

Chapter 5

Case Study of Gujarat

5.1 Introduction

This chapter discusses the case study for Gujarat. The objective of conducting this study is to find, how Gujarat as a State has responded to the role of identified Barriers and Challenges for Mega Watt Scale Grid Connected Solar Photovoltaic Power Plants executed in this region.

This study is part of multiple case study design and is single holistic unit of analysis in nature. Gujarat has been considered because it has the maximum installed capacity from grid connected solar PV power plants in the country, which is close to 900 MW¹⁸.

Data was collected through various sources as mentioned in section 3.5.3 of chapter 3. Sources for data collection have been interviews, documents and observations. A visit to Solar Park in Charanka in Gujarat (observations) assisted the researcher in developing this case study. The interviews were conducted during the months of March and April 2013, the details of the interviews have been provided in the section 5-6. The documents consisted of State and Central policy documents, various regulation orders, State and company reports etc. Interviews were recorded and transcribed for data coding and analysis. The data was coded with the help of ATLAS.ti software.

Analysis of coded data was a three-step process, data selection and presentation, within-case analysis, and cross-case analysis. The codes have

¹⁸ *Accounts to 40% of the total installed capacity in the country.*

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. Further, the last section of the chapter presents the results from within case analysis for the study, as it aided in creating the base for cross case analysis carried out in chapter 7.

5.2 State of Gujarat

Gujarat is a State on the northwestern part of India. It was formed on May 1st 1960 by assimilating 17 northern districts of the former state of Bombay. The state currently has 26 Districts, 242 Towns, 18,618 Villages and 226 Talukas. Tapi District was formed out of some Talukas separated from Surat District in 2007 (Government of Gujarat, 2009).

The State shares its international boundary with Pakistan and regional boundaries with Rajasthan, Madhya Pradesh and Maharashtra and the Union territories of Diu, Daman, Dadra and Nagar Haveli. The State has the longest coastline in the country surrounded by Arabian Sea. The map for Gujarat is shown in figure 5-1.

It is home to approximately 6.03 Crore people as per the census 2011, which is almost 5% of India's total population and as a state it covers 6% of the total country's land area (IBEF, 2014).

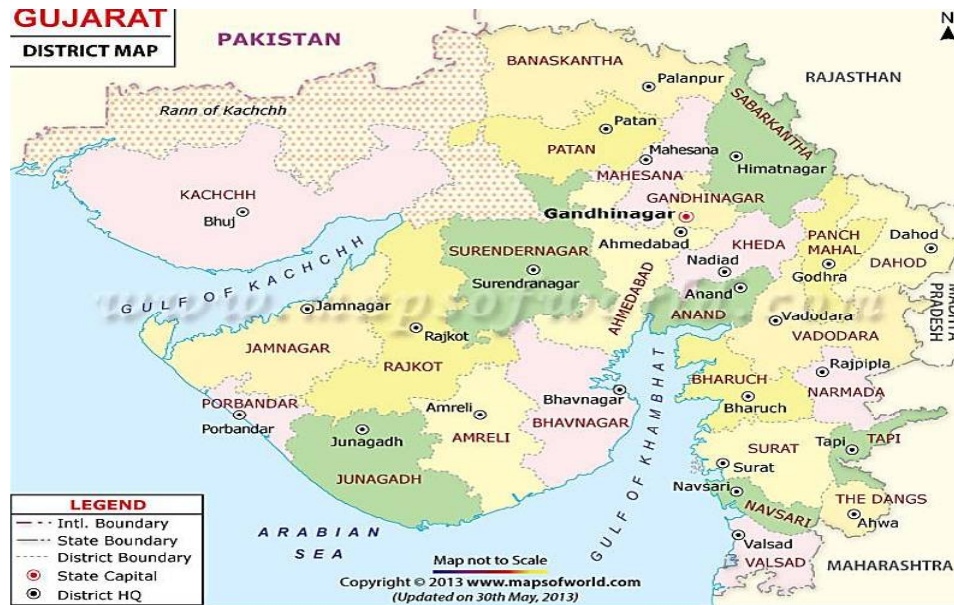


Figure 5-1 District map of Gujarat

Source: Maps of India

Gujarat has been developing at robust pace since last two decades and has a Cumulative Annual Growth Rate (CAGR) of 9.1% for the period 2008-11, which was well above the national growth rate of 8.2% for the same period (Government of Gujarat, 2014). Having attained a balanced economic growth structure Gujarat has emerged as one of the major industrial and trade hub.

The primary¹⁹, secondary²⁰ and tertiary²¹ sectors together have been supported by a strong infrastructure network in the state. Gujarat is among the top five states which contribute to almost 7% of the country's GDP (DEA, 2014). State has registered a continuous increasing trend in the per capita income for last 10 years, which has apparently been more than the country's per capita income growth rate (DES, 2014). The table 5-1 shows the fact file for Gujarat.

¹⁹ Extractive activities: Fishing, Farming, Forestry, Mining

²⁰ Transformative activities: Processing, Manufacturing

²¹ Service activities: Transportation, Retailing, Maintenance

Table 5-1 Gujarat Fact File

S.No.	Parameters	Details
1	State Capital	Gandhinagar
2	Area (Sq. km)	1,96,024
3	Population(2011 Census)	6.04 Crores
4	Population Density(per Sq.Km)	308 persons
5	Districts	26
6	Average GSDP growth rate (%)	16 %
7	Sex Ratio (2011 Census)	917 females per '000 males
8	Key Industries	Textiles, Engineering, Petrochemicals, Drugs and Pharmaceuticals, Dairy and Jewelry, Dimensional Stones.
9	Fiscal Deficit to GSDP (2012-13)	-2.61 %
10	Literacy Rate	79.3 %

5.3 Power Sector Scenario in Gujarat

Gujarat has showcased a strong growth in power sector development since 2005. Since its decision to unbundle its State Electricity Board (SEB) in 2005, it has made a turnaround with a remarkable transformation from power deficient state to power surplus and its electricity board (SEB) which was burdened with huge loss of ₹ 737 Crore in the year 2005-06 realized profits of ₹ 436 Crore in the year 2011-12.

The Gujarat Electricity Board (GEB) was established in 1960 under Section 5 of the Electricity (Supply) Act 1948 (GUVNL, 2014). When GEB started its operations it had a base of 14 lakh consumers and an installed capacity 315 MW. Gujarat had a major thrust on electrifying the rural areas and due to GEB's steady focus on rural electrification, the

Gujarat became the first State to achieve the landmark of 100% rural electrification.

The Electricity Act 2003, was passed by Central Government to introduce power sector reforms, similarly Government of Gujarat introduced Gujarat Electricity Industry (Re-organization and Regulation) Act 2003, which aimed at restructuring the electricity sector by improving its efficiency in management system and service delivery to consumers.

The functional responsibilities identified under Gujarat Electricity Industry (Re-organization and Regulation) Act, 2003 were Trading, Generation, Transmission and Distribution. These responsibilities were divided under seven companies. The figure 5-2 shows the reorganization of former Gujarat Electricity Board (GEB) with effect from 1st April, 2005.

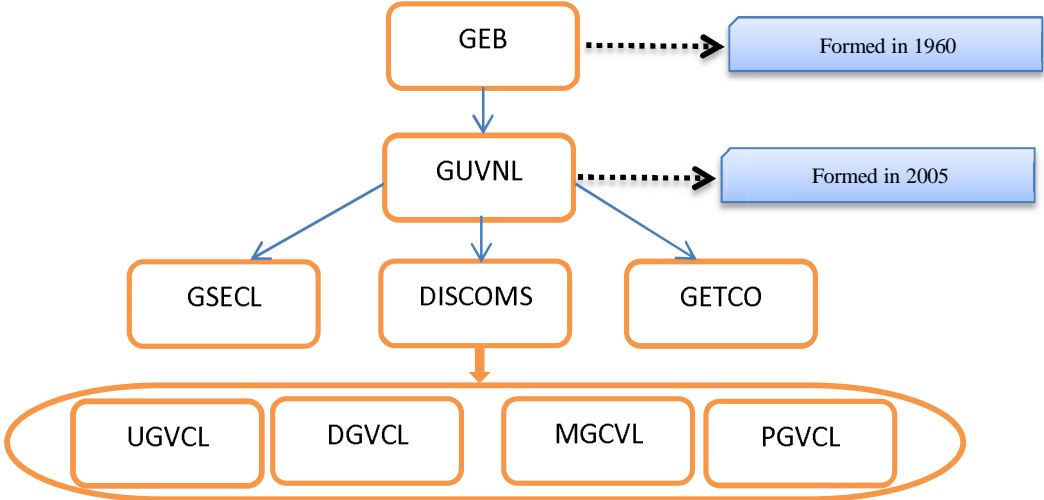


Figure 5-2 Gujarat Power Sector structure

The companies are as follows

- The Holding Company
 - GUVNL – *Gujarat Urja Vikas Nigam Ltd* was formed as a government company in 2005. It is the holding company engaged in the business of bulk purchase and sale of electricity.
- Generation
 - GSECL – *Gujarat State Electricity Corporation. Ltd* is engaged in the business of generation of electricity.
- Transmission
 - GETCO – *Gujarat Energy Transmission Corporation. Ltd* is engaged in the business of Transmission of Electricity.
- Distribution Companies – DISCOMS
 - UGVCL – *Uttar Gujarat Vij Company Ltd.* in northern region
 - DGVCL – *Dakshin Gujarat Vij Company Ltd.* in southern region
 - MGVCL – *Madhya Gujarat Vij Company Ltd.* in central region
 - PGVCL – *Paschim Gujarat Vij Company Ltd.* in western region

These DISCOM's are engaged in the business of distribution of electricity in these areas of Gujarat.

5.4 Power Generation Scenario

Gujarat has cumulative installed capacity generation of 22,396 MW as of 31-03-2013, it includes different sources of energy namely, coal, gas, hydro, nuclear, wind, biomass, mini hydel and solar.

The table 5-2 shows the details of different fuels used to generate power in the state as of December 2013.

Table 5-2 Sources of electricity generations

Fuel	Capacity MW	Share %
Hydro	779	3.50
Lignite	1040	4.65
Coal	11720	52.34
Atomic/Nuclear	559	2.50
Gas	4172	18.62
Wind	3231	14.42
Biomass	31	0.14
Mini Hydel	7	0.03
Solar	857	3.82
Total	22396	100

The power sector includes different categories of players who are involved in generation of electricity in Gujarat, such as, GSECL is responsible for 5496 MW of electricity generation, Independent Power producer (IPP-private) produces 5960 MW of electricity, and Independent Power producer (IPP-State) generates 1567 MW etc. The details for power generation by different companies are presented in table 5-3.

Table 5-3 Contribution of different sectors in power generation

Category of Players	Capacity MW	Share %
GSECL	5496	24.55
IPP State	1567	7
IPP Private	5960	26.61
Licensee	1648	7.35
Central	3368	15.03
SSNNL²²	232	1.03
Renewables	4126	18.42

5.5 Solar Energy Generation Scenario

To exploit the solar potential in the State, Government of Gujarat launched an ambitious mission in order to promote solar energy, which is also an effort to curb challenges rising due to climate change and global warming. Solar Power Policy was introduced on 6th January 2009, under the Resolution No. SLR-11-2008-2176-B dated 7.1.2009 (GERC, 2010). On introduction to this policy Gujarat became the first state in country to do so. Solar Policy aimed at promotion of green and clean power, besides this it also aims to develop sustainable market for clean development mechanism (CDM), use the wasteland in the state efficiently, promote local manufacturing, employment, skill enhancement and promote research and development for the technology. The details for solar policy have been summarized in the table 5-4.

²² *Sardar Sarovar Narmada Nigam Limited: A Wholly owned Government of Gujarat Undertaking*

Table 5-4 Details of the Gujarat Solar Policy 2009

S.No	Parameters	Details
1	Policy Name	Solar Power Policy 2009
2	Operative Period	2009-2015
3	Capacity Planned	500 MW
4 (a)	Tariff (Rs/kWh) from 2009 – 2012	15.00 (1 st to 12 th years) (from the COD) 5.00 (13 th to 25 th year)
4 (b)	Tariff (Rs/kWh) from 2012 - 2015	<u>For MW Scale Plants:</u> Jan 2012-March 2013: 10.37 (Without AD), 9.28 (With AD), FY 2013-14: 9.64 (Without AD), 8.63 (With AD), FY 2014-15: 8.97 (Without AD), 8.03 (With AD)
5	Category / Types of Projects	Category 1 - Competitive bidding
		Category 1 - Feed in Tariff
		Category 2 - Open Access
6	Current Installed Capacity (MW)	865
7	Off Taker	GUVNL
8	Radiation kWh/m ² / day	6.5-7
9	Nodal Agency	GEDA
10	Other Incentives	Exemption from Demand cut upto 50%
		Electricity Duty Exemption
		Cross subsidy surcharge not applicable

Initially the policy planned to install 500 MW of capacity through grid connected Solar Power Plants but eventually it has installed close to 900 MW through grid connected solar PV. The policy had a 5 MW capping on the minimum capacity that can be allotted under the policy, but GERC through order 2 of 2010 stated that, generation is not a licensed activity as per EA 2003 and the generator has the freedom to install any capacity for generation (GERC, 2010).

During an annual conference organized by State government called *Vibrant Gujarat Global Investors' Summit 2009*, it signed Memorandum

of Understanding (MoA) with 44 companies who showed interest in investing money in Solar Power business in Gujarat. The MoA was signed for 3,257 MW worth ₹66,251 Crore and same year in August, State government issued a Letter of Intent (LoI) to 34 companies for setting up a cumulative capacity of 710 MW. Looking at the positive interest showed by developers, more application flowed in of which some were accepted. A total of 75 projects have been installed in the State with a cumulative installed capacity of more than 870 MW. By achieving this feat, State also comprehensively met its RPO through solar as per the MNRE guidelines. The figure 5-3 shows the Solar RPO for Gujarat.

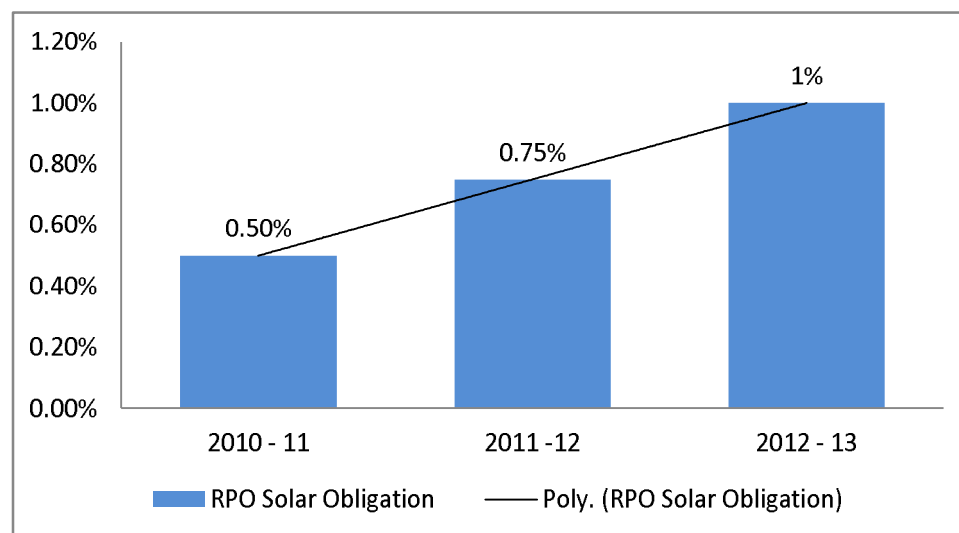


Figure 5-3 RPO Solar for Rajasthan for the year 2010, 2011 and 2012

Gujarat Electricity Regulatory Commission determines the tariff for procurement of power, from solar energy projects, by Distribution Licensees and others. The tariff for power generating projects is categorized as:

- Market based or Cost Plus Tariff
- Project specific or Generalized Tariff

- Single Part of Two part Tariff
- Front Loaded Tariff, Back Loaded Tariff or Levelised Tariff

A vide Order No.2 of 2010, GERC declared a single part, generic levelised tariff based on cost plus basis for Solar Power Projects (GERC, 2010). The components considered for calculating the tariff were:

1. Evacuation cost
2. Capital cost
3. Operations and Maintenance charges
4. Debt - Equity Ratio
5. Loan Tenure
6. Interest rate on loan
7. Return on equity
8. Rate of Depreciation
9. Interest on Working Capital
10. Capacity Utilization Factor (CUF)
11. Duration of Tariff
12. Auxiliary Consumption

Based on the above components the Commission worked out a levelised tariff of ₹ 12.54 / kWh and decided to divide the tariff in two sub periods. The Commission declared a tariff of ₹ 15 / kWh for first 12 years from the date of commissioning and ₹ 5 / kWh for 13th to 25th year (Table 5-5).

Table 5-5 Tariff given by the GERC

Years	Tariff (Rs/kWh)
1 st – 12 th year (from the COD ²³)	15
13 th – 25 th	5

²³ COD – Commercial Operation Date

The tariff was inclusive of accelerated depreciation, and on the contrary, projects which do not want to avail benefits of accelerated depreciation can ask the Commission to determine tariff separately. The declared tariff was considered by Government of Gujarat and was applicable to the plants to be commissioned on or before 28-1-2012. The list of commissioned solar PV plants in Gujarat is attached in Annexure 8.

On 27th January 2012, GERC through Order No.2 of 2010 declared revised tariffs for solar projects to be commissioned during the period starting from 29th January 2012 and ending on 31st March 2015. after 28th January 2012 (GERC, 2010). Keeping in view the interest of all stakeholders, Commission decided to have a successive revision to the tariff. This was done largely due to steadily decreasing prices of solar PV modules in the World market.

The successive revision will be done on year on year basis thereby reducing the burden on end user of electricity and encourage the projects to come up and ensure timely commissioning in the State. Commission decided to have a 7% rate of declining on tariff applicable from 1st April 2013 to 31st March 2014 and further 7% decline from 1st April 2014 to 31st March 2015.

The summary of tariffs declared GERC for MW scale solar PV power projects is shown in Table 5-6.

Table 5-6 Tariff declared by GERC for Solar power plants

Period	29 th January 2012 to 31 st March 2013	1 st April 2013 to 31 st March 2014	1 st April 2014 to 31 st March 2015
<i>For the MW scale plants power availing Accelerated Depreciation (AD)</i>			
Levelised tariff for 25 years	₹ 9.28 / kWh	₹ 8.63 / kWh	₹ 8.03 / kWh
1st – 12th year (From COD)	₹ 9.98 / kWh	₹ 9.13 / kWh	₹ 8.35 / kWh

12th – 25th year	₹ 7.00 / kWh	₹ 7.00 / kWh	₹ 7.00 / kWh
<i>For the MW scale power plants not availing Accelerated Depreciation (AD)</i>			
Levelised tariff for 25 years	₹ 10.37 / kWh	₹ 9.64 / kWh	₹ 8.97 / kWh
1st – 12th year (From COD)	₹ 11.25 / kWh	₹ 10.30 / kWh	₹ 9.42 / kWh
12th – 25th year	₹ 7.50 / kWh	₹ 7.50 / kWh	₹ 7.50 / kWh

In a bold step towards developing solar energy sector in the State and set a benchmark for the World to see, Gujarat government introduced the concept of Solar Park. Gujarat Power Corporation Limited (GPCL) is designated as nodal agency for development of Solar Park in the State. The State gained laurels for developing Asia's largest Solar Park and a state of art infrastructure in India. The planned capacity for the Solar Park is 590 MW of which the GPCL has already achieved 224 MW by end of 31-12-2013. This initiative has showcased a perfect way of creating job opportunities for local people and optimally using the barren land which is not favorable for agriculture activities. It further aided in economic development and upliftment of a remote areas. The details of solar power plants installed in Charanka are shown in Annexure 9.

5.6 Information and Data collected

Looking at the kind of development in the State, researcher was keen to examine the role of Gujarat in addressing various barriers and challenges found earlier in the study. This following sub-section discusses the responses and experiences of different developers in state of Gujarat. This assisted the researcher to gain knowledge on how Gujarat has responded to the role of various barriers and challenges in its region.

The respondents were interviewed during the months of March to April 2013. Respondents refused to disclose their names, name of the company,

the name of the project which were mostly SPV's (special purpose vehicle) neither they allowed the researcher to mention their financier's name. During every interview researcher signed a Confidentiality Agreement with the interviewees in order to adhere to limitation.

The table 5-7 shows the details of interviews conducted in State of Gujarat. Table specifies the code used for interviewee, date and time of interview conducted and limitation posed by the respondents.

Table 5-7 Interview and data collection details

Codes	Interviewee	Date of Interview	Time of Interview	Comments
G1	1 st respondent from Gujarat	12 – March – 2013	10:30 am – 11:50 am	Do not disclose any necessary information that are important to organization, project or any related individual
G2	2 nd respondent from Gujarat	13 – March – 2013	11:20 am – 1:15 pm	
G3	3 rd respondent from Gujarat	20 – March – 2013	5:15 pm – 6:30 pm	
G4	4 th respondent from Gujarat	25 – March – 2013	3:00 pm – 4:00 pm	
G5	5 th respondent from Gujarat	27 – March – 2013	9:00 am – 11:25 am	
G6	6 th respondent from Gujarat	14 – April – 2013	12:40 pm – 1:15 pm	
G7	7 th respondent from Gujarat	18 – April – 2013	6: 15 pm – 7:00 pm	

The following sub sections present the respondent's experiences as shared during the interviews for various Barriers and Challenges identified in chapter 3. The researcher has tried to discuss the overall response of the different respondents for each category of barriers and challenges and then supported it with interview statements.

5.6.1 Discussions on Financial Barrier

The respondents expressed their views on how grid connected solar PV power plants were funded. It was understood from the information shared by them that, financing of projects was difficult as banks were hesitant in funding such projects. Banks usually claimed higher interest rates for lending money. In most of the cases banks did lend money but it was only

after they were assured of the revenues are being realized by the project. Banks mostly provided syndicate loan to mitigate the risk that persisted in the sector.

Due to these limitations, developers had to arrange funds from different sources for their respective projects. In spite of the fact, the projects were self-financed in most cases, nevertheless, developers looked for equity investors who could lend money. The short term loan (or bridge loan) was arranged through banks. Some developers opted to avail Buyers' Credit to purchase modules and related equipment for the projects. The developers went for cost cutting on different aspects in order to achieve project feasibility.

The respondents expressed their discomfort of bearing high investment on their own, as banks were funding back end projects in the same sector like manufacturing of modules, cells, equipment to name a few.

The above discussed is evident from the following discussions.

The construction period for developing grid connected Solar PV power plant is less than a year, which helps the developer to believe that it can start realizing its revenues within one year. It was learnt that, if a developer was able to manage finance for a project then he had gone forward to develop the plant, commence its operation and then approached the banks for funding. Further it depends on the developer how he can cut down cost to make the project financially viable. This is clearly understood through the statements given by **G3**.

[Equity funding] *Our company had all the projects equity funded, it was only after commissioning of project and payment were being realized, [Bank lend money after project commissioned] the*

bank provided us with loan money for the projects. We have arranged [Short term loan] short term loan which is also called the [Bridge loan] bridge loan from our banker, it was done in the initial stages of project. For being competitive we had to [Cost cutting] cut down cost on every possible aspect like [Engineering, Human Resource, Modules] modules, engineering and human resource. Modules for our project were mostly sourced from China as it helped us in reducing the cost of project because it accounts for [Cost of module is 50% of the total project cost] 50% of the total project cost.”

“As compared to all large scale infrastructure sector projects which can have a gestation period of anywhere around 2 to 5 years ranging from road, power to large hydro, [Gestation period being 6 - 12 months] a solar PV project can be installed within a span of 6-12 months and be ready for operations, if there are no delays.”

Further **G3** stated that, banks go through a *Due Diligence* process before they fund a project. Normally they take around 8 to 12 months, depending on the nature of infrastructure project.

In case of solar, it was realized by developers, that if they wait for banks to complete the process and issues them No Objection Certificate (NOC), in that case, they can readily execute the plant to start its operations and realize revenues.

This can be clearly understood from the following responses.

“When financial institutes or banks are approached for funding they carry out whole [Due diligence] process for [Project appraisal] project appraisal as per the industry requirements, which is again a long process taking around 12 to 18 months. The

solar power plants are having [Gestation period being 6 - 12 months] a very short construction time period ranging from 6 months to 12 months so it becomes very difficult for the developer to arrange funds from the bank or financial institute on time. This procedure and time frame are normal for appraising an infrastructure project.”

[Self-finance, Equity funding] “(...) this is why initially all the projects of our company have been self-financed or equity financed. After the operations were scheduled and power was produced, banks saw and [Payment Surety] confirmed the stream of [Revenue inflows] revenue inflows then only they funded the projects.”

It is evident from the information provided by **G3** that, banks lend money at a higher rate of interest.

[Higher interest rate at 12% - 15%] “Our bankers lend money at an interest rate of 13.25% and 11.25%. This was because banks are not exposed to solar energy sector they hesitated in lending money and if they did they did lend the money it was at a higher rate.”

The respondent further explains that most common practice for financing a project in an infrastructure sector is through a syndicate loaning, where a group of bankers come together and finance the project. One out of them becomes a lead banker. They together come up with a determined interest rate for lending the money, which is at times higher than the prevailing

market rates. These high interest rates were a challenge for the Solar Power Developers (SDP's).

This is being stated in following interview statement.

[Syndicate loaning] *“Syndicate is the most common way of funding large infrastructure project and if any of the syndicate **[Higher interest rate at 12% - 15%]** raises the interest rate then all syndicate member banks raised their interest rates which become very difficult for the developer.”*

*“On the other hand, as a company we were facing some problems because our balance sheet was showing losses for the last 3 years so in our case so projects were commissioned on project equity basis**[Equity funding]**.”* **[Respondent G3]**

It is further understood from interview given by **G1** that, banks were not sure of the technology, as a result, they showed no interest to developers towards funding the projects, but later on when banks realized the payment receipts are being cleared, they funded the projects.

*“Most of the projects are **[Self-financed]** self-financed, equity was raised by arranging money from **[Equity investors]** different sources and **[Short term loan]** short term loan was arranged through our banks. **[High investment borne by the developer itself]** High investment risk was all borne by developer by infusing in their **[Equity funding]** equity in the project. The average **[Payback 10 years]** payback calculated for our projects was around 8-10 years. We never went for **[Foreign financing]** foreign financing institutions.”*

[Bank lent money after project commissioned] *“Once the plant was commissioned payments were exchanged with the concerned authority, they verified the documents for purchasing and selling and then only they funded.”* **[Respondent G1]**

Banks were funding the manufacturing projects of solar equipment but were cautious in funding power generation projects, if they did finance the projects, they did it at a higher interest rate.

This is evident from the following response by **G6**.

*“Banks were giving loans for **[Back hand projects]** backend projects like **[Cells, Wafers and Modules manufacturing]** wafer manufacturing, cell manufacturing and module manufacturing, but for power projects related to solar energy they were not quite sure about the technology.”*

The respondents **G6** and **G5** further stated that banks hesitated in funding projects at construction phase. Developer availed Buyers’ Credit for buying modules and other related equipment to develop the project. Further they looked for equity investors apart from self-funding.

*“There was no help from the banks at construction stage instead all the construction work was carried out with the help of the **[Buyers’ Credit]** ‘Buyers Credit’. Similarly we did this for importing modules (...) banks were charging **[Higher interest rates]** higher interest rates.”*

“Our company looked for [Small investors were looked for, Equity investor] small investors for financing the project. These investors had money but didn't know where to invest.”

“Construction is not a big challenge as the [Gestation Period] gestation period is very small which is maximum of 3-6 month.”

[Respondent G6]

[Equity funding] “The projects were equity financed.”

[Respondent G5]

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

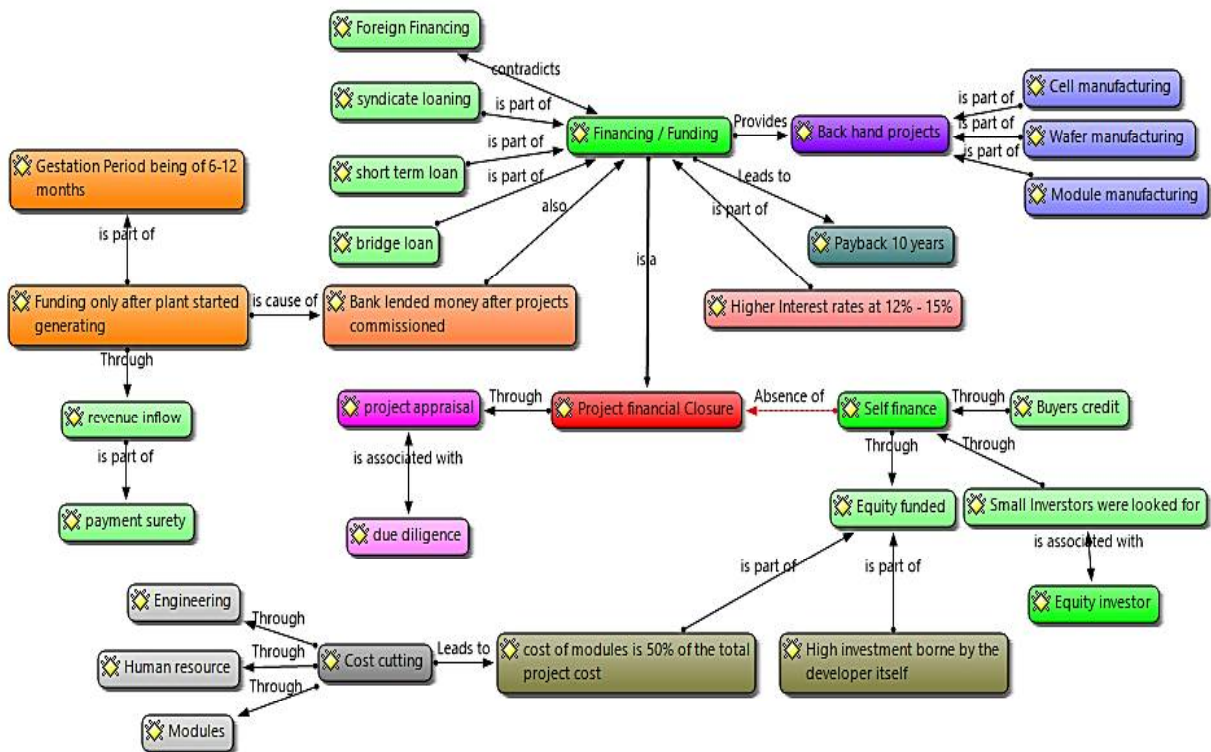


Figure 5-4 Associative network of outcomes on Financial Barrier in State of Gujarat

Thus it is evident from the experiences shared by different respondents, that, Gujarat had no significant response to the role of Financial Barrier in the State.

5.6.2 Discussions on Policy and Political Barrier

The respondents informed that Gujarat had promoted solar PV sector through strong initiatives. Infact, Gujarat is the first State to announce solar policy, which helped it to have a 1st mover advantage. The policy provided attractive tariffs which were strongly backed up by payment security mechanism introduced by State government.

Government of Gujarat showcased strong political will to facilitate developers in the region. The State developed not only India's but as well as Asia's first Solar Park which is supported by strong infrastructure. The Solar Park is spread across in area of more than 5000 acres with a potential to install 590 MW through grid connected solar energy. Currently the total installed capacity in Solar Park is 224 MW, which is through grid connected solar PV power plants.

Further, government held a Banker's Meet to win the trust of different stakeholder especially the financing institutions, and asked them to come forward and invest in the sector. Government of Gujarat built a strong transmission infrastructure across the state particularly to remotest of areas on priority basis.

Policy had clarity along with it the local governance was effective and efficient. The bureaucracy in the State was time effective as a result of which it assisted developers to execute their projects without any delays.

The respondents strongly communicated that, government created an investor friendly environment to attract investments in solar sector, which apparently represents high risk. Further, respondents strongly claimed that, it was only due to strong leadership and long term vision.

An investor likes to invest money, when they have confidence in what they plan to invest in.

In case of Gujarat, developers / investors had the confidence in State. They found Solar Policy 2009 to be attractive and investor friendly. Developers were confident of the opportunities that state was trying to provide, through strong and clear policy. Government of Gujarat created confidence in developer by facilitating with a strong Payment Security Mechanism. Further, government offered the developers to avail Letter of Credit (LC)²⁴ in case, if DISCOM defaulted in bill payments. State government also held a '*Bankers' Meet*' to facilitate the developers in an effort to win the trust of Banks and Financial Institutes.

Along with a good policy introduced by a State, a lot depends on its strong Political Will to attract investments in the region. It lot depends on the kind of infrastructure government provides to retain its investors.

The above discussed is evident from the following discussions.

The following responses are given by respondent **G2**.

a) Policy

²⁴ *Letter of Credit: A written commitment to pay, by a buyer's or importer's bank (called the issuing bank) to the seller's or exporter's bank (called the accepting bank)* (Business Dictionary, 2014).

“Gujarat government introduced the [LC mechanism in Gujarat] ‘Letter of Credit’ (LC) Mechanism for assuring the payment security of the bills.”

[Grid connectivity infrastructure in Gujarat was good and strong] *“Grid connectivity was not a major challenge as state had good [Transmission lines] transmission infrastructure that assured substation in proximity. [66 kV Grid connectivity] All plants were connected to 66kV transmission line which helped in reducing [Substation upgraded and had no fluctuation] transmission losses. At times when the capacity of a substation or transmission lines were not as per the standard, [Developer] developers and state had pooled in to upgrade the facility as per requirement on active basis, it mostly happened in [Remote area] remotest of the areas where only few plants were setup initially and grid connectivity was difficult.”*

b) Political

[Banker’s Meet – Gujarat government] *“Gujarat took a step further and went on to hold a ‘bankers meet’ to win their confidence in the sector on behalf of the developers.”*

[Respondent G2]

The respondent **G3** states that, GUVNL played a very important role in developing solar sector in the State. The bill payments were realized on timely basis. Further, respondent expressed that Gujarat solar policy had more clarity as compared to JNNSM.

a) Policy

“Under the 1st phase of Gujarat policy our company has 3 plants of 15 MW each. [GUVNL point of contact] GUVNL has played a very important role in promoting the sector and all [Ease to have PPA] PPA’s are signed with them. The company got into negotiation for granting of [LC mechanism in Gujarat] ‘Letter of Credit’ (LC) to make PPA bankable, but as of date we never practiced LC, as they are making [Payment on timely basis, Fast clearing bills] payment of bills on timely basis as per the PPA signed.”

[Clarity in policy guidelines] “The Gujarat Solar policy had more clarity than the JNNSM policy.”

The government showed special interest in promoting the sector, they strongly backed the tariff declared by the regulator of State.

b) Political

[Strongly backed the tariff in Gujarat] “Gujarat government made it very clear to strongly back the tariff which assured revenue streams for developers. The very strong factor [Strong political will] worked for Gujarat was all potential applications under phase 1 and phase 2 of Gujarat Solar policy were allocated. This showed [Special interest in the promoting the solar sector] how serious they were to have this sector developed in the state.”

[Respondent G3]

The following response given by **G4** assisted the researcher to understand that Gujarat had taken strong steps to attract investments in solar energy sector.

a) Policy

“Government support was very high [Strong political will] as compared to other states. [Annual Conference Vibrant Gujarat] Gujarat in 2008 in its annual conference called the ‘Vibrant Gujarat’ announced a policy for promotion of [Gujarat Solar policy 2009] solar energy sector. They were proactive [Strong political will] in promoting the policy as they were [1st mover advantage] 1st state to announce solar policy in the whole country with [Attractive Tariff] FiT. Gujarat Solar Policy was out in 2009 and National Solar Mission came in 2010. Solar Policy was supported at all levels in [Active department, Local government supported] all departments which made us comfortable in doing our business. [LC mechanism in Gujarat] Letter of credit (LC) was negotiated but never used it because [Payment on timely basis, Fast clearing bills] payment security was very strong and [Strong political will] backed up by government.”

G4 further informs that Gujarat has excellent infrastructure which support the sector development. Whenever it was felt that necessary infrastructure should be provided to support the development, it was done on priority basis.

b) Political

“They were [Solar Park 1st in Asia] 1st state to introduce the concept of solar park for promoting the sector. Land was much [Solar Park expensive] expensive in Gujarat as compared to Rajasthan land prices, but they provided [Necessary infrastructure] basic infrastructure to the developers [Water supply, Transmission lines, Road connectivity, Grid

connectivity] like road was available to the site, nearest transmission point to plant switchyard, water connectivity and other basic facilities were available. Government took the advantage of [**1st mover advantage, Solar Park 1st in Asia**] 1st mover advantage by developing Solar Park in 2nd phase of the [**Government facilitation**] Gujarat solar policy”

“The [**Substation upgraded and had no fluctuation**] upgraded substations were [**Necessary infrastructure**] readily available for connectivity and evacuation. Bank hesitated in lending money as their exposure to solar industry was nil, so Gujarat held a [**Banker’s Meet – Gujarat government**] bankers meet to [**Government facilitation**] facilitate the sector and win the trust of bankers.”

[Respondent G4]

It is evident from the following statements given by G5 and G7 that Gujarat had strong bureaucracy and effective local government, which aided the developers in timely execution of projects. G7 further commented that it was largely due to long term vision of Gujarat State Chief Minister.

a) Political

“Gujarat was smooth in [**Bureaucracy effective**] government procedures as compared to any other state at that time. The [**Local government supported**] local government was helpful because of their support and [**Active department**] activeness to respond to the applications, from case to case to basis. Gujarat showed proactive approach to promote the sector with a [**1st mover advantage**] “First mover advantage” in introducing the state specific solar policy with [**Attractive Tariff**] strong tariff to

attract developers and well before JNNSM and also by creating [Solar Park 1st in Asia] first and the largest solar park in Asia. This was all because of [Leadership Vision] leader's vision that Mr. Modi had." **[Respondent G5]**

a) Political

[Government facilitation] *"Government facilitated the player through providing [Strong political will] strong and positive political help. [Active department] The local government supported in fast execution of projects. [Bureaucracy effective] The bureaucracy in state is one thing that other states should learn."* **[Respondent G7]**

The associative network diagram in figure 5-5 shows the relationship between the responses given by the interviewees on Policy and Political Barrier.

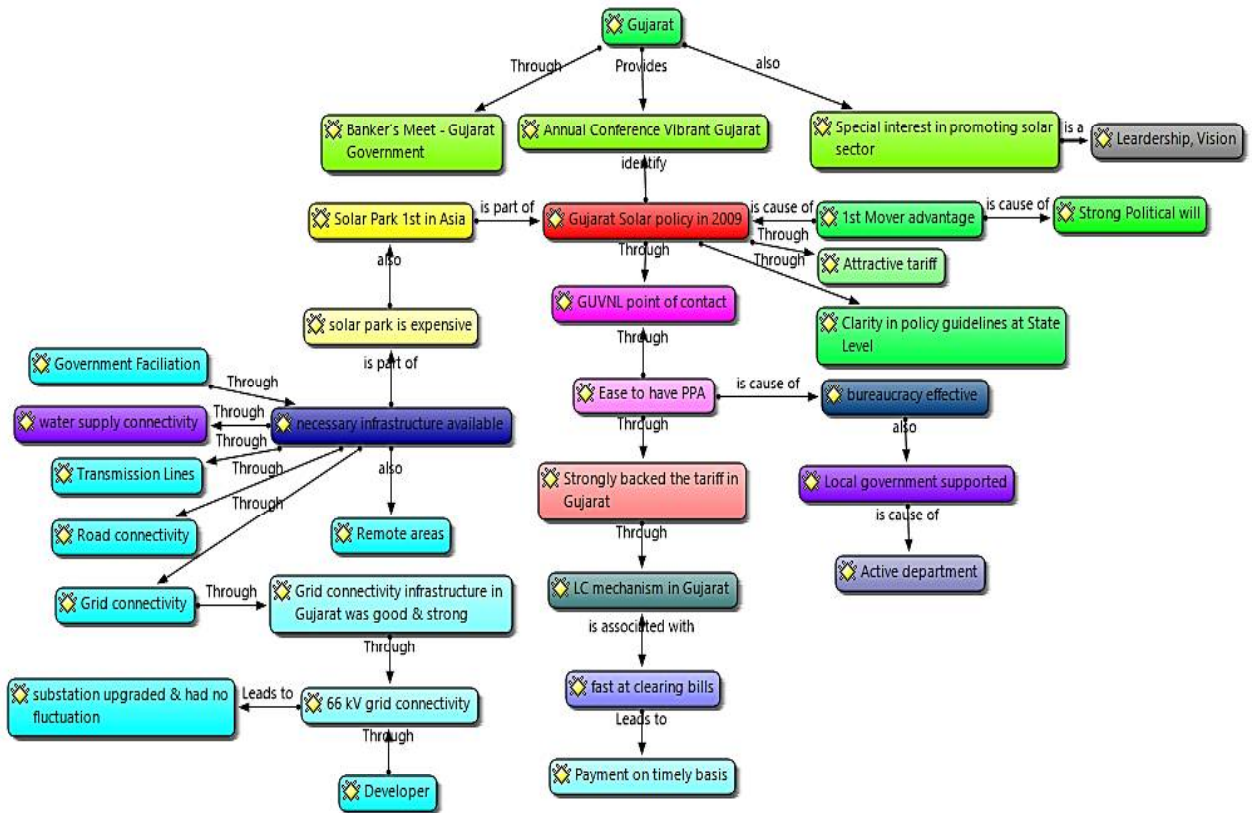


Figure 5-5 Associative network of outcomes on Policy and Political Barrier in State of Gujarat

Thus from the experiences shared by different respondents, it is evident that, Gujarat had significant response to the role of Policy and Political Barrier in the State.

5.6.3 Discussions on Institutional Barrier

The respondents stated that they faced issues related to availability of reliable and accurate solar radiation data for a specific location. This situation persisted across the State. The DNI data was not dependable as a consequence of which developers had to be dependent on different software namely HOMER and PVsyst designed by international agencies.

Moreover, developers referred the data provided by NASA and IMD but data was not accurate and had to be double checked.

Training institutes which are involved in capacity building, particularly for solar sector were an issue and industry faced challenges to limited workforce. As respondents stated it was not that serious issue but apparently agreed that there is limited skilled workforce in the sector. Developers largely carried out training at site only.

Another issue faced by solar sector is the level of R&D activities and facility in the country. The respondents agreed that there is very low level of R&D in country and has not aided them in any manner. Though few developers had signed MoU with some institutions to carry out R&D but they are still in very nascent stages.

These concerns are evident from the statements as follows.

a) DNI

“DNI was calculated with help of [preferred software] software’s like [HOMER, PVsyst] Homer and PVsyst for a specific location whereas [NASA, IMD] NASA and IMD data were also used [DNI data reliability is an issue] but they were not that reliable but helped in assessing the radiation for a location. [DNI priority] Still there is requirement of ground level reliable data which can be considered for calculating generation. [Pyronometer is a compulsory installation at plant of 1 MW above] (...) we have installed Pyronometer as per the mandate.” [Respondent G1]

b) Academic Interaction

“Our company has some [Interaction with IIT-K] interaction with IIT-K for PV [no academic interface] but again that’s only an eye wash for gaining initiative and grants from central government. I don’t want to further comment on it...”

[Respondent G5]

c) Training / Capacity Building

[Onsite training of 2-3 months sufficient, Workforce limited, skilled workforce an issue]

“It is a maximum of 2-3 months of training for new engineers. They can be trained on site. The only important thing at construction phase is handling of modules and maintaining it during operations. It is more of a bolting and fixing the equipment and modules in the right direction and angle for higher output. This kind of skill can be developed in 2-3 weeks.”

[Respondent G6]

a) Academic Interaction

“We do have [Academic interaction] interaction at the academia level. Our company recently signed a [MoU²⁵ with PDPU²⁶ R&D, scholarship] MoU with PDPU for scholarships, testing and R&D, [R&D limited] but still that needs to go a long way forward and it is at a nascent stage”

[Respondent G5]

The associative network diagram in figure 5-6 shows the relationship between the responses given by the interviewees on Institutional Barrier.

²⁵ Memorandum of Understanding is a document describing a bilateral or multilateral agreement between parties. (Merriam-Webster, 2014)

²⁶ Pandit Deendayal Petroleum University

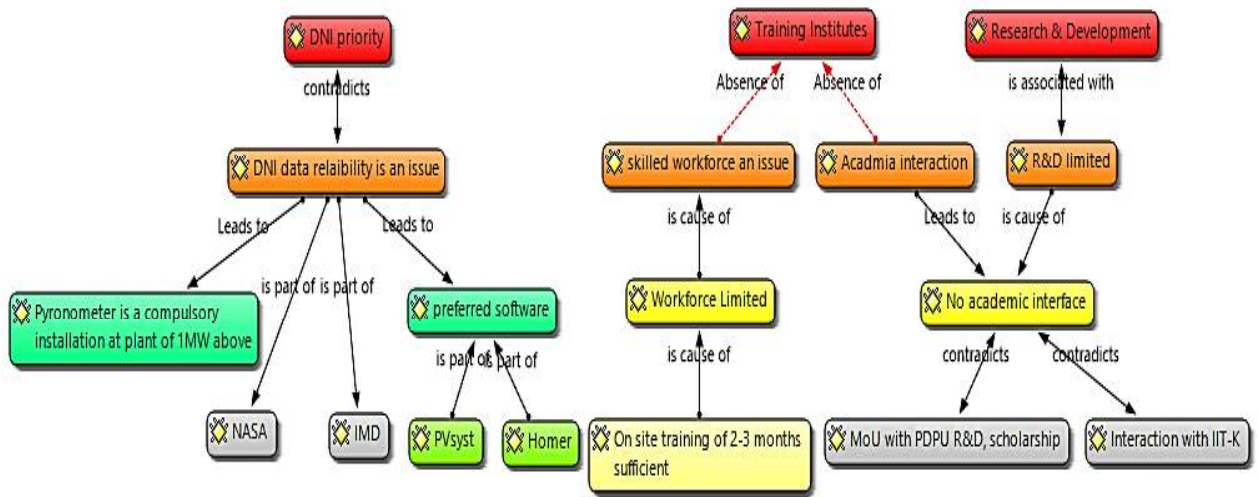


Figure 5-6 Associative network of outcomes on Institutional Barriers in State of Gujarat

Thus through the experiences shared by different respondents, it is evident that, Gujarat had no significant response to the role of Institutional Barrier in the State.

5.6.4 Discussions on Land Information Challenges

The respondents shared their experience related to availability of necessary information required for identifying the potential land for grid connected solar PV power plants. Respondents communicated that state governance was very effective in providing necessary information to a particular land.

Developers mostly acquired private land without much of delays, as the departments were active and were efficient in provided all information to

developers, as required. They further expressed that (Patwari) Village Accountant²⁷ was much of help in identifying the right piece of land.

Government of Gujarat had identified land on behalf of developers. They developed Asia 1st Solar Park by providing necessary arrangements that a developer looked for developing a solar plant (grid connectivity in vicinity, shadow free area, no reserved area nearby, water supply, good strata and contour)

It is understood from the information provided by **G7** that, a suitable land for Solar Power project is identified on the bases some important evidences, which is communicated in following statements.

[Factors for land identification]

“The necessary information collected on land, before we acquire or buy it from [Land holder] land owner are:

- 1. Is there any charge on land like loan*
- 2. Information on Mortgage of land*
- 3. Deed of trust*
- 4. Unpaid real property taxes*
- 5. Tax Lien*
- 6. Mechanic Lien*

“In the process of acquiring identified [Private land] private land for our plant in Gujarat, we first we did [Index search] Index search, we gathered the details from Registrar office by looking through the [Revenue records] revenue records. [Village Accountant helps the investor with the land details] Land is being identified through the land arrangers or local land brokers,

²⁷ A government official who keeps records regarding ownership of land (Oxford Dictionary, 2014).

[Land arranger is very important and efficient] *who is very important to a developer. There are different forms of land that we came across for our solar power plants. These all are [agriculture land title records] agriculture land:*

1. *Form 7/12*²⁸ **[Form 7/12]**
2. *Form 8a*²⁹ **[Form 8a]**
3. *Form 6*³⁰ **[Form 6]**

The respondent further explained that administration and bureaucracy in the state was efficient in providing necessary information on potential land.

“Then we looked at whether the land is single owner held or multiple owner held. The two of types land holdings are found out through:

[Name wise, Survey number of land]

1. *Survey number of land which is multiple owner held land*
2. *Name wise which is a single owner held land*

“The industrial commissioner was very helpful and proactive in getting the land allotted also the [Active department] second in charge – collector, was proactive. Government facilitated the investor / developer. Local government supported in the execution

²⁸ **Form 7/12** is called the *Hak Patrak* in Gujarati, which is known as Record of Right (RoR) that has the details of the survey number, tenure, farm name, land use, type, area, waste land portion, owners name, borrowings and other rights details, tenants details, condition imposed by the government and has the details regarding cultivator and crop details year wise and season wise.

²⁹ **Form 8A** shows the total survey number wise land holdings of a person

³⁰ **Form 6** contains the survey number wise ownership / rights of the person (CAGI, 2012)

of the project. [Active official – Registrar] Registrar was supportive in granting clearances and approvals.”

[Local government supported] “Gujarat government helped us in a big way to give clearances and converting the land for commercial use.” **[RespondentG7]**

The respondent **G3** expressed that, their experience in Gujarat was good as they were supported by government at all level, as a result of which they faced no issues in acquisition of land

“Our experience in Gujarat was very good, [Local government supported] we hardly faced any delays or any sought of problem from government side. The District Collector and [Active official – Registrar] Registrar were efficient and fast in processing the applications and granting clearances. The [Active department] NA facilitation is very fast in Gujarat as all our projects are on private land Gujarat posed no serious issues on land side.”

[Respondent G3]

The respondent **G1** stated that, physical aspects are also considered in identification of land such as, land should be continuous in nature, should be flat and leveled, should be south facing (depends on the design of plant), grid connectivity in proximity.

“[Private Land] Private land was available with much of help of the [Active official – Registrar] gazette officer. The information that was needed for identification of land is:

- 1. DNI – the radiation level [High DNI]*
- 2. Basic infrastructure*

3. *Connectivity to nearest substation to minimize losses*

[Receiving Substation in the proximity]

4. *Level land, flat and continuous in nature*

[Good Strata, Continuous land, Land contour]

5. *Clarity in land title* **[Land holder]**

6. *South facing* **[South facing]**

7. *Water supply connectivity* **[water supply connectivity]**

G1 further states that, administration at local level was very efficient.

“Local government involvement **[Local government supported]**
was seen at all level by the **[Active department]** *state nodal*
agencies in Gujarat. **[Active official – Registrar]** *Registrar office*
had all necessary information on land.”

“Private land was available with much help of **[Village**
Accountant helps the investor with the land details, Land
arranger is very important and efficient] *land arranger, who*
helped in land identification and information on land.”

[RespondentG1]

Respondent **G4** mentions few important factors for identification of land, such as, land should be free from any kind of shadow, it should be free from legal issues, should not be mortgaged and related property taxes should be paid off.

[Factors for land identification]

“Factors that are important for identifying the land for a solar power plant are:

1. *The land should be south facing* **[South facing]**

2. *It should be shadow free* [**Shadow free zone**]
3. *Land title should be clear* [**Land Holder**]
4. *Land should be clear* [**Good Strata**]
5. *Continuous in nature and level*
[**Continuous land, Land contour**]
6. *Connectivity to nearest substation*
[**Receiving Substation proximity**]

G4 further stated that, presence of forest land or any kind of reserve land around or in vicinity of the plant site creates problem during the execution of it.

[**No protected area in proximity like Gouchar or Magra Land**]
“No forest land and reserved land should be near the site (reserved for cattle which is called Gouchar or Magra or Gram Panchayat land)”

*“The [**Village Accountant helps the investor with the land details**] land arranger was responsible for arranging land who can be an advocate or a real estate manager.”* [**Respondent G4**]

The associative network diagram in figure 5-7 shows the relationship between the responses given by the interviewees on Land Information Challenges.

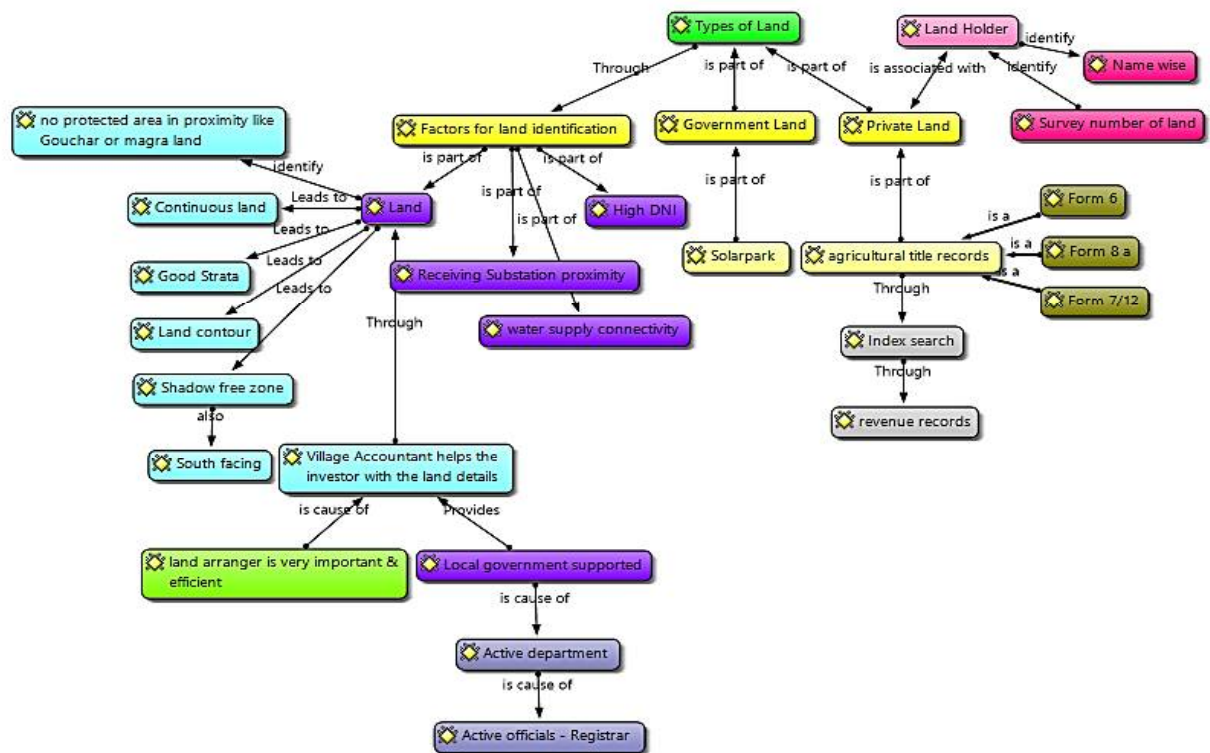


Figure 5-7 Associative network of outcomes on Land Information Challenges in State of Gujarat

Thus from the experiences shared by different respondents, it is evident that, Gujarat had significant response to the role of Land Information Challenges in the State.

5.6.5 Discussions on Land Acquisition Challenges

Gujarat as a state has huge land mass which is barren and not suitable for cultivation. The climate of northern Gujarat is dry and southern Gujarat is moist in nature. The average yearly rainfall received by state ranges from less than 60 cm to maximum of 150 cm. The semi desert area of Kutch has a very low average rainfall. Certain areas like Banaskantha, Panchamal,

Surendranagar and Kutch districts receive less or no rainfall (Government of Gujarat, 2009).

Gujarat's

- Latitudinal Location: 23.00 N
- Longitudinal Location 72.00 E

"Solar Park" is located in village Charanka of Patan district in Gujarat spread across 5,384 acres of unused land with an allotted capacity of 590 MW. This "Solar Park" has state of art infrastructure with provision to harness rain water besides power evacuation at the door steps. Installed capacity of 224MW Solar Project has been commissioned by 20 developers, accounting to 10% of total solar generation developed India (GEDA, 2014).

Solar Park also accounts for 3,42,400 tons Carbon Emission Reductions (CERs) which is one of the largest CERs contributing Project in the Renewable Energy Sector. Development cost of Solar Park was Rs. 4500 Crores, which includes Rs. 550 Crores for infrastructure and land acquisition and Rs. 3,996 Crores for Solar Power Plant (Developers investment).

It helped in creating employment opportunities for more than 1,000 people. Project was launched on 30.12.2010 in second phase of Gujarat solar policy and commissioned on 31.12.2011 and formally dedicated to the Nation by the Chief Minister of Gujarat on 19.04.2012.

Even Gujarat Industrial Development Corporation (GIDC) had land bank to facilitate the developers.

But it is apparent from interviews and secondary data that most of the grid connected solar PV power plants have come up on private land. The ratio of installed capacity on government land as compared to installation on private land was 1:4 at the end of 1st Phase of Gujarat Solar Policy.

Respondents further stated that acquiring private land was with the much help of local government, the governance was very strong and bureaucrats were very effective and supportive. As result of which the related clearance were provided in a time bound manner.

It was learnt from response given by **G1** that, Solar Park was expensive but it had its own merit of providing a world class infrastructure. Still developers went for private land acquisition. Government land was expensive as compared to Rajasthan.

[Solar Park 1st in Asia] *“Solar Park is the solution for promotion of sector which Gujarat did it proactively but **[Expensive government land in Gujarat]** land banks are expensive as compared to land banks in Rajasthan. The advantages with the Solar Park are that all the related clearances were already approved and it was well connected with transport infrastructure.”*

[Respondent G1]

*“We have acquired **[Private Land]** private land for all our plants in Gujarat.”*

[Respondent G4]

G7 mentions that for their project, private land was acquired, under the Bombay Tenancy Act 1939. As mentioned above, government land was expensive, so developers went for acquisition of private land. The agriculture land was acquired for developing solar power plants by the company, as it was not suitable for agriculture activities.

This is apparent from the statement in following interview.

*“We acquired mostly [**Kherood or Kisan land**] Kherood land or Kisan land for our projects in Gujarat, they are extremely salty in nature and [**Unsuitable for agriculture**] it was difficult to do any agriculture activity, so it was best suited for such kind of activity for commercial purpose.”*

[**Land acquisition**] *“Land Acquisition in Gujarat is done under two types of [**Land Acquisition acts**] land laws*

1. *Bombay Tenancy Act 1939* [**Bombay Tenancy Act 1939**]
2. *Saurashtra Gharked Ordinance*
[**Saurashtra Gharked, Tenancy Settlement and Agriculture Lands Ordinance 1949**]

And under these land laws were two types of land ownership

1. *Tenure Holders* [**Tenure Holder**] *or Tiller Owner* [**Tiller Holder**] – *Tiller are the people who hold a land and allow a farmer, who is not the owner, to work on a part of land. In return these farmers are to share a percentage of the output from farming as agreed upon with the owner. This type of holding is large in number and number of farmers depends employed depends on the size of land.*
2. [**Khalsa Land – Government land**] *Khalsa Land - Land owned by Government.*

G7 was assisted by land arranger for acquiring the land. The same person also helped in finalizing the compensation amount with mutual consent among the developer and local community.

In case of the Tenure Holder or Tiller owner of land the [Compensation as per land arrangers and Local community] compensation was given to people who were owner as well as farmer. This compensation amount was finalized after the decision taken by the [Land Arranger] land arranger or local community in our case.

G7 mentions that, bureaucracy was very efficient and effective which helped them to execute their projects without any delay.

“Industrial commissioner, the registrar and collector for the concerned area, were very helpful and proactive in getting the land allotted and awarding land related clearances.”

G7 further explained that, land was acquired through a process called Agreement to Sell (ATS). Whenever there are multiple owners to the identified land, it becomes very difficult for a developer to ask every owner to be present on the same day at the same place (registrar office) together. In that case ATS procedure was very effective. Through this process developer can individually register the land with every owner at different time. It was most effective in a case where the owners were Non Resident of India (NRI).

“If there is a [Name wise, Single Owner] single owner to the land then it is not much of a challenge to acquire it, but when we come across [Survey number of land, Multiple land owners] multiple owners then we follow a process of [Agreement to Sell (ATS)] Agreement to Sell (ATS) to get the possession of land. It is easier than getting registration (i.e. Land Deed), because while going for land deed it is difficult to call upon all the owners at one place at one time, that is to the registration office.”

“In our case all the land has been acquired through [Agreement to Sell (ATS)] ATS, which is one to one signing and getting approval by the owner wherever they are. Most of the times it happened that some [NRI owners] owners were NRI, so the documents were sent to them to through email or courier and signed documents were received. Whenever they were available in the country they can be present in registrar office to transfer the land physically. Because of this practice it gave us leverage to acquire land as per the concerned party availability on different time.”

[Respondent G7]

The respondent **G6** and **G4** expressed that, government land in Gujarat was much expensive in comparison to Rajasthan. As result of which maximum installations have come up on private land in Gujarat.

“In Gujarat the problem is that they don’t have land holdings which Rajasthan did. This is one advantage which Rajasthan enjoyed. Gujarat Industrial Development Corporation (GIDC) had land holdings but was not sure of the radiation level in those areas moreover [GIDC has land but expensive] they were quite expensive. [Expensive Government land in Gujarat] Solar Park is an excellent idea but expensive. Gujarat governance was very strong and effective as compared to Rajasthan or any state as a matter of fact.

[Respondent G6]

“We have more than 50 MW installed in Gujarat at different location and all our projects are on [Private land] private land.”

[Respondent G4]

The associative network diagram in figure 5-8 shows the relationship between the responses given by the interviewees on Land Acquisition Challenges.

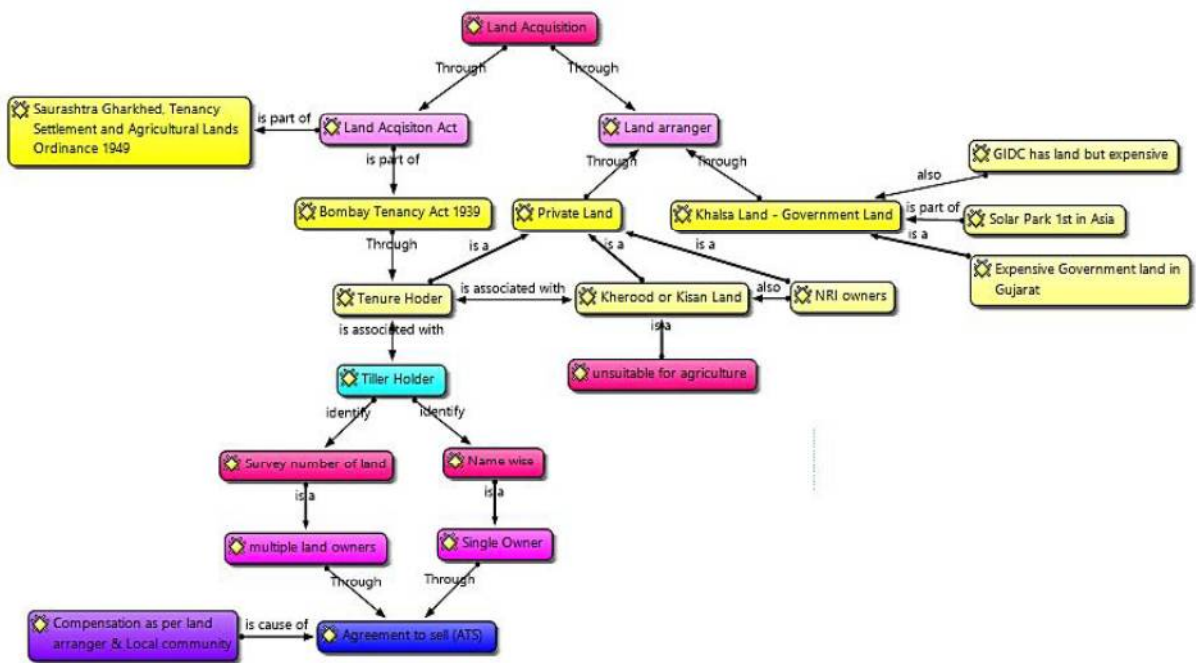


Figure 5-8 Associative network of outcomes on Land Acquisition Challenges in State of Gujarat

Thus from the experiences shared by different respondents, it is evident that, Gujarat had significant response to the role of Land Acquisition Challenges in the State.

5.6.6 Discussions on Administrative Challenges

The respondents shared a positive experience on the kind of administration in the State. It was learnt from their responses that Gujarat had effective Single Window Clearance Mechanism (SWC). Government assisted developer at all levels. The support provided by government to developers was very high and proactive.

It is evident from the responses mentioned earlier that bureaucracy and administration was strong. Clearances were provided on timely basis which helped the developer to execute its project without much delay.

The Power Purchase Agreements (PPA) was successfully signed with Gujarat Urja Vikas Nigam Ltd (GUVNL). It made sure that developers were made the payments on timely basis as per PPA signed.

The Registrar was proactive and supportive in processing the acquisition of private land in the State. Further, Industrial Commissioner played an important role in execution of projects.

The following responses from respondents **G1, G2, G3, G4 and G7** stated that, governance in state of Gujarat was efficient and proactive in promoting the sector. The nodal agency GUVNL as an authority signed the Power Purchase Agreement (PPA) with developers. The Single Window Clearance (SWC) mechanism was effective and had cleared the bills on timely basis. This can be understood from interview stated below.

[Government support was high] *“Government support was very high as compared to any other states. They were proactive in promoting the policy as they were 1st state to announce solar policy in whole country. [Effective Singe Window Clearance] Single Window Clearance was implemented for which [GUVNL point of contact] GUVNL was the moderator for signing the [PPA successful] PPA. It was easy and [Payment on timely basis] on timely basis.”* **[Respondent G2]**

[Government support was high] *“Gujarat as a state was very supportive and [Strong administration] local level administration was very strong in clearing documents related to project. It was*

not much of a challenge for seeking information on the identified land from [Registrar was active] Registrar office. Gujarat government was fast in clearing [Payment on timely basis] bills within said stipulated time as per policy. [Effective Single Window Clearance] (...) Single Window Clearance (SWC) in Gujarat is very effective. [GUVNL point of contact] GUVNL is the agency designated by the [Government Facilitation] government to facilitate the approvals and signing of PPA's and [PPA successful] they did it on priority basis. Though many states promised SWC but Gujarat was very active.” [Respondent G1]

[Strong administration] “The Gujarat administration was strong and they are making [Payment on timely basis] payment of the raised bills on timely basis as per PPA signed. [GUVNL point of contact] GUVNL has played a very important role in [PPA successful] promoting the sector, as all PPA's are signed with them.” [Respondent G3]

[Industrial commissioner was helpful] “The industrial commissioner was very helpful and proactive in getting the [Private Land] land allotted, also the second in charge - collector for the area was proactive. [Government Facilitation] Government facilitated the developer. Local government supported in the execution of project. [Registrar was active] Registrar was supportive in granting clearances and approvals.”

[Respondent G7]

“Our experience in Gujarat was very good, we hardly faced any delays or any sought of problem from the government side. The District Collector and [Registrar was active] Registrar were

efficient and fast in processing the applications and granting clearances. [Strong administration] The NA facilitation is very fast in Gujarat as all our projects are on [Private Land] private land Gujarat posed no serious issues on the land side.”

[Respondent G4]

The associative network diagram in figure 5-9 shows the relationship between the responses given by the interviewees on Administrative Challenges.

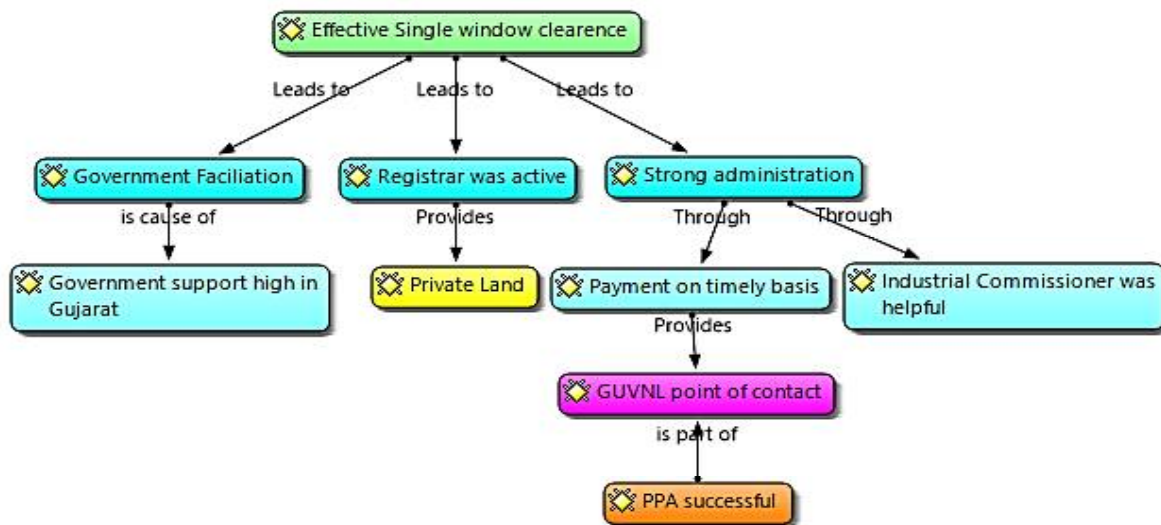


Figure 5-9 Associative network of outcomes on Administrative Challenges in State of Gujarat

Thus through the experiences shared by different respondents, it is evident that, Gujarat had significant response to the role of Administrative Challenges in the State.

5.6.7 Discussions on Regulatory Barrier

It is learnt from respondents experience that Gujarat Solar Policy provided attractive tariff which was higher as compared to any other policy,

moreover they provided Feed in Tariff as compared to competitive tariff in JNNSM.

The policy provided front loaded tariff of ₹15/- per kWh for first twelve years from commercial date of operation and next thirteen years developers will be provided ₹5/- per kWh.

The source for generation of electricity is solar radiation, which is intermittent in nature, because of which solar power plant does not come under the purview of Merit Dispatch Order³¹. Hence, under the policy, government had no Merit Dispatch Order for solar power plants. The developers were assured of whatever was generated will be fed into the grid.

The Gujarat Electricity Regulatory Commission (GERC) is the authority to take decision on the tariff for Solar Power sector in the State. According to the information provided, attractive tariffs were given to developers. As a result of which, State has the maximum number of power plants installed in its region.

The following responses by **G3**, **G4** and **G5** in Gujarat, stated that, regulatory environment was investor friendly and aided the developers to have reasonable returns on their investments.

[GERC offered higher tariff, Attractive tariff] *“The tariff offered by regulator was very lucrative in Gujarat.”*

[Respondent G4]

[GERC offered higher tariff] *“Gujarat Electricity Regulatory Commission (GERC) had offered higher tariff as the investment*

³¹ It dictates that the least cost power should be dispatched in preference to more costly power (MoP, 2014)

were also high and as the costs have become competitive likewise tariff were also revised. The regulator had not set any **[No merit for dispatch of power in Gujarat]** merit order dispatch list for solar power plants. It helped in creating a level playing field for solar power developers (SPD) along with other generators, whether generating power using expensive source or cheaper source of fuel, all were given equal opportunity to dispatch their power.” **[Respondent G3]**

[Attractive tariff] “Tariff determination by regulator in Gujarat (GERC) was very attractive for all the developers. **[1st -12th year Rs. 15/-, 13th -25th year 5/-]** The Feed in Tariff (FiT) offered was ₹15 for every unit generated for 12 years and the **[Payback 8 years]** payback could be achieved easily in 7-8 years.”

[Respondent G5]

The associative network diagram in figure 5-10 shows the relationship between the responses given by the interviewees on Regulatory Barrier.

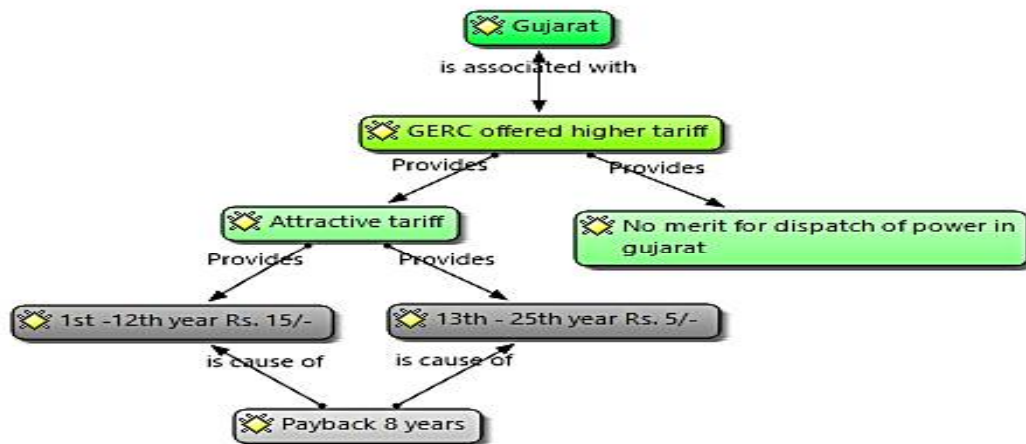


Figure 5-10 Associative network of outcomes on Regulatory Barriers in State of Gujarat

Thus from the experiences shared by different respondents, it is evident that Gujarat had significant response to the role of Regulatory Barrier in the State.

5.6.8 Discussions on Market and Technology Barrier

It is evident from the interviews that country lacks matured market for solar energy sector.

It was learnt from the responses that, developers had a very little choice to make between PV manufacturers in India. Moreover there were issues related to efficiency of PV modules manufactured in the country.

Hence most of developers had to import modules and related equipment from different countries. Most preferred country for importing Crystalline PV modules was China followed by Japan, whereas USA was most preferred for importing Thinfilm PV modules by developers.

The respondent communicated that developing a grid connected solar PV power plant in country is more of a logistic management as most of the plant part (modules and related equipment) are being imported. In case of Gujarat, it had an advantage of having Ports in its region which played an important role. This facilitated the developer to reduce overall cost of the project.

According to the information shared by **G6**, they used Thinfilm technology, which had to be imported from USA, as they had no other option but to import. India does not have a manufacturing unit for Thinfilm.

“We have mostly used [Thinfilm Technology] Thinfilm technology for our plants but we have used [Crystalline Silicon

Technology] *crystalline modules also they were all [Imports] sourced from outside the country. We preferred [Modules from USA China Japan] China and Japan for crystalline modules and USA for Thinfilm modules.* **[Respondents G6]**

The solar market is not developed in India. Crystalline silicon modules manufactured in India are expensive as compared to Chinese and Japanese manufactured modules. It is clear from the following statements that attaining project feasibility was difficult with Indian manufactured PV modules.

“In order to optimize our total cost of the plant [Limited PV Manufacturers] we used our own modules in some projects but switched on to [Thinfilm Technology] Thinfilm technology which we [Modules from USA China Japan] sourced from USA. We also have a plant running on combination of [Crystalline Silicon Technology, Thinfilm Technology] Crystalline and Thinfilm PV modules. Crystalline modules were [Maximum imports from China] mostly imported was China and Japan and Thinfilm from USA.”

G1 stated that unregistered PV manufacturers cannot impact the solar PV market as they are small manufacturing unit, whereas the demand is very high.

[Unregistered and unqualified Manufactures, Limited PV Manufacturers] *“(…) the presence of Unregistered or unqualified manufacturers [No negative impact] cannot affect the market because [Manufacturing of low Watt Peak (Wp) rating modules] they do not have the capacity to generate huge numbers*

to meet the demand (so it is impossible to impact the utility scale plants market).” **[Respondent G1]**

G3 states that, in an attempt to reduce the overall cost of project, they tried to cut down cost on various aspects such as human resource, engineering and modules which alone accounts to 50% of the total project cost.

*“For being competitive we had to cut down cost on every possible aspect. (...) modules for our project were mostly **[Maximum imports from China]** sourced from China as it helped us in **[China is competitive as it has cheap labour]** reducing the cost of the project because it accounts for 50% of the total project cost.”* **[Respondent G3]**

The respondent **G2** stated that, their company has its own set of parameters to rate modules and equipment which they import. They even take feedback from those companies who have used same modules and equipment from the same manufacturer. This helps them to have a quality check for the technology. The manufacturing companies mostly provide 25 years of guarantee to buyer.

*“PV panels were mostly **[Modules from USA China Japan and Canada]** sourced from USA China Japan.”*

*“When sourcing the panel **[Assessment of the Modules manufacturer]** we rate the company on our own set of parameter, **[Feedback from the other consumers]** gain feedback from other customer of modules, who have already sourced panel from that particular company and we assess the company’s market value.”*

*“The companies provide **[25 year guarantee]** 25 year guarantee on modules”* **[Respondent G2]**

Similarly, respondent **G6** states that, as market is very nascent so companies mostly preferred to import modules and equipment from different countries. In that case, port logistics played a very vital role in Gujarat. **G6** further explained, that how proximity of different ports helped his company in timely execution of solar projects in the state.

“For [imports] importing modules [Logistics] we used [Pipava port for plant imports] Pipavav port in Gujarat and also for [Handled maximum import activities] most of our import activities. Other ports used were [Neva Sheva for port in Mumbai for plant imports] Neva Sheva Port in Mumbai it [20% import activities] handled almost 20% of our imports and [Mundra port in Gujarat for plant imports] Mundra port (Gujarat) which [10% of import activities] accounted for around 10% of our plant imports. Technically it depends on the handling capacity of vessels by port and [Berth Availability] the availability of berth. [Port proximity in Gujarat] Pipavav was near to our sites and [Port played a significant role] also port charges were reasonable as compared to other ports. JNPT in Mumbai is a major port in India and after doing our calculation we found that, there is was a significant difference of [30% less logistic charges as compared to JNPT] at least 30% in port charges as compared to Pipavav port. [Average container turnaround period of 5 days from port to site] The turnaround period for a container from port to site in Gujarat is 5 days. Gujarat has very good connectivity through road and rail for transportation and Logistics.”

Gujarat port played a significant role to optimize the cost for the projects. This is apparent from the mentioned statement given by **G6**.

[Logistic management] “We had a good logistic team for reducing our overall cost of project. [Logistic cost 1% - 2% of the total project cost] (...) it cost around 1% - 2% of the project cost.” [Respondent G6]

The associative network diagram in figure 5-11 shows the relationship between the responses given by the interviewees on Market and Technology Barrier.

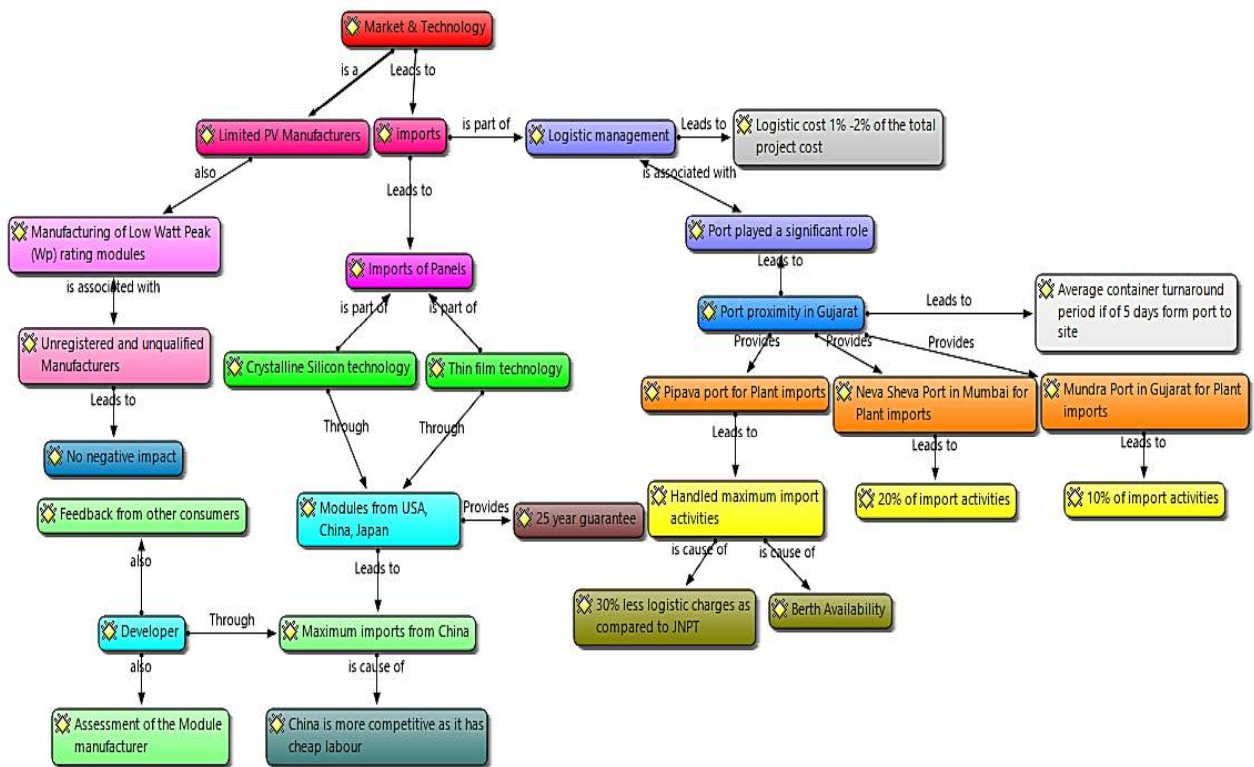


Figure 5-11 Associative network of outcomes on Market and Technology Barriers in State of Gujarat

Thus from the experiences shared by different respondents, it is evident that Gujarat had no significant response to the role of Market and Technology Barrier in the State.

5.6.9 Discussions on Development Cost Barrier

The development costs are also known as pre operating cost which was not a barrier for developers at large. Responses by developer pointed out that it is hardly 10% of total project cost.

The development cost consists of different heads which are:

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

Developers who are desirous of installing a solar power plant had to fulfill a minimum financial criteria and one of them was net worth³². As per the Gujarat solar policy the net worth of a developer has to be 2 Crore per MW. The developers stated that, it was not an issue and never obstructed our operations.

[Pre-installation investments high] *“Pre installation cost or Pre development cost are [No negative impact] very minimal as compared to any other power project cost, as far as solar PV projects are concerned it is easily managed.”* **[Respondent G3]**

[Net-worth cost was high] *“Net worth was [No negative impact] not a problem for any of the projects, it is as per requirement of*

³² Net Worth is the total assets minus total outside liabilities of an individual or a company.

the sector security to ensure seriousness from the investor or developer side.”

[Pre-installation investments high] “(...) pre installation cost is **[No negative impact]** not that big expenditure.” **[Respondent G1]**

[Net-worth cost was high] “Net worth was **[No negative impact]** not an issue for our company.” **[Respondent G6]**

[Net-worth cost was high] “Net worth of the company was **[No negative impact]** never an issue for any of our projects.”

[Respondent G5]

The associative network diagram in figure 5-12 shows the relationship between the responses given by the interviewees on Development Cost Barrier.



Figure 5-12 Associative network of outcomes on Development Cost Barriers in State of Gujarat

Thus from the experiences shared by different respondents, it is evident that Gujarat had no significant response to the role of Development Cost Barrier in the State.

This completes the description on Gujarat's response as State on the identified Barriers and Challenge

5.7 Epilogue

The chapter discussed about Gujarat as a State, it provided information on its power sector, generation capacity, solar energy sector and its generation.

This section reports the overall finding of several interviews conducted in Gujarat. The assessment across different respondents from same State was shown through an associative network diagrams along with statements, as it helped the researcher to better understand State's response to the role of identified barriers and challenges for grid connected solar PV in the region. This process facilitated the researcher to develop a strong base for cross case analysis in chapter 7.

The figure 5-13 shows the overall findings for current case study. The factors encircled are those identified barriers and challenges to which Gujarat had significant response, as a result of which State was able to attract maximum investment for grid connected solar PV power plants in its region. Whereas, factors which lie outside the circle are the ones to which Gujarat couldn't have significant answer to mitigate them.

As interpreted, these are those factors which a State alone cannot answer, moreover strong national policy measures need to be taken to support the State(s) for mitigating them. It was understood that Financial Barrier is market driven and not State driven, inspite of the fact, Gujarat is having strong investment environment for solar energy sector.

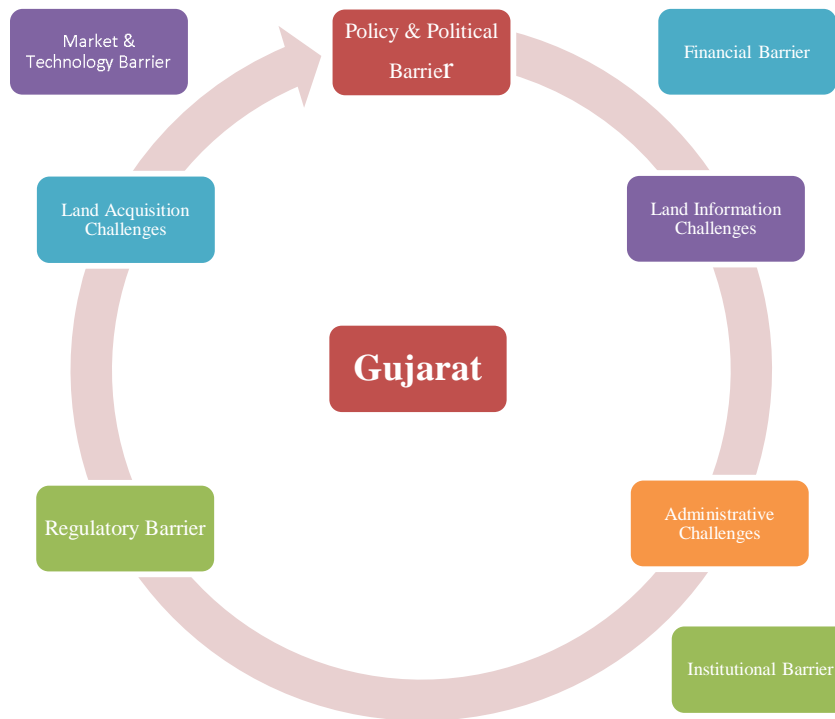


Figure 5-13 Results of Gujarat Case Study

The Market and Technology Barrier alone cannot be mitigated by State as overall manufacturing cost of PV modules is expensive anywhere in the country. Moreover, technology R&D in country is lacking due to which definite reductions in cost is not predictable. Hence, country will continue to depend on other countries like China, Japan and USA for sourcing modules as well as related equipment for grid connected solar PV power plant.

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

This completes the Within Case analysis for Case Study of Gujarat. The next Chapter presents the Case Study of Rajasthan.