



## STUDY OF FINANCIAL RISK MANAGEMENT IN SOLAR POWER PROJECTS IN INDIA

**Prof. Sushma Verma\***      **Dr. Kishor N Jagtap\*\***

*\*Asst. Professor, Sinhgad Institute of Business Management, Mumbai.*

*\*\*Principal,,Smt C.K Goyal Arts and Commerce College,Pune.*

### **Abstract**

*It has already been established that there is a direct correlation between power consumption and economic development. There has been a rapid economic development in India leading to increasing demand of energy. Due to various reasons Renewable energy has been identified to be a significant part of total portfolio of energy. Solar has been identified to a very high potential but the most underutilized source within the basket of Renewable Energy. One of the reasons identified is the lack of finance. For financiers every investment is based on risk return assessment. Study attempts to identify the critical risks affecting solar power project financing and the state of Financial Risk Management for solar power projects in India.*

**Key Words: Solar Power Project, Financing, Risk, Risk Management.**

### **I. INTRODUCTION**

Risk is something we cannot escape whether it is life or business. There is always a possibility of loss as much as there is a chance of gain. This possibility of loss is called as risk. As per Williams and Heins (1976),” Risk can be defined as the variation existing in the possible outcome in a given situation”. But generally it is the negative outcome bothering us is referred as risk. Oxford dictionary of English defines the term risk as,” hazard , chance of a bad consequence, loss, exposure to chance of injury or loss”.

In guide to the Project management Body of Knowledge (PMBOK) (2003) , published by PMI, risk has been defined as ,” an uncertain event or condition that if it occurs, has a positive or negative effect on a project objective. Risk plays a dominant role in investment decisions as investors are risk averse. . As per Investopedia, “Financial Risk is generally taken as the umbrella terms for different types of risks associated with financing”.

Financial Risk Management is basically a specialization of risk management wherein financial instruments are employed to manage risks. As per Investorwords.com, Financial Risk Management is defined as the process of evaluating and managing current and possible financial risk at a firm as a method of decreasing the firm’s exposure to the risk ,FRM is undoubtedly the key element in any kind of commercial investment. As per Marsh (2004), little attention is given to its use in RE projects especially when it comes to developing countries.

### **II OBJECTIVE OF THE STUDY**

- a. To study various risks affecting the financing of solar power projects.
- b. To understand the perception lenders and developers with reference to selected risks affecting the availability of finance in terms of criticality when it comes to financing decision.
- c. To study the current practices and Instruments of risk management employed in Solar PV Power Projects with reference to selected risks in India.

### **III. METHODOLOGY OF STUDY**

The study is based both on primary and secondary data. Secondary data is obtained from various research articles, books, previous research works conducted, Journals, websites, various working committees reports, five year plan documents  
Primary Data: Primary data will be collected by means of a Questionnaire and where ever possible by means of personal Interview from executives working in Developer companies, Banks, Financial Institutions Only developers operating grid connected Solar PV projects in India has been included in the sample.

**The procedure:** First stage of this research work was a detailed literature survey to identify the various risks affecting solar power project financing. Studies conducted in global context as well as in Indian context were extensively studied to develop an initial list of risks. Research is focusing on the following seven broad set of risks identified from the literature review:

1. Regulatory Risk
2. Construction Risk
  - a. Time Over run
  - b. Cost Over run
3. Counter Party Risk
  - a. Construction Contractor

- b. O&M Contractor
- 4. Financial Risk
- 5. Power Off Taker Risk
- 6. Resource supply Risk
- 7. Force Majeure Risk

Then the risk perceptions in terms of criticality in decision making of lenders for the selected risks are found by means of questionnaire survey. Then the risk mitigation measures commonly used for mitigating selected risks is also found by means of Questionnaire survey from developers.

**Questionnaire Survey:** Any perception based evaluation is very subjective and can turn out to be vague. Thus for improving the reliability of survey replies, a six degree rating system is used.

**Rating System:**

<u>Ratings</u>	<u>Risk criticality</u>
<u>0</u>	<u>Don't know/NA</u>
<u>1</u>	<u>Very Low</u>
<u>2</u>	<u>Low</u>
<u>3</u>	<u>Medium</u>
<u>4</u>	<u>Significant</u>
<u>5</u>	<u>Very significant</u>

Data collection: Data was collected by means of two separate questionnaire prepared for developers as well as lenders. Questionnaire was distributed to about senior executives of around 35 developer companies, out of which 18 responded, out of which 1 is incomplete. Thus 17 fully filled questionnaires is the source of primary data. For financiers, we have 10 fully filled questionnaire distributed to banks/ Financial Institutions financing solar PV projects.

Data Analysis: Following table shows the perception of developers and lenders as the criticality of risk affecting solar project financing:

**Risk Criticality in solar power project financing from developers perspective**

	% Respondents						Weighted Mean	Ranking
	very significant	Significant	medium	low	Very low	don't know/ NA		
regulatory	35.29%	47.06%		11.76%	5.88%		3.941176	1
Const(TO)	17.65%	29.41%	29.41%	11.76%	11.76%		3.294118	4
Const(CO)	11.76%	23.52%	29.41%	29.41%	5.88%		3.058824	5
CP (CC)	5.88%	29.41%	52.94%	11.76%			3.294118	4
CP (ONM)		17.67%	47.05%	35.29%			2.823529	
Financial	11.76%	47.05%	29.41%	11.76%			3.588235	3
Power Off taker	17.64%	47.05%	35.29%				3.823529	2
Resource Assessment	5.88%	17.64%	41.17%	35.29%			2.941176	
Force Majeure		11.76%	17.64%	83.33%	11.76%		2.294118	

Thus regulatory risk is perceived to be the most significant with a mean value of 3.941 as compared to other risks. It is followed by power off taker risk with a mean value of 3.8235 and third most significant risk influencing financing is financial

risk with a mean value of 3.588. Counter party risk( O & M ), resource assessment, force majeure risk have a mean score below 3, so they are being perceived to be of medium to low significance.

### Risk Significance in solar power project financing from lenders perspective

	% Respondents					don't know/NA	Weighted Mean	Ranking
	very significant	Significant	medium	low	Very low			
regulatory	71.48%	14.28%	14.28%				4.57	1
const(TO)		14.28%		71.48%	14.28%		2.14	8
Const(CO)			14.28%	71.48%	14.28%		2.00	9
CP (CC)	28.57%	14.28%	14.28%	42.857%			3.29	5
CP (ONM)	14.28%		14.28%	71.48%			2.57	6
Financial	14.28%	57.14%	28.57%				3.86	3
Power Off taker	28.57%	71.48%					4.29	2
Resource Assessment	14.28%	42.857%	28.57%	14.28%			3.57	4
Force Majeure		14.28%	14.28%	71.48%			2.43	7

As per lenders also , Regulatory risk is perceived to be most critical with an mean score of 4.57 and a lesser standard deviation. This is followed by power off taker risk with higher mean value of 4.29 and lowers standard deviation. Third most critical risk here also is financial risk. The mean value is more than 4 for first two ranking risk.

Least ranking in terms of significance has been assigned to force majeure risk by developers with a mean score of 2.29. Whereas for lenders least significant risk is Construction risk( cost overrun)followed by time over run risk. Thus we can say that construction risk is not at all perceived to be critical at all by lenders. Whereas it is considered to be of medium significance be developers with a mean score of more than 3 in both the cases. Thus lenders and developers have a conflicting view here.

### Risks actually materialized

There are questions in the questionnaire with a purpose to find out the risks which have actually been experienced by developers at some point of time in past. Following table summarizes the response:

	Regulatory risk	Construction risk (time over run)	Construction risk (cost over run)	Counter party risk (Construction contractor)	Counter party risk (O& M contractor)	Financial Risk	Power off taker risk	Resource assessment risk	Force majeure risk
In a Major way	11.76%	5.88%				5.88%	5.88%		
On a average way	35.29%	23.52%	11.76%	29.41%	11.76%	5.88%	5.88%		
Slightly	29.41%	23.52%	47.05%	23.52%	17.64%	52.90%	41.17%	29.41%	23.52%
Very slightly	23.52%	47.05%	41.05%	4.17%	64.70%	35.29%	47.05%	70.58%	76.47%
Not at all				5.88%	5.88%				
Don't know/NA									

From the table it can be clearly seen that only regulatory, time over run, financial, power off takers risks are only experienced in a major way by respondents with 11.76% only experiencing it in a major way followed by 5.88% respondents in other three categories.. Only 5.88% of respondents say that they have experienced power off taker and financial risk in a major or average way. Similarly construction risk( cost overrun), counter party risk( construction contractor and O&M contractor), resource assessment and force majeure risk are also never been experienced in a major way.

After this there was certain questions, where the purpose is to understand the current practice of risk management followed by companies.

**a. Measures taken by company to manage construction risk:**

Measure	frequency	%
Insurance	15	88.23%
CAR	10	58.52%
Using only proven technology	16	88.88%
Construction through turnkey projects	11	64.70%
Any other	2	11.76%

Because of multiple responses, the total % may be more than 100.

**b. Measures taken by company to manage counter party risk**

Measure	Frequency	%
Performance Bank Guarantees	15	88.23
Liquidation Damages	14	82.35
Due Diligence Process	14	82.35
Any other	1	5.88

**c. Measures taken by company to manage Power off taker risk**

Measure	Frequency	%
Bank Gurantees	13	76.47
LC	12	70.58
Escrow	6	35.29
Any other	0	

**d. Measures taken by company to manage Resource Assessment risk**

Measure	Frequency	%
Captive Insurance	3	17.64%
Using several year data and combining it with ground measured data	17	100%
Self Insurance	1	5.88%
Any other	0	

**e. Measures taken by the company to manage Force Majeure Risk**

Measure	Frequency	%
Insurance	17	100
Any other	0	

**f. Measures taken by company to manage financial risk**

Measure	Frequency	%
Standard derivative products	10	58.82%
Self Insurance	2	11.76%
Captive Insurance	2	11.76%
SPV	15	88.23%
DSRA	15	88.23%
Any other		

**g. Measures taken by the company to manage Regulatory Risk**

Measure	Frequency	%
Frequent and detailed communication with policy makers/ Industry bodies and regulators	14	82.35
Statement of assurance from regulators regarding policy direction	7	41.17
Any otherb		

Confidence in the ability of their company to manage various risk: When asked the developers as to their confidence in the ability of their companies to manage various risks, following response was obtained:

	% Respondents					Weighted score	Weighted Mean	Standard deviation
	Very confident	Confident	Moderately confident	Slightly confident	Not at all sure			
Construction risk	58.82	23.52	11.76	5.88		74	4.35	.903664
Counter party risk	17.64	52.94	23.52	5.88		65	3.82	.784804
Financial risk	23.52	47.05	17.64	5.88		64	3.76	1.0588
Power off taker risk	17.64	35.29	29.41	5.88		58	3.41	1.191
Resource assessment risk	23.52	41.17	29.41	5.88		65	3.82	.8564
Regulatory risk	5.88	35.29	29.41	5.88		50	2.94	1.2588
Force Majeure risk	11.76	35.29	52.94			61	3.588	.69102

Broadly it can be seen that weighted mean score is more than three for all categories of risk as per responses given by developers, except for regulatory risk which is showing a weighted mean score of 2.94. Thus we can say that developers are confident on an average level as to their capabilities to manage all other risks other than regulatory risk, where the confidence is slightly on the lower side.

Following table shows the lenders response in the ability of companies to manage various risks:

	% Respondents						Weighted Mean	Standard deviation	
	Very confident	Confident	Moderately confident	Slightly confident	Not at all sure	don't know/ NA			
Construction risk	42.85	57.14					31	4.42	.4948
Counter party risk		28.57	57.14	14.28			22	3.14	.6388
Financial risk		14.28	85.71				22	3.14	.3499
Power off taker risk			42.85	57.14			17	2.42	.329



Resource assessment risk		71.42	28.57				26	3.71	.4517
Regulatory risk			42.85	57.14			17	2.42	.4948
Force Majeure risk			42.85	28.57	14.28		19	2.71	1.16

Like developers lenders also have the highest confidence when it comes to managing construction risk with a mean score of 4.42, but the confidence level is lowest for power off taker risk and regulatory risk with a mean score of 2.42.

## CONCLUSION

This Research Paper attempts to find out the risk perception of lenders and developers as to criticality of risk in terms of its effect on financing of Solar PV projects. Perception of lender is significant because they are the providers of debt whereas the perception of developers is significant because they are the one responsible for risk management and risk mitigation. Regulatory risk is undoubtedly rated both by lenders and developers as most critical risk affecting financing. Study also reveals after extensive literature survey and analysis of Primary data collected that very basic FRM instruments are available in India. Insurance is the most widely used FRM instrument and much needs to be done for developing advanced FRM instruments for risk mitigation. Financial Risk Management is in a very nascent stage in India as far as solar power projects are concerned.

## REFERENCES

1. Marsh Ltd(2004),” Scoping Study on Financial Risk Management Instruments for Renewable Energy Projects”, UNEP Reference Document.
2. PMBOK(2003),” A guide to the Project Management body of Knowledge”. Project Management Institute.
3. Williams,C.A. and Heins,M.R.(1976),”Management and Insurance; New York,Mc Graw-Hill Books Co.
4. [www.investopedia.com](http://www.investopedia.com).
5. [www.oxforddictionaries.com](http://www.oxforddictionaries.com).