Chapter 4

Developers' Perspective

4.1 Introduction

The basis for the discussion in this chapter is driven by the developers' perspective, as to how they perceive the barriers and challenges identified in chapter 3. The researcher conducted interviews with developers who had executed projects in the State of Gujarat and Rajasthan. During this process researcher got an insight with explicit dimensions on the identified barriers and challenges in context to Gujarat and Rajasthan.

In chapter 3, the researcher has identified various barriers and challenges which prevent the growth of grid connected solar PV installation in India. Hence, it is imperative to understand developers' perspective about these barriers and challenges in the State of Gujarat and Rajasthan. The interviews conducted for purpose of the study helped the researcher to create a strong background for developing the case studies of Gujarat and Rajasthan.

The researcher required to understand the identified barriers and challenges found in case of India (w.r.t. grid connected solar PV power plants), whether they stands same in case of these States or not. Besides, this they have achieved maximum installations in the country and if they do exist, then how they are perceived by the developers. Further, the perspective of developers on barriers and challenges was understood at the time of field study.

While interviewing the developers it was found that the dimensions of the identified barriers and challenges were diverse in nature but connotes the same meaning in these States as they as perceived in universally across India. The findings are represented as an associative network for each identified barrier and challenge. The codes have been highlighted in [**bold**] during the discussions of all barrier and challenges. It helped in developing associative network diagram, presenting the relationship between the responses given by the interviewees on each identified barrier and challenge.

According to Confidentiality Agreement signed between researcher and interviewee (shown in Annexure 7), researcher has not disclose the company name, project details and interviewee name in the study.

The respondents are represented as G1, G2, G3…and R1, R2, R3…in case of Gujarat and Rajasthan respectively. The details are shown in the table 4-1

Table 4-1 Data Collection

Gujarat		**Rajasthan**	
Term Used	Interviewee	**Term Used**	Interviewee
G1	1st respondent from Gujarat	**R1**	1st respondent from Rajasthan
G2	2nd respondent from Gujarat	**R2**	2nd respondent from Rajasthan
G3	3rd respondent from Gujarat	**R3**	3rd respondent from Rajasthan
G4	4th respondent from Gujarat	**R4**	4th respondent from Rajasthan
G5	5th respondent from Gujarat	**R5**	5th respondent from Rajasthan
G6	6th respondent from Gujarat	**R6**	6th respondent from Rajasthan
G7	7th respondent from Gujarat	**R7**	7th respondent from Rajasthan

4.1.1 Discussions on Financial Barrier

The researcher understood the diverse meaning of 'Financial barrier' from developers' point of view in the State Gujarat and Rajasthan. It was understood that for an investor, decisions to finance a project is an important aspect.

The developers faced difficulties in getting their projects funded by banks / financial institutions. All the more it remains same, still diverse dimensions of the identified Financial barriers was understood from developers' perspective through the following responses.

4.1.1.1 Small Developer

There were many companies who entered the solar energy sector and some were new entrants, who had little or no experience in developing similar kind of projects. Therefore, banks hesitated in financing these new and small players. This can be deduced from the following interview.

> [**Project finance was difficult**] *"Project finance was difficult for* [**Small developers faced financing challenge**] *small players who were questioned on the account of* [**Inexperience in infrastructure sector**] *experience they have in power sector or large infrastructure projects of similar kinds. Banks were not ready to risk their money in the sector which was still evolving and* [**Question on Technology sustainability**] *technology was new."*
>
> *"(…) small developers faced problems, which had no such background / inexperience in area of solar energy*."
>
> **[Respondent R1**]

4.1.1.2 Immature Market

The entire value chain for solar energy sector covers all activities ranging from manufacturing to transportation of final products. The solar market in India remains immature, as it lacks indigenization and has limited PV modules manufacturers in country. The respondents explained about current market scenario, which was clear from comments given by them.

> *"Yes there is limited presence of manufactures in the* [**Immature market**] *country. They are expensive and it is difficult to attain project feasibility with Indian manufactured modules."*
>
> **[Respondent G1]**

> *"Modules were sourced mostly from* [**Immature market**] *outside country. Our sourcing is mostly from China as they were cheaper and economical and cost of modules count for 50% of total project cost".* **[Respondent G3]**

4.1.1.3 Technology Awareness was nil

The sector faced challenges related to lack of awareness about the technology during 2008-09. The first policy to be introduced in India was in 2009 by Government of Gujarat. At that time, neither developers nor bankers were aware of Solar PV technology, nor were they sure about its performance under Indian conditions.

This can be derived from the following comments by respondents.

> *"In 2008-2009* [**Technology Awareness was nil**] *nobody knew the technology and this problem existed till 2011. In 2008, Germany*

was the only country which was doing well. In India nobody knew what PV modules are."

"Banks said this is glass and will crack under stress and heat. [**Technology Awareness was nil**] *how can it generate electricity?"*

"There were great difficulties in getting finance for thin film technology. Similar scenario took place in Germany that no one was ready to finance thin film technology. (…) even USA struggled to make the technology bankable initially" **[Respondent R2**]

"The banks are not [**Technology Awareness was nil**] *exposed to solar energy sector, so they hesitate in lending money"*

[Respondents G3]

"Banks hesitated in lending money as their [**Technology Awareness was nil**] *exposure to solar industry was nil.*"

[Respondent G4]

"Banks had [**Technology Awareness was nil**] *less or no knowledge of PV technologies available in World market, nor did they ever finance such kind of project. So automatically they showed less interest towards such kind of a power project.*"

[Respondent G5]

"Issues were there in the financing of the project. Banks were [**Technology Awareness was nil**] *hesitant in lending money."*

[Respondent R1]

4.1.1.4 Economic Slowdown affected Power Sector

The other reasons preventing the bankers to fund the project was economic slowdown in the year 2008, which affected the economies across globe. In India, economic slowdown had great repercussions on banking and financing sector.

Power sector requires heavy investment and financial institutes were not in a position to extend loans to the sector, in a period whereby nearly every business was getting a hit. Therefore investment in power sector and especially solar power business was not sounding reasonable to banking and financing sector.

This can be understood from the following comments by respondent.

> *"Looking at the economic slowdown and current scenario of power sector banks are still not sure* [**Economic slowdown affected Power sector**] *because of the risk involved.*
>
> *(…) similar problems were faced by Germany, it took them 3 years to convince the banks."*
>
> *"Banks are* [**Economic slowdown affected Power sector**] *not investing money in any of the domain since 2 years as whole economy was down."*
>
> *"Banks in 2010 were not receiving returns on PPA that was signed for ₹2.20, so how would they be sure of getting ₹10 back from the developer for each unit generated.* [**Respondent R5]**

4.1.1.5 Higher Interest Rates

It was understood through the interviews that, some developers did get the projects funded on agreement of certain clauses and parameters like higher interest rates, which can range anywhere in between 12% to 15%. This was decided after looking upon the company's background and the assessed technological risk by the bank.

Banks posed questions on sustainability and reliability of PV modules whether, mono crystalline poly crystalline or Thinfilm technology.

> *"Banks were charging around* [**Higher interest rates**] *14%-15% (perceived very high as per industry rates) interest rate but it was the trend across, it largely depends on company health and who is borrowing money."* **[Respondent R2]**

> *"Lenders took time but did finance the projects. The* [**Higher interest rates**] *interest rate was charged around 12%-13%."*
>
> **[Respondent R1]**

> *"(…) because if the banks lend they did it by charging* [**Higher interest rates**] *higher interest rates which made the project payback longer."* **[Respondent G4]**

> *"Our bankers were not exposed to solar sector they hesitated in lending money but when they did they lend it a* [**Higher interest rates**] *higher interest rate of 13.25%."* **[Respondent G3]**

> *"(…) if any one of the syndicate raised interest rate then all member banks* [**Higher interest rates**] *raised their interest which becomes very difficult for a developer."* **[Respondent G5]**

"Project finance was biggest problem also at initial stages banks showed no interest in funding project instead they asked for [**Higher interest rates**] *higher interest rates."* **[Respondent G1]**

"Financing institutes had [**Higher interest rates**] *strict parameters to approve a long term loan as they had questions whether the technology will sustain or not."* **[Respondent G2]**

4.1.1.6 Difficulty in Project Finance

Some projects got funding from banks only after they were commissioned. This was because, banks were not sure whether technology is feasible enough to generate electricity or not under Indian condition. Once they were sure of plant generation, they did lend money. They refrained from lending money during the construction phase of the project.

"No [**Difficulty in Project Finance**] *help was extended by banks during construction stage or importing of modules and equipment's."* **[Respondent R5]**

"[**Difficulty in Project Finance**] *(…) after the operations were scheduled and power was produced the bank saw and confirmed the stream of revenue inflow then they funded the project."*

[Respondent G3]

"Project finance was the biggest problem. [**Economic slowdown affected Power sector**] *At the initial stages bank showed no interest in funding the project."* **[Respondent G2]**

The associative network diagram in figure 4-1 shows the relationship between responses given by the interviewees on Financial Barrier.

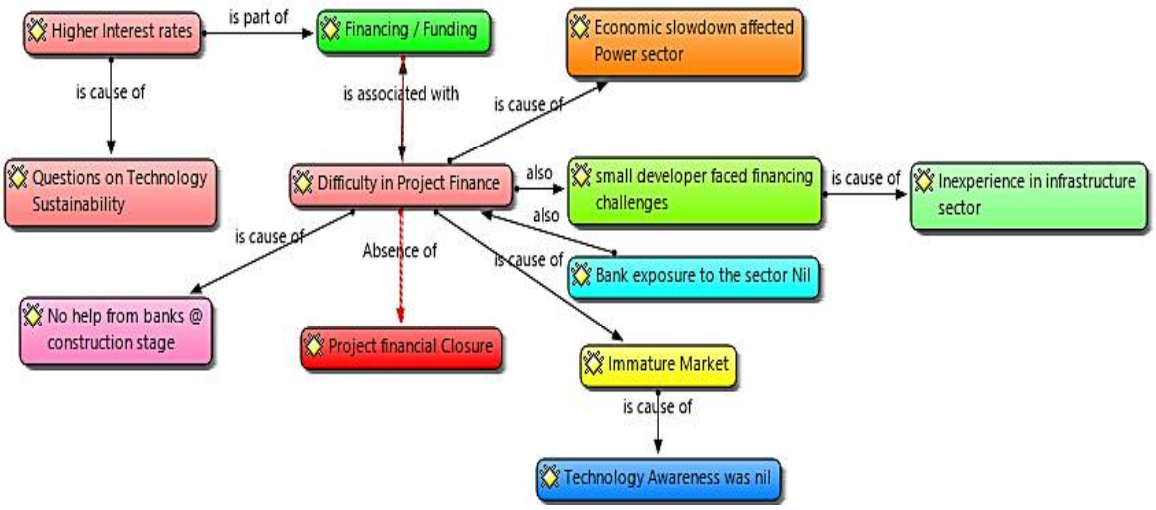

Figure 4-1 Dimensions to Financial Barrier in State of Gujarat and Rajasthan

Table 4-2 Outcomes on Financial Barrier

Outcomes on Financial Barrier	
Small Developers	Economic Slowdown
Immature Market	Higher Interest Rate
Technology Awareness	Difficulty in Project Finance

4.1.2 Discussions on Political and Policy Barrier

Policy is a formal statement of principles and guidelines declared by a government or a body to achieve certain objectives in the interest of national or a specified set of community. The political will of a government, act as one of the important pillars which help in successful implementation of a policy.

The respondents stated that, there were issues in the policy which led to difficulties in getting projects financed. There were delays in getting approvals though single window clearance mechanism was available.

There were some serious challenges in acquisition of land faced by developers. It was evident from the interviews that if a policy is backed up

by strong political will, then it helps in developing an investment friendly environment for the investors to carry out business.

Following are the dimensions to Policy and Political barriers as revealed through interviews.

4.1.2.1 Land Acquisition was difficult

Land is a very important factor for developing an infrastructure project. Now days in India many infrastructure projects are initiated through PPP mechanism. Through this practice the government helps developer with identification of land and various clearances for the project. Grid connected solar PV power plants require huge land. The Solar PV technologies namely Crystalline Silicon and Thinfilm, requires a land area of 2.5 Hectare/ MW and 3.5 Hectare/ MW respectively (Government of Rajasthan, 2011). The respondents share their views on acquisition of land for their project.

> *"Land acquisition is a biggest issue for any infrastructure project. Similarly it has been a* [**Land Acquisition was difficult**] *challenge for us in our project. Land acquisition has been a major issue in any part of the country."* [**Respondent G1]**

> *"Land acquisition was very* [**Land Acquisition was difficult**] *difficult as we had to face challenges from local people, communities which was at times lead by Gram Panchayat indirectly. We lost days for commissioning our project because of the local disturbance nuisance."* **[Respondent R6]**

4.1.2.2 Financing biggest problem

A good policy helps in creating a business environment for investments, and when it comes to big investment, such as investments in an infrastructure sector, the policy ought to be strong enough to win trust of different stakeholders at large.

As discussed previously, financing of solar PV projects was a challenging task for many developers. It is evident from statements below, stated by respondents that policy lack the merit to win trust of many bankers.

> *"Getting the project funded from banks was* [**Financing biggest problem**] *difficult task because there were issues in clarity of the policies. (…) they were not sure of the policy"* **[Respondent G3]**

> *"Issues are there in financing the project, bankers were hesitant, clarity was not there in the policy among bankers, and even at times central government was not clear on the policy. Even the major companies were finding it* [**Financing biggest problem**] *difficult to finance their projects."* **[Respondent R4]**

4.1.2.3 Single Window Clearance (SWC) was an issue

The policies announced by Central Government and Federal States to promote solar energy in India, provide Single Window Clearance Mechanism to facilitate developers for timely execution of grid connected solar PV projects. But it was clearly evident from the experiences shared by respondents that, they faced problems in getting clearances on time at some levels.

"Obtaining clearances for land was time consuming and difficult. [**Single Window Clearance (SWC) was an issue**] *Single Window Clearance was somewhat cumbersome. It was at times problematic and time consuming which resulted is delays and in turn affected the project."* **[Respondents R6]**

"[**Single Window Clearance (SWC) was an issue**] *Clearances in the State were time consuming as the policy was a central government subject, because of which the nodal agency had few limitation which resulted in delays. Land clearance took time after."* **[Respondent R1]**

[**Single Window Clearance (SWC) was an issue**] *"Single Window Clearance is available in all those States having solar policy, but the catch is whether the facility provided under the policy in fully implemented or not."* **[Respondent G5]**

[**Single Window Clearance (SWC) was an issue**] *"(…) though many states promised SWC but what matters is that how active is the nodal agency in implementing it."* **[Respondents G2]**

4.1.2.4 Land Acquisition issues

Land acquisition had many impacts on the projects, such as local disturbances created by local community, issues in getting clearance on Right of Way (RoW), deciding upon appropriate compensation amount to land owner or getting land lease transferred.

This was evident from statements given by developers in Gujarat and Rajasthan.

"Land acquisition was plagued with lot of problems like getting the [**Land Acquisition issues]** *Right of Way (RoW) was the biggest issue. Getting clear information on land titles was a big problem. The land requirement is huge for installing solar PV power plant, getting a private land which is continuous in nature, was a challenge and if lucky, then finding such a land with single land owner was a challenge."* **[Respondent G1]**

"When acquiring a private land a developer should always be prepared at the back of his mind [**Land Acquisition issues]** *that they ought to face some local agitation."*

*"(…) it is not only about convincing multiple land owners, but at the same time convincing other land owners near the plant for laying transmission line through their property."***[Respondent G2]**

"At times there were issues in acquiring private land for our project. [**Land Acquisition issues]** *The land was not clear, there were issue related getting Right of Way (RoW), there were litigation issues."* **[Respondent R3]**

[**Land Acquisition issues]** *"(…) we had to face local agitation while laying the transmission lines to the substation."*

[Respondent R4]

[**Land Acquisition issues]** *"Land acquisition was difficult as we had to face local people and community's pressure. At times they demanded money which was not at all reasonable and tried to drive the matter politically. (…) we lost days for commissioning our project. The project execution teams faced threat and, they*

were even stone pelted at one time. The boundary wires were uprooted during nights." **[Respondent R6]**

The associative network diagram in figure 4-2 shows the relationship between the responses given by the interviewees on Policy and Political barrier.

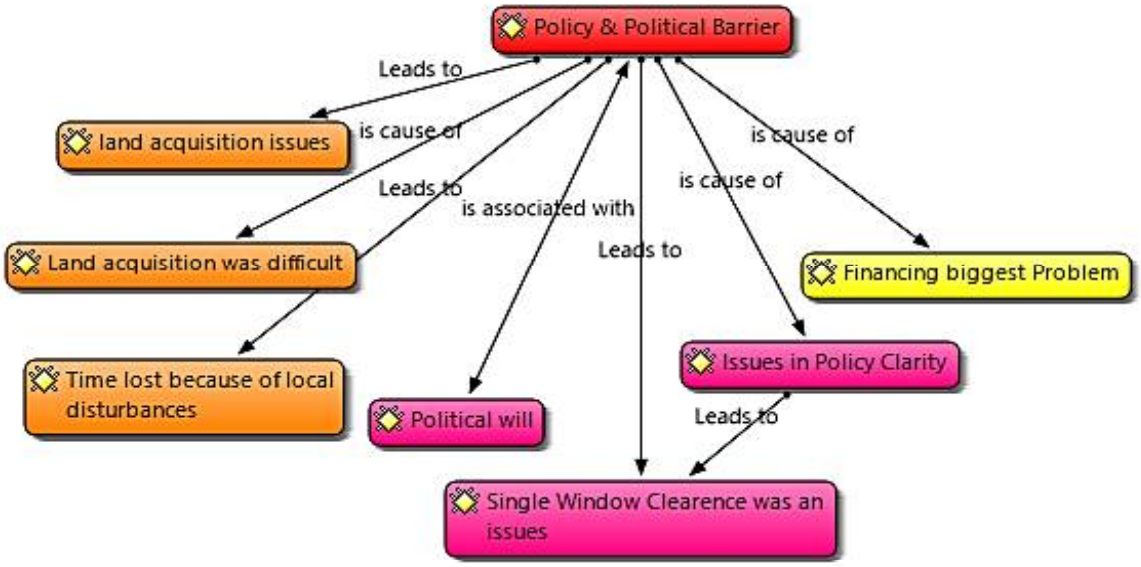

Figure 4-2 Dimensions to Policy and Political Barrier in State of Gujarat and Rajasthan

Table 4-3 Outcomes on Policy and Political Barrier

Outcomes on Policy and Political Barrier	
Land Acquisition was difficult	Issues in Policy Clarity
Land Acquisition issues	Single Window Clearance was an issue
Political Will	Financing biggest problem
Time lost because of local disturbances	

4.1.3 Discussions on Institutional Barrier

The institutional barrier discusses the challenges faced by solar developers in areas of Research and Development, training of workforce and organizations providing reliable and authentic information on radiation of

a specific location i.e. Direct Normal Irradiance (DNI). The developers feel that, there is a need in the country to have institutions which can provide accurate and reliable data on solar radiation for a place. Further, there is a need for institutions which can provide credible R&D facilities and carry out result oriented activities and establishments which can help the sector with capacity building.

These concerns are evident from experience shared by respondents stated as follows.

4.1.3.1 DNI data reliability is an issue

DNI is the most important factor for generation of electricity whether through PV or Thermal, greater the DNI for specific longitude and latitude, greater the generation of electricity.

> **[DNI data reliability is an issue]** *"Reliability of data was not sure in the initial years. The relevancy of a place having DNI 5 kwh/m^2/per day was same as 6 kwh/m^2/per day. The database was satellite based, so all developers had same level of data information regarding DNI."* **[Respondent R4]**

> **[DNI data reliability is an issue]** "*(…) data on DNI was an issue as it was satellite based data."* **[Respondent R6]**

> **[DNI data reliability is an issue]***"Data taken from NASA and IMD which are not reliable. There is still requirement for a reliable data."* **[Respondent G2]**

> **[DNI data reliability is an issue]** *"(…) the distance between the data stations was very far from each other so the data collected for a location in between data stations was extrapolated, so at times*

the results, after generation on that place, showed a difference of 20% between actual and recorded data." **[Respondent R1]**

4.1.3.2 Limited Research and Development

R&D has always been on a challenging front in India and requires time and money. India still needs to go a long way in attracting world eyes towards it as a research oriented country. To support the R&D process in area of solar energy, academic institutions can play an important role in close coordination with industry.

Solar energy technology is still in its developing phase across the World and India's R&D faces a stiff challenge to make a mark. The country lacks R&D support facilities and academic interface. It is perceived as money burning initiative by developers. This is evident from interviews stated below.

[**R&D Limited**] *"There is no significant R&D in the country. No one wants to burn money in R&D process. Majorly it is because of the lack of mindset."* **[Respondent R2]**

"R&D level in the country is [**R&D Limited**] *quite low and there is no assistance for our project from the current R&D level."*

[Respondent R1]

"R&D has always been an issue in the country specifically for renewable energy and [**R&D Activities and Facilities not supportive**] *for solar, in our case there has been no help."*

[Respondent R6]

"R&D in the country has been nil…" **[Respondent R3]**

"R&D is limited and nascent in stage and [**No R&D – No investments**] *nobody wants to invest money. R&D has not supported us in any of our projects in any way."* **[Respondent G4]**

4.1.3.3 Training Institutes

There are limited institutes which provide technical education and can help in capacity building for solar sector. There is a lack of interaction between industry and academic for diffusion of knowledge, largely because of which there has been lack of skilled workforce in sector. The developers state that, there has been an interaction gap between industry and academia.

[**Skilled workforce an issue**] *"Skilled workforce is limited.*

[Respondent R4]

"(…) skilled workforce was an issue" [**Limited workforce**]

[Respondent R6]

"There is and has been [**Limited workforce**] *limited workforce which is skilled enough to work at solar power plant sites?"*

[Respondent R3]

The associative network diagram in figure 4-3 shows the relationship between responses given by the interviewees on Institutional Barrier.

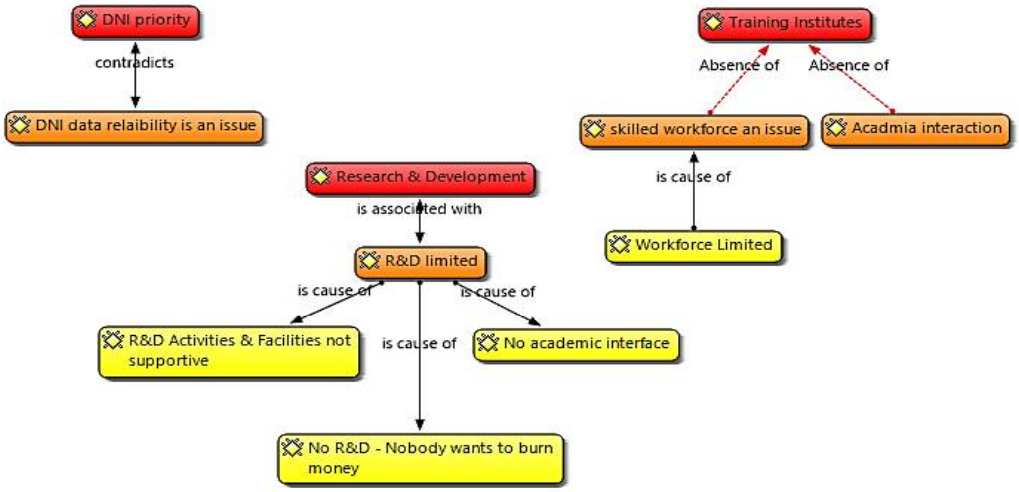

Figure 4-3 Dimensions to Institutional Barrier in State of Gujarat and Rajasthan

Table 4-4 Outcomes on Institutional Barrier

Outcomes on Institutional Barrier	
DNI priority	Nobody wants to burn money in R&D
DNI reliability issues	Skilled Workforce an issue
R&D Limited	Limited Workforce
R&D activities and facilities not supportive	No academia interaction

4.1.4 Discussions on Land Acquisition and Land Information Challenges

Land is a vital part of any infrastructure project and researcher has discussed concerns related to land acquisition, under Policy and Political barrier in section 4.1.2. This section of the chapter discusses challenges related to Land acquisition and Land information in detail.

4.1.4.1 Physical aspect of land

Identification of land depends on some physical artifacts especially for grid connected solar PV power plant such as land should be continuous in

nature, contour[14] of the land should be good and it should be away from any kind reserved area or protected area. This information can be referred to below statement by developers.

> *"Important factors that are to be kept in mind for identifying land for a project site are,*
>
> - *It should be* [**Continuous Land**] *continuous in nature;*
> - *Level of land i.e.* [**Good Contour**] *contour should be good because if there is difference in level of land then there are few issues, first cost increases to get it leveled and secondly angle get affected of array or modules which can lead to less generation.*
> - *No proximity of reserved area, we have faced this problem in one of our project because of which we had to take our transmission line around the* [**Reserved or Protected Area in Proximity**] *forest area."* **[Respondent G4]**
>
> *"Getting private* [**Continuous land**] *continuous land was a big issue. Identification of land was done on the basis that it should be free from all disturbances and* [**Reserved or Protected Area in Proximity]** *no proximity of the protected area."* **[Respondent G1]**

4.1.4.2 Encumbrances

An encumbrance[15] is any right or interest that exist in someone, other than the owner of an estate and that restricts or imparts the transfer of the estate

[14] *Contour is defined as the outline of a mass of land (or a line on a map that joins point of equal height or depth, in a way that shows high and low areas of land)* (Cambridge University Press, 2014)
[15] *It is a general term for any claim or lien on a parcel of real property* (The Free Dictionary, 2014).

lowers its value. This might include an easement, a lien, a mortgage, a mechanic lien or accrued and unpaid taxes (The Free Dictionary, 2014).

Solar PV power plants require large land for installations, the current requirement for installing a megawatt of solar PV power plant developer needs to acquire around 3-4 acres of continuous land (MNRE, 2010).

When a developer goes for an acquisition of private land, it becomes very important for a developer to look in to matters related to encumbrances. The land should have a clear land titles, should not be mortgaged and taxes should be paid off. The land should not be under any kind of litigations or charges.

There are certain terminologies associated with acquisition of land which are to be understood during the interviews.

These are:-

1. *Mortgage of land*

   "A debt instrument, secured by the collateral of specified real estate property, that the borrower is obligated" (Investopedia, 2014).

2. *Deed of trust*

   "A document that embodies the agreement a lender and a borrower to transfer an interest in the borrower's land to a neutral third party, a trustee, to secure the payment of a debt by the borrower" (The Free Dictionary, 2014).

3. *Land Titles*

"A process by which proof of ownership of real property is filled in the appropriate local government office or court to allow purchasers, creditors and other interested parties to determine the status of the property interest therein" (The Free Dictionary, 2014).

4. *Mechanic lien*

"A guarantee of payment to builders, a contractor and construction firm that builds or repairs the structures. Mechanic lien also extends to suppliers of material and subcontractors and covers the building repairs as well. The lien ensures that the workmen are paid before anyone else in the event of liquidation" (The Free Dictionary, 2014).

Definition 2 – "A charge or claim upon the property of another individual as security for a debt that is created in order to obtain priority of payment of the price or value of work that is performed and material that are provided in the erection or repair of a building or other structures" (The Free Dictionary, 2014).

5. *Tax Lien*

A legal claim by a government entity against a non-complaint tax payer's assets. Tax lien is a last resort to force an individual or business to pay back taxes (Investopedia, 2014).

a. State tax lien

"A lien on the property of a taxpayer that tax collector can use upon default of payment of taxes" (Investopedia, 2014).

b. Property Taxes

"Property tax is the annual amount paid by a land owner to the local government or a municipal corporation of his area. The property includes all tangible real estate property houses, office buildings and the property rented to others" (Economic Times, 2014).

"The tax assessed on real estate by the local government. The tax is usually based on the value of the property (including land) a person owns" (Investopedia, 2014).

6. *Easement of Right*

"It is a right of use over the property of another. The most important Easement of Rights are the Right of Way (RoW) and Right of Water (RoW)".

"An easement is a non-possessory interest in another's land that entitles the holder only to the right to use such land in a specific manner. It is distinguishable the right to enter another's land and remove the soil itself or a product thereof" (The Free Dictionary, 2014).

These terms explained above can now be easily associated with the statements given by developers stated below, in context to necessary information that is required to acquire land for a solar project.

> *"In the process of identification land it should be free from all* [**Encumbrances to land Acquisition**] *encumbrances. The encumbrances include charges on land like*
>
> - *Loan*
> - *Mortgage of land* [**Mortgage on Land**]

- *Deed of trust* [**Deed of Trust**]
- *Unpaid real property taxes* [**Unpaid property taxes**]
- *Tax lien* [**Tax Lien**]
- *Mechanic lien* [**Mechanic Lien**]

Local government support is important in getting clearances and [**Conversion of land**] *converting the identified land for commercial use.*

The change of use of land takes place when we are granted a [**Conversion of land**] *NA- Non Agriculture land certificate by registrar.*

These clearances also include easement of right certificate which are getting

- *Right of Way* [**Right of Way**]
- *Right of Water* [**Right of Water**]

The Easement of Right [**Easement of Right**] *is necessary for getting water supply to plant from the nearest source and when developer lays the transmission line to nearest substation for connectivity."* **[Respondent G7]**

"We faced delays in getting clearance on Rights of Way (RoW) for our project, getting information of land titles was a challenge. As a developer we sought information on land titles, grid connectivity in proximity to the plant as it helps in reducing overall cost and minimize losses." **[Respondent G2]**

"The land should be barren / arid in nature because we need to have a [**Conversion of land**] *NA*[16] *certificate from registrar office. (…) we did face some issues related to clear information on land title, clearances for Right of Way (RoW) and some litigation cases."* **[Respondent R3]**

"A [**Conversion of land**] *NA certificate is to be issued as per industrial act of the state."* **[Respondent G5]**

The associative network diagram in figure 4-4 shows the relationship between responses given by the interviewees on Land Acquisition and Land Information Challenges.

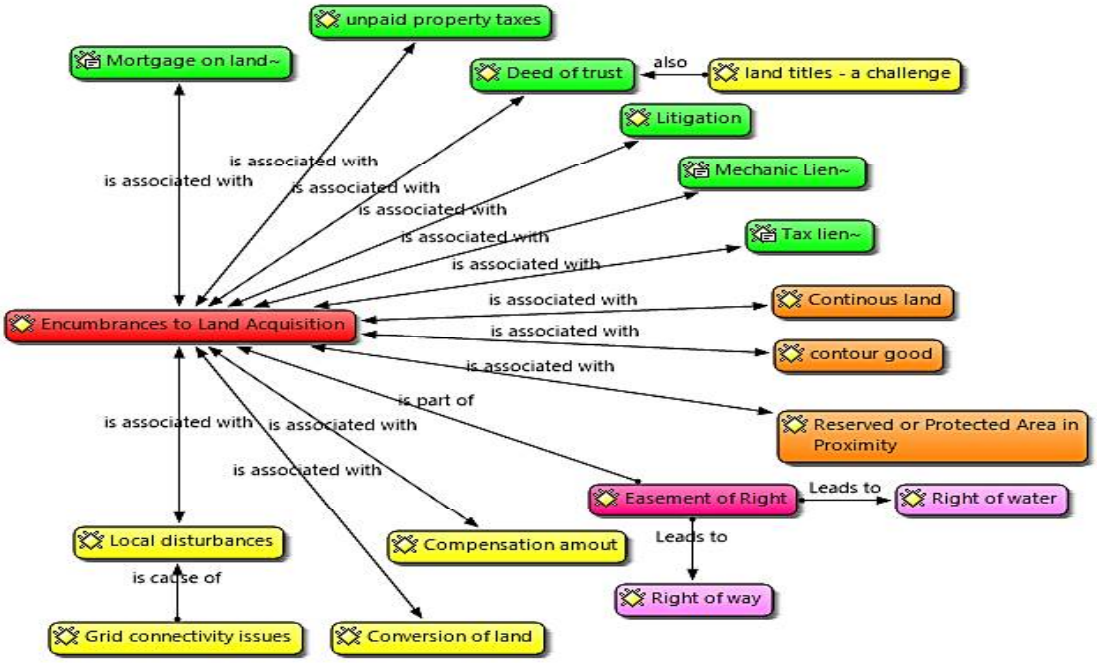

Figure 4-4 Dimensions Land Information and Land Acquisition Challenges in State of Gujarat and Rajasthan

[16] *Non Agriculture (NA) Land means the land which is used for purposes not connected with agriculture or horticulture* (PRSIndia, 2014).

Table 4-5 Outcomes on Land Information and Land Acquisition Challenges

Outcomes on Land Information and Land Acquisition Challenges	
Mortgage on Land	Unpaid property taxes
Deed of Trust (Land Titles)	Litigation
Mechanic Lien	Tax Lien
Continuous Land	Contour good
Reserved or Protected Area in Proximity	Easement of Right
Right of Way	Right of Water
Local Disturbances	Compensation amount
Grid connectivity issues	Conversion of Land

4.1.5 Discussions on Administrative Challenges

The administrative barrier highlight issues related to delay in getting clearances. The developers stated that there were issues in clarity of policy and effectiveness of Single Window Clearance Mechanism.

This was evident from responses from the interviewees.

> *"RRECL*[17] *was in charge of promoting JNNSM in State and* [**obtaining clearances, issues in policy clarity**] *at time few matters were escalated to the central government* [**Issues of delay**] *that caused delays in some projects."* **[Respondent R1]**

> *"(…) Single Window Clearance facility was available but it was* [**Issues of delay**] *time consuming as it was not fully implemented and normally they were time consuming."* **[Respondent R1]**

> [**Single Window was an issue**] *"Single Window Clearance was a somewhat cumbersome* [**issues of delay**] *because of some problems it delayed our project."* **[Respondent R6]**

[17] *A nodal agency is responsible for development of the solar sector in a concerned area. Rajasthan Renewable Energy Corporation Limited (RRECL) is the nodal agency in Rajasthan likewise Gujarat Energy Development Authority (GEDA) in Gujarat and NTPC Vidyut Vyapar Nigam (NVVN) under Central Government.*

The associative network diagram in figure 4-5 shows the relationship between responses given by the interviewees on Administrative Challenges.

Figure 4-5 Dimensions to Administrative Challenges in State of Gujarat and Rajasthan

Table 4-6 Outcomes on Administrative Challenges

Outcomes on Administrative Challenge	
Issues in Policy Clarity	Obtaining Clearances
Single Window Clearance was an issue	Issues of delay

4.1.6 Discussions on Regulatory Barrier

The regulatory barrier relates to the issues posed by regulations or regulators. The regulators are responsible for developing the market for a concerned sector, in solar energy sector, the important responsibilities of a regulator is revising capital cost and tariff for solar power market on time to time basis.

The developers expressed their views in support of regulations. The related outcomes on Regulatory Barrier are discussed in detail in respective case studies of States in chapter 5 and 6.

4.1.7 Discussions on Market and Technology Barriers

Most developers imported modules from outside the country. The reasons being, the market was the immature and it still needs to go a long way. The developers pointed out that with Indian manufactured modules it was difficult for them to achieve project feasibility.

As mentioned before that India lacks R&D facilities and it poses a serious problem, when the policy claim for using indigenous products (MNRE, 2010).

India has very limited manufacturing units involved in production of solar power related equipment, to name a few like cells, wafers, silicon etc.

There are two technologies commercially proven, Crystalline Silicon and Thinfilm, of which India has manufacturing capacity for Crystalline Silicon only. Thinfilm modules are 100% imported.

The world leader in manufacturing of modules is China. Some developer claimed that the buying cost of Indian manufactured modules is more than the landing cost of the Chinese modules in India.

Another major problem is the availability / production of silicon which is the main component to manufacturer cells for a module.

The figure 4-6 explains the value chain of photo voltaic manufacturing.

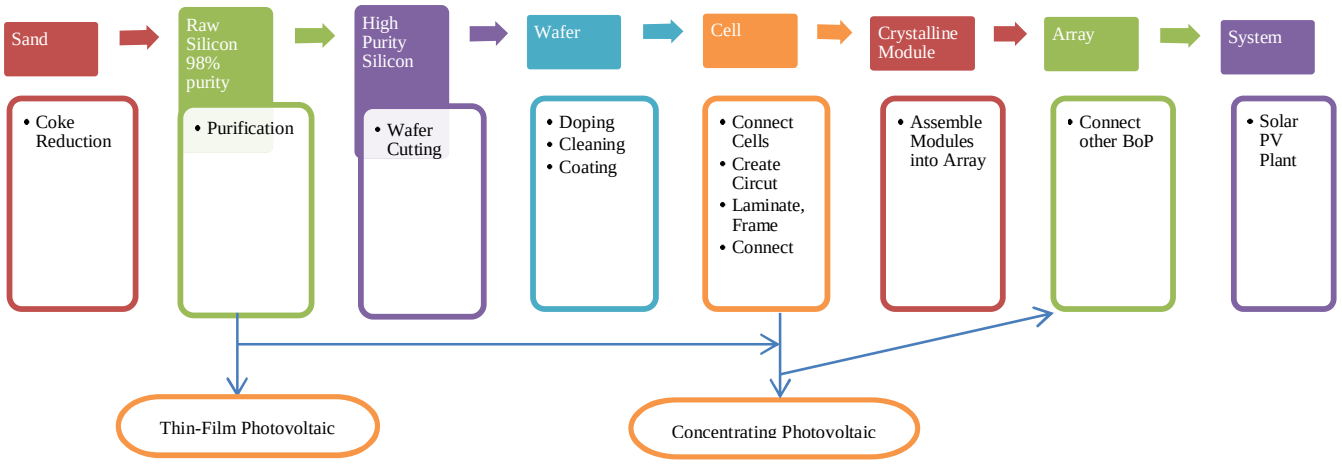

Figure 4-6 Value Chain of Solar Photovoltaic (PV)

One of the developers who installed imported modules faced technical issue in its initial year of operations.

The following mentioned technical problems faced by the PV modules are explained below as it helps to understand the terms during the interview statement quoted later.

1. *PID Losses*

"Potential Induced Degradation occurs when the modules voltage potential and leakage current drive ion mobility within the molecular between the semiconductor material other element of the modules [e.g. glass frame] thus crossing the modules power output capacity to degrade" (AE Solar Energy, 2014)

2. *Snail Trail*

It is defined a product of the formation of silver carbonate Nano partials which discolor the silver grid. They are the dark lines or partial cell dis colorations on the PV module, though the effect of snail trail is minimal on the efficiency of PV modules, but still there are concerns of snail trail influence on the PV modules in the long run (Peng & Hu, 2012)

3. *Thermal Shocks and Thermal cracks*

"It is caused due to the fluctuation in temperature crossing stress in a material it often result in fracture" (SABCS, 2013).

> [**Imports**] *"We have sourced our panels from China. It's been almost 18 months since I'm here on the plant site. One day I notice that there were some dark lines on panels as if a leech has crawled through, later I found out that it is known as 'snail trail' which is recently being noticed in solar world. Some other* [**Technical problems**] *technical problems faced by some plants are Thermal Cracks, PID losses Thermal Shocks, Micro Crack etc."*
>
> **[Respondent R6]**

> *"The competitive eco system* [**immature market**] *has not at all developed in India at any stage. Today we have installed around 2000 MW which is almost 1% of the total installed capacity in the country and still we need to go a long way. The major challenge for India in the coming year will be the availability of land and silicon."* **[Respondent R5]**

> [**Unregistered Manufacturer**] *"Unqualified module manufactures will have no significant impact. I should rather use a term for them as new manufactures, who are venturing into this business as they*

saw new opportunities. They hired people with experience and started their business. These were mostly manufacturers of modules of low watt peak rating which makes it very difficult for them to impact the utility scale market of solar PV. Chines still have cheaper modules there [**imports**] *landing cost is less than the cost of sale in India."* **[Respondent R2]**

"Yes there is [**Limited PV manufacturers**] *limited presence of module manufacturing in India. They are* [**Expensive Indian Modules**] *expensive it is difficult to attain project feasibility with the Indian manufactured modules. Now a days installing PV modules from Indian manufactures makes no viability for large projects."* **[Respondent G1]**

[Expensive Indian Modules] *"Self-manufactured panels were not sustaining because of high cost, because the commercial electricity is expensive which reflects in their final cost, unorganized transport sector and* [**Limited R&D**] *R&D backing is nil"*

[Respondent G5]

[**Imports**] *"Modules for our project were mostly sourced from China as it helped us in reducing the overall cost of the project."*

[RespondentG3]

"The modules were [**Imports**] *imported from different countries like China, USA. Thin films modules from USA."*

"We faced some problem in the movement of modules imported from China. Chinese packaging standards were exceeding the normal height and weight standards in India and because of which

we had to pay penalties imposed on the [**Penalties on ODC and OWC**] *Over Dimension (ODC) and Overweight Weight Consignment (OWC).''* **[Respondent G6]**

The associative network diagram in figure 4-7 shows the relationship between responses given by the interviewees on Market and Technology Barrier.

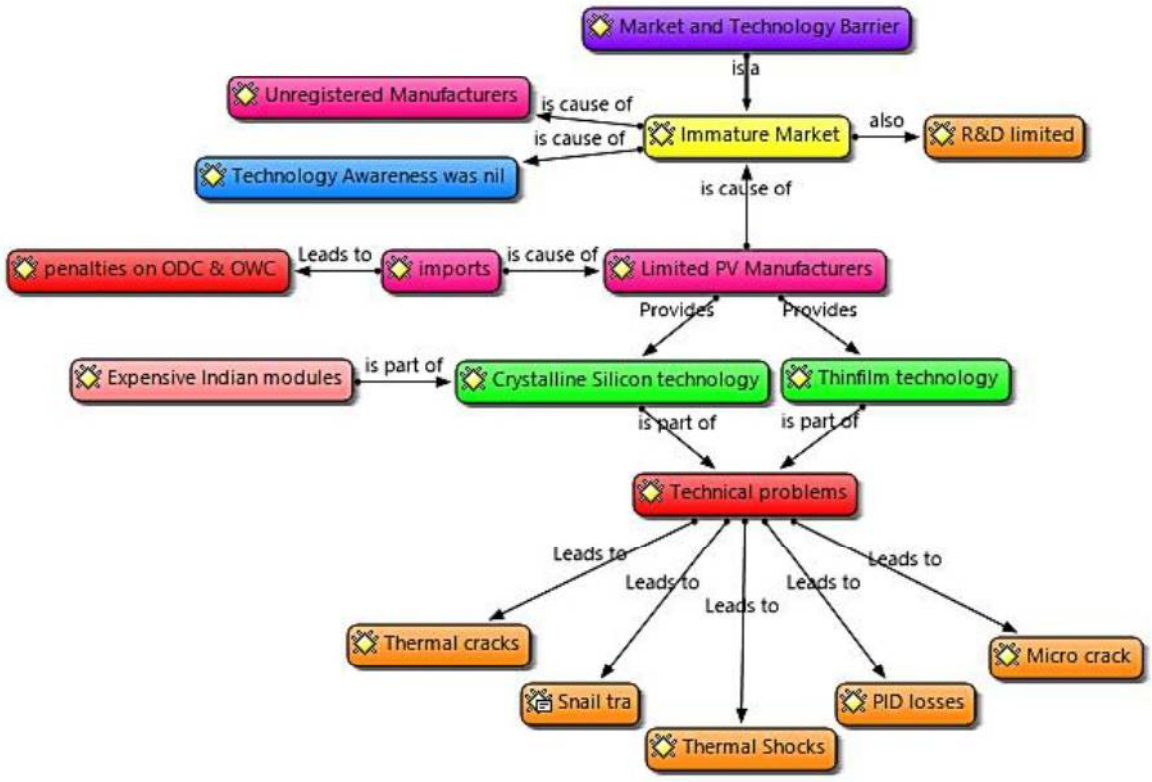

Figure 4-7 Dimensions to Market and Technology Barrier in State of Gujarat and Rajasthan

Table 4-7 Outcomes on Market and Technology Barrier

Outcomes on Market and Technology Barrier	
Technology Awareness	Unregistered Manufacturers
Limited PV manufacturers	Crystalline Silicon Technology
Thinfilm Technology	Penalties on ODC and OWC
Expensive Indian Modules	Technical problems

Thermal cracks	Micro crack
PID losses	Thermal Shocks
Snail Trail	Imports
R&D Limited	

4.1.8 Discussions on Development Cost Barrier

The development cost or pre operating cost is a very small percentage of the total project cost as mentioned by developers. It is hardly 10% of the total project cost. The Central Electricity Regulatory Commission states the development cost as composite of different cost centers.

The development cost consists of different heads they are:

- Insurance Cost: 0.5%
- Contingency: 0.5%
- Interest during Construction (IDC): 5%
- Financing cost: 1%
- Project management cost: 1%
- Pre-operative Cost: 1%

The developers who are desirous of installing a solar power plant had to fulfill the minimum financial criteria and one of them was net worth.

The associative network diagram in figure 4-8 shows the relationship between responses given by the interviewees on Development cost Barrier.

Figure 4-8 Dimensions to Development Cost Barrier in State of Gujarat and Rajasthan

Table 4-8 Outcomes on Development Cost Barrier

Outcomes on Development cost Barrier	
Net worth requirement for a project	Pre installation cost involved in a project

4.2 Epilogue

This chapter covered various perspectives of identified Barrier and Challenges according to developers' in Gujarat and Rajasthan specifically.

It is evident that similar barrier and challenges have existed in these two States as it does in India.

This chapter helped in building a strong base to conduct two Case Studies of Gujarat and Rajasthan.

The next chapter presents the case study for Gujarat.