance to the customers. The energy cost to the customer with the financial investment Rs. 3.6/kWh which is similar or comparable with utility.The results were computed and shown in fig 5&6.

LCOE values at 13% for BOOT

LCOE	Rs/kWh
With Battery	4.5
Without Battery	3.6

With battery

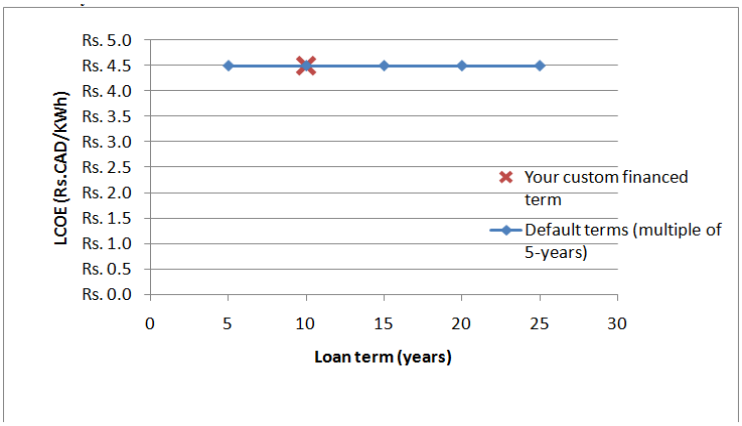

Fig1

Without battery

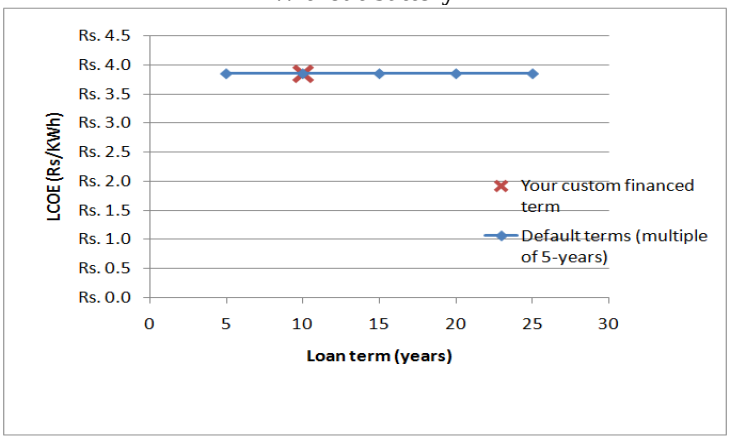

Fig 2

LCOE Values at 13% for BOO Model

LCOE	Rs/kWh
With Battery	4.5
Without Battery	3.6

With battery

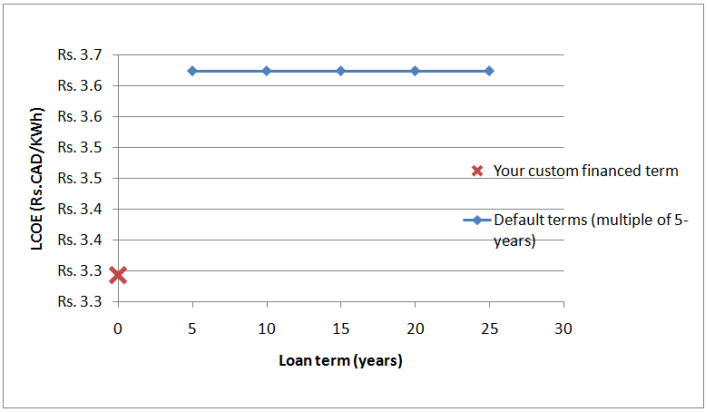

Fig 3

Without battery

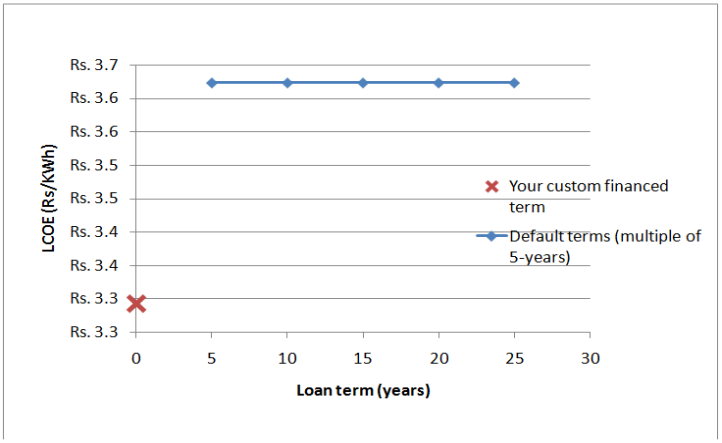

Fig 4

LCOE Values at Interest 13% for EPC Model

LCOE	Rs/kWh
With Battery	4.5
Without Battery	3.6

With battery

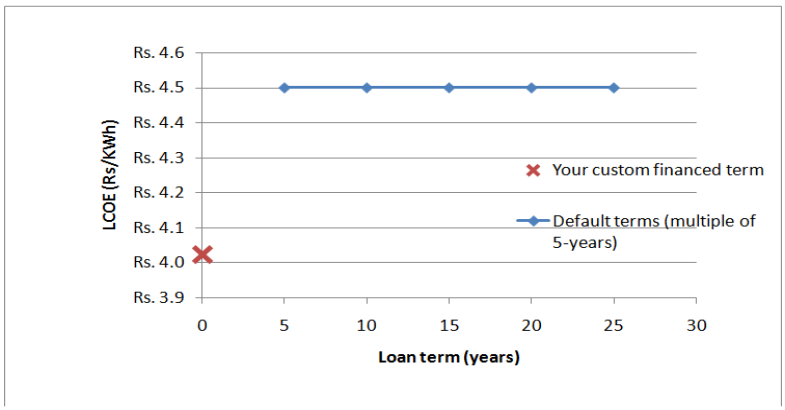

Fig 5

Without battery

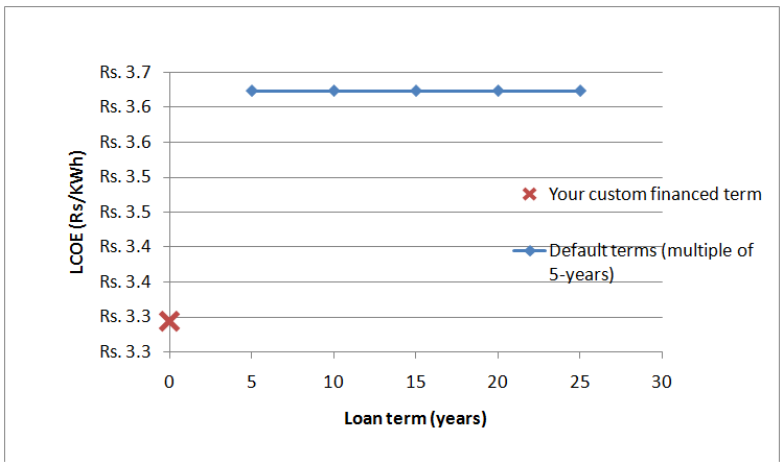

Fig 6

VII. Conclusions:

An attempt has been made to analyze the various sales & marketing models for solar PV power systems. It is concluded that, there is no common practice and it is still evolving which model works for what type of customers. Future study needs more date to verify each model.

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