

Chapter 8

Conclusion and Recommendations

8.1 Introduction

As a known fact, India requires uninterrupted supply of energy sources for its sustainable development. Currently in India fossil fuels are the prime sources of energy and looking at the consumption trends, India needs to find alternative sources of energy which are cleaner and promising in nature for a sustainable growth. India has huge potential for solar energy and has seen a significant growth since 2009. GoI launched JNNSM in January 2010 with an aim to install 20,000 MW grid connected solar power plants. Out of which a total of 2210 MW installation has already been achieved as of January 2014, of which, majority of the installation has been achieved through solar PV power plants. Along with JNNSM, fourteen other States have announced their solar policies. Among them, Gujarat was the first one to do so in 2009, which was apparently earlier than JNNSM. Gujarat as a State has attracted maximum investment in this sector, as a result of which it has achieved close to 900 MW of installed capacity, followed by Rajasthan which has an installed capacity close to 500 MW.

The chapter discusses the overall results of this study followed by recommendations, and limitations of the study.

8.2 Findings

This section presents overall finding of the study. The findings have been summarized in accordance with objectives of the study.

The first objective in the study was:

1. To identify the various barriers and challenges that impact the growth of grid connected Solar PV installations in India.

The first objective of the study was achieved by identifying barriers and challenges which impact the growth and development of grid connected solar PV power plants in India as shown in figure 8.1. This objective was achieved through factor analysis.

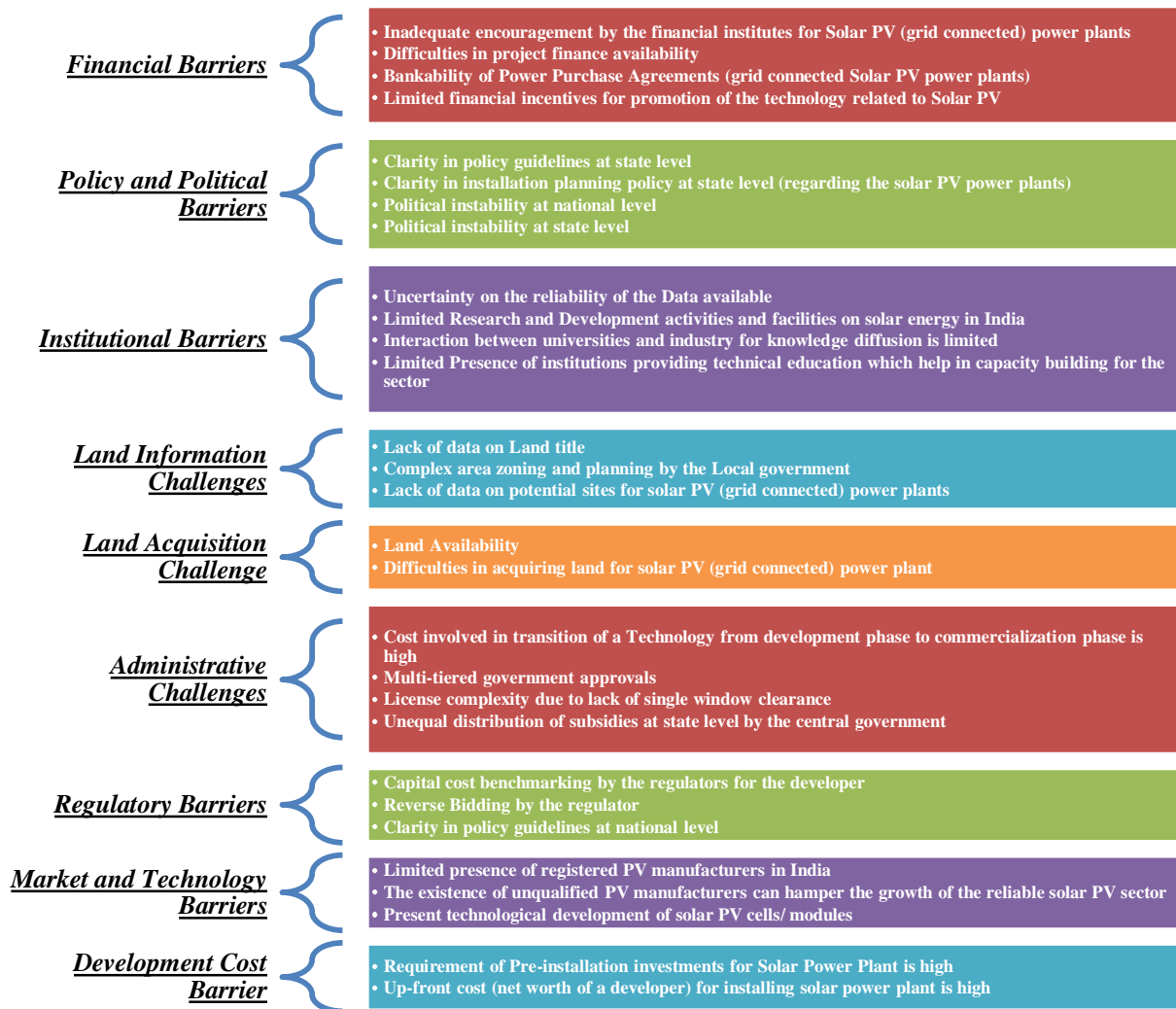


Figure 8-1 Identified Barrier and Challenges to grid connected solar PV power plants in India

The second objective in the study was:

2. To find out how the State(s) of Gujarat and Rajasthan have responded to the role of the identified barriers and challenges on the growth of grid connected Solar PV installation in their respective regions.

To achieve the second objective of the study, researcher visited Gujarat and Rajasthan for revalidating the identified Barrier and Challenges through objective 1. This objective was achieved by conducting semi-structured interview with developers who had experienced in execution of grid connected solar PV power plant projects in these States.

The table 8-1 compares how the States of Gujarat and Rajasthan have responded to the role of identified barriers and challenges in their respective regions. The responses are marked as [+], [±], [-], and these results were drawn from within case and cross case analysis in previous chapters (5, 6 and 7).

Table 8-1 Comparison of how Gujarat and Rajasthan have responded to the role of identified Barriers and Challenges

S.no	Barrier and Challenges	Gujarat Response	Rajasthan Response
1	Financial Barrier	-	-
2	Policy and Political Barrier	+	±
3	Institutional Barrier	-	-
4	Land Information Challenges	+	+
5	Land Acquisition Challenges	+	+
6	Administrative Challenges	+	-
7	Regulatory Barrier	+	-
8	Market and Technology Barrier	-	-
9	Development Cost Barrier	<i>Negated by respondents</i>	
<p><i>[+] means that State has responded significantly to the role of that barrier or challenge.</i> <i>[±] means that State has responded moderately significant to the role of that barrier or challenge.</i> <i>[-] means the State has not responded significantly to the role of that barrier or challenge.</i></p>			

Financial Barrier

Both States show [-] sign because they couldn't win the trust of financial institutions or banks to fund the grid connected solar PV power plants in their respective regions.

Policy and Political Barrier

Gujarat shows a [+] sign because it showed, strong political will to develop the sector and is the first State to introduce solar policy in the country. Gujarat has clear and supportive solar policy to attract investments for grid connected solar PV. On the other hand, Rajasthan shows an [±] because all commissioned capacity was been executed under JNNSM rather than Rajasthan Solar Policy. But due to supporting political environment in Rajasthan, the government assisted developers with land banks in different parts of the State.

Institutional Barrier

Both States show a [-] sign, as they lack R&D facilities, Training institutes and data centers to provide accurate and reliable solar radiation database. There was also a lack of industry-academia interaction in these regions

Land Information Challenges

Both States show a [+] sign, as the respective government were proactive in providing the necessary information to developers. The local governance and bureaucracy was efficient enough to provide assistance to developers.

Land Acquisition Challenges

The States show a [+] sign, as they are having an advantage of availability of huge barren land, which is not favorable for agricultural activities. In

Rajasthan, government acquired land for developers and leased it at an economical rate for 30 years. Whereas in Gujarat, government, not only developed the Solar Park but also assisted the developers to acquire private land.

Administrative Challenges

Gujarat shows a [+] sign, as they have an effective single window clearance mechanism. The government assisted the developers at all level through strong bureaucracy and administration, such as fast clearance of payment bills and granting permissions. Whereas, Rajasthan is marked with a [-] sign, as developers had to face issues in getting timely clearances and single window is not effective.

Regulatory Barrier

Gujarat shows a [+] sign, as GERC had offered a Feed in Tariff with a front loaded tariff of ₹ 15 / kWh generated for 12 years from Commercial Date of Operation (COD) and ₹ 5 / kWh for next 13 years. In Rajasthan, RERC had offered ₹ 6.45/ kWh of electricity generated as per bids received on competitive basis. Even after selection of seven developers, no project was been executed in Rajasthan (as of March 2014) as this tariff is quite low to achieve project feasibility.

Market and Technology Barrier

Both the States show a [-] sign due to lack of solar PV and related equipment manufacturing industries. These markets are immature across the value chain and the developers are finding it difficult to achieve project feasibility with indigenous solar PV modules.

Development Cost

In both States the development cost is not a barrier for developers and it is a small percentage compared to the total project cost.

8.3 Concluding Remarks

The study found various barriers and challenges which impact the growth and development of grid connected solar PV installation in India. There are nine factors identified as barriers and challenges which are prominent across the country. These factors being, Financial Barriers, Policy and Political Barriers, Institutional Barriers, Land Information Challenges, Land Acquisition Challenges, Administrative Challenges, Regulatory Barriers, Market and Technology Barriers and Development Cost Barriers.

Gujarat has significantly responded to the roles of Policy and Political Barrier, Land Information Challenges, Land Acquisition Challenges, Administrative Barrier and Regulatory Barrier, but was unable to respond to the roles of Financial Barrier, Institutional Barrier and Market and Technology Barrier.

However Rajasthan had significantly responded to the role of Land Information and Land Acquisition Challenges and had moderately significant response to the role of Policy and Political Barrier. But Rajasthan was unable to respond to the role of Financial Barrier, Institutional Barrier, Administrative Barrier, Regulatory Barrier and Market and Technology Barrier.

It was evident from the results obtained that, there are factors which Gujarat and Rajasthan cannot answer alone. Hence strong national policy initiatives need to be taken to support the State(s) for mitigating them.

In spite of the fact, Gujarat and Rajasthan are having strong investment environment for solar energy sector, it was understood that, Financial Barrier is market driven and not State driven, which meant that banks / financial institutions lay emphasis on the project feasibility and its promoters, irrespective of the States, while funding a project.

The Market and Technology Barrier alone cannot be mitigated by the State, as overall manufacturing cost of PV modules is expensive anywhere in the country. The technological competency and R&D in the country is lacking, due to which reductions in cost cannot be not estimated. Hence, the country is and will continue to depend on other countries like China, Japan, Canada and USA for sourcing PV modules and related equipment.

Further, Institutional Barrier can be managed by State, but as of today, the State lacks such facilities to assist stakeholders and contribute significantly to the development of solar PV sector.

Finally, the study concludes that Gujarat as a State, has been more influential in attracting investment for grid connected solar PV in its region by significantly responding to most of the identified barrier and challenges, whereas Rajasthan as a State, has not been able to make a mark in grid connected Solar PV installations. It has been purely because of the support of Central government that Rajasthan has gained hype in the industry, but overall as a State, it completely fails to attract investments in its region as of date.

8.4 Recommendation

The recommendations have been categorized into two levels, first being Central Government level and second at State Government level, in order to have continuous growth of grid connected solar PV power plants in the country.

8.4.1 Central Government level

- a. There have been efforts to promote manufacturing industries for solar energy related equipment in the country but apparently, these efforts didn't have much impact. Central Government needs to push up these industries in solar energy sector through strong mechanism wherein they can become competitive and hence developers can their reduce dependency on imports.
- b. The government needs to promote robust R&D activities with supporting facilities, to improve the overall performance of the technology and likewise reduction in cost can be estimated. One way is to develop healthy partnerships with developed countries for diffusion of technology & its development.
- c. Industry and academic interface should be promoted and strengthened to enhance R&D in the field of solar energy sector by Central government in coordination with State government.
- d. Introduction to innovative financing mechanism to encourage investments in the solar sector. (Introduction of Solar Bonds in the country).
- e. Introduce guidelines for strong implementation of purchase obligation. (Enforcement of RPO's).

8.4.2 State Government level

- a. There is need to prioritize the sector without getting it affected by political instability.
- b. Effective and efficient implementation of Single Window Clearance Mechanism
- c. Technical and managerial skill should be promoted in various arenas of solar energy sector to make the workforce 'industry ready'.
- d. Develop strong administration at all possible level for efficient process to assist the developers.
- e. There is a need for a paradigm shift from money intensive to resource creation R&D process.

8.5 Limitation to Study

The limitations of the study are:

- a. The study considers only Gujarat and Rajasthan as these were top two States having maximum installed capacity for grid connected solar PV power plants in India.
- b. There are possibilities that the impact of identified barriers and challenges might change under different environment and geographies.
- c. The current study focuses only on Mega Watt Scale Grid Connected Solar PV Power Plants in Gujarat and Rajasthan.
- d. Study is specifically focused on the experience of developers in executing grid connected solar PV power plants in Gujarat and Rajasthan
- e. There was limitation to disclose the company's name, respondent's name and project's name.

8.6 Further Scope of Study

- a. There is further scope for similar studies on other technologies of solar energy like Concentrated Solar Thermal Power Technology.
- b. Furthermore studies can be carried out on Rooftop PV and Small Solar Power Generation Programme (RPSSGP).
- c. It shall be motivating to test the similar factors under different policy, political and regulatory environment.
- d. There is further scope for study on perspective of different stakeholders, other than developers in the same / other States and sector.