teri school of advanced studies

Report

Addressing Land Issues for Utility Scale Renewable Energy Deployment in India

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ABBREVIATIONS

CAGR	Cumulated Annual Growth Rate
CERC	Central Electricity Regulatory Commission
CLU	Change in Land Use
CPCB	Central Pollution Control Board
DILRMP	Digital India Land Records Modernization Programme
EIA	Environmental Impact Assessment
ESIA	Environmental and Social Impact Assessment
FDI	Foreign Direct Investment
FTE	Full Time Equivalent Jobs
GoI	Government of India
GDP	Gross Domestic Product
GW	Giga Watts
Ha	Hectare (1 Hectare = 2.47 acres)
IPP	Independent Power Producer
ISTS	Inter-State Transmission System
KREDL	Karnataka Renewable Energy Development Limited
LADF	Local Area Development Fund
MoEFCC	Ministry of Environment, Forests and Climate Change
MNRE	Ministry of New and Renewable Energy
MoP	Ministry of Power
MW	Mega Watts
NDC	Nationally Determined Contribution
NIWE	National Institute of Wind Energy
NISE	National Institute of Solar Energy
NREDCAP	New & Renewable Energy Development Corporation of Andhra Pradesh
NSM	National Solar Mission
PPP	Public Private Partnership
RPO	Renewable Purchase Obligation
RE	Renewable Energy
RREC	Rajasthan Renewable Energy Corporation
SECI	Solar Energy Corporation of India

SNA	State Nodal Agency
SPCB	State Pollution Control Board
Sqm	Square Meter
SSEF	Shakti Sustainable Energy Foundation
UNFCCC	United Nations Framework Convention on Climate Change
WEG	Wind Energy Generators

EXECUTIVE SUMMARY

The government of India is promoting renewable energy (RE) as an effective tool to mitigate climate change besides enhancing energy security and enabling energy access. It has set an ambitious target of 175 GW RE capacity to be achieved by the year 2022. Procuring land for the upcoming 50 GW ground mounted solar plants and 35 GW of wind power, estimated at about 1,50,000 hectares of land (considering 1.5 hectares per MW for wind projects and 2 hectares per MW for solar projects) would pose a significant challenge to both the policy makers as well as the project developers.

Having only 2.4% of the total geographical area, India supports 17% of the global population. However, there has been no comprehensive land utilization policy either at the federal level or at the state level. More than two-thirds of our population depends upon farmland either directly or, indirectly, though the contribution of agriculture to the national economy is abysmally low at 15%. With a large number of small and marginal farmers having a land holding of 2 hectares and below, most of the agriculture farms are of very small size, leading to low yields and limited avenues for technological interventions. The land area in India has been classified into eight categories which include forests, arable land, barren and unculturable land, wasteland, fallow land and land used for non-agricultural purposes.

Since independence, land utilisation in India underwent significant changes. While the lands under net sown area, forests and non-agricultural uses have increased, the lands under "other areas" have halved. As such, for future land demands, the forest lands and agricultural lands may have to be used. Effective land use planning and management can facilitate optimal utilisation of land resources, based on regional development plans and looking into the aspect of competing demands of different sectors of the economy.

Land being a state subject, approvals are required from the concerned departments of the state government (revenue, panchayat, SNA, industrial, etc.) to procure/ lease the land, making it time consuming. It is estimated that it takes over 6-9 months to procure land for setting up solar/ wind project, even though many of the SNAs provide a deemed Non-Agricultural (NA) status with regard to change in land use status. The

lack of digitization of land records makes the procurement procedure even more tedious. Types of land procurement include revenue land allotted on lease and private land which is to be purchased on mutually agreeable terms. In areas having high cost of land, leasing of private land has been witnessed in recent years. Revenue land is typically associated with low rentals, while the private land creates a long-term asset for the investor.

Land requirement for a wind project varies, depending upon several factors like wind speed, turbine technology (hub-height) and topography. Similarly, for a solar project, it depends upon the latitude of the location, solar insolation, topography and technology. There has been a marked improvement in wind and solar product profiles- higher efficiency a well as module wattage and higher capacity of turbine, due to increased hub height and longer blades.

However, the minimum land requirements under most of the government programmes have not been revised to reflect upon the changing ground realities; the Solar Energy Corporation of India (SECI) has kept the minimum size of land required for setting up a solar PV project at 1.5 hectares per MW. In comparison, the power capacity of a module (Wp per square meter) has increased substantially since last 5 years, from 280 Wp to 335 Wp using the same module area, depicting a 25% increase. Another important factor is the latitude of the location of a solar project, which determines the spacing between modules. The latitude varies vastly in India from 10-degree N in Northern states to 35-degree N at the Southern tip of Peninsular India, which may influence the land requirements for solar PV projects.

As per a study conducted by the National Institute of Solar Energy (NISE), the total solar potential in the country has been estimated as 750 GW, considering use of 3% of wasteland area. The National Institute of Wind Energy (NIWE) has also estimated 150 GW of wind power potential in India on wasteland areas. However, it may be noted that there has been a marked decline in the area categorized as barren and culturable wasteland since independence. Moreover, the wasteland is concentrated in only a few states of the country.

In India, solar photovoltaic power and wind energy projects are not covered under the ambit of Environmental Impact Assessment (EIA) Notification, 2006 and no environment clearance is required for such projects under the provisions thereof. The Ministry of Environment, Forests and Climate Change (MoEFCC), Government of India, has placed wind and solar PV projects under 'White Category' industries, which are exempted from obtaining 'Consent to Operate' from the concerned State Pollution Control Board (SPCB).

As in any other infrastructure project, there are socio-economic challenges associated with solar and wind energy projects. These include accessibility of common resources, opportunity cost to villagers due to land diversion, adequacy of compensation offered, livelihood impact on land owners as well as non-title holders and relocation of built up structures. Most wind and solar projects lead to employment creation for local community, however the same is limited to unskilled jobs like security personnel, drivers and module cleaners. Moreover, employment tapers steeply as the project moves from commissioning phase to maintenance phase. Another impact is use of fertile land for setting up solar and wind projects which may impact the food security of the nation. Most of the state governments allow purchase and use of agriculture land by way of deemed change of land use to non-agriculture (NA) category.

Project developers have been working for last many years on the ground aptly guided by the state agencies and it would be pertinent to highlight some of the best practices followed in the sector. With regard to land procurement and allotment, some of the SNAs have created land banks and have been sharing land coordinates through their portals. They also offer deemed land use change for the purpose of setting up of solar and wind projects.

Solar Parks, being developed by SECI in coordination with the state governments, facilitates land to the project developers with all necessary approvals. Some of the state governments, through their agencies, have started single window approval facility to for the investors. In order to ensure prudential use of land, SNAs are earmarking land limits to be considered while allotting land to the solar and wind project developers. In case of delay in project execution, the state governments have been strict in taking back

the land to be re-allotted to other companies. MNRE has recently advised the state governments to ensure that the wind projects are developed within 4 years of allotment of revenue land.

Internationally, the Bureau of Land Management in the United States of America encourages projects developers to bid on government-selected tracts with gusty winds and intense sunlight pre-cleared of major environmental conflicts. In many European countries, landowners lease their land to project developers for installing wind turbines enabling them to receive remunerative rentals in range of $1,250 - 5,000 per turbine, besides royalty payments equivalent to 2-6% of the gross project revenue.

The study has estimated the land requirements for the solar and wind sectors under different scenarios. Under the base case scenario, land requirement is around 3.4 lakh acres after considering existing land usage trends. This gets reduced by about 25% after taking into account the following interventions -

a) Using higher wattage solar modules and taller hub-height wind turbines
b) Promoting repowering and re-allotment of unused wind sites
c) Using land neutral technologies like canal tops and floating solar systems
d) Co-locating solar modules in existing wind farms

Based on a thorough assessment of the policies, regulations and field practices, while taking into account views of the stakeholders, the study recommends the following interventions. These interventions shall facilitate land procurement for setting up solar and wind projects while minimizing the impacts on the community.

Policy

- Developing land utilization policy for each state to balance the land requirements of different sectors in an ecologically friendly manner
- Expeditious computerisation of land records
- Prioritizing use of wasteland for solar and wind energy projects, including inter-state projects exporting power to states with low wasteland area
- Developing 'Model Land Lease Agreement' taking concerns of all entities

- Re-allotting sites in case of delay in project implementation
- Using brown-field sites like vintage wind farms and reclaimed mining sites for setting up projects

Technical

- Identifying suitable project sites considering land type, its use, resource potential, latitude, availability of transmission infrastructure, roads. This can include superimposing maps of resource availability, land use, land records and ownership
- Setting up solar-wind hybrid projects in vintage wind farms
- Promoting land-neutral technologies using rooftops, canal tops and floating systems besides encouraging new technologies like solar trackers

Socio-economic

- Conducting 'Social Impact Assessment' for wind farms and solar projects including solar parks above a certain capacity threshold, which could include livelihood and skill development planning for the local community
- Exploring community participation schemes using innovative business models, wherein, landowners can become shareholders in RE companies based on the notional value of their land

1.0 INTRODUCTION

India's high economic growth coupled with a growing population has led to a steady growth in the levels of energy demand. The sustained growth in the economy is aimed at ameliorating the living standards of the masses. Due to a positive correlation between energy consumption and economic growth, there has been a concomitant growth in the energy generation capacity and transmission facilities.

The Indian grid is having a substantial share of fossil fuel based electricity, with about 80%[1] of the total power generation attributed to coal fired plants, which are considered as key source of greenhouse gas (GHG) emissions. Associated with minimal emissions, renewable energy based power generation technologies offer a mitigation to the sustainability problems associated with conventional fossil fuels, besides enhancing the energy security of a country.

With these perspectives, the government of India has set large scale renewable energy targets to meet the climate goals and provide clean energy to the masses. It has been supporting the renewable energy sector by a slew of policy interventions including preferential tariff, tax and duty exemptions, besides priority in power evacuation and despatch. As a result, over 60 GW of renewable energy based projects have come onstream, which is equivalent to 15% of the total installed capacity and contributes 7% to the grid (as on July 2017); major contribution is from the wind energy and solar photovoltaic based power projects.

Under the 'Nationally Determined Contributions' (NDC) committed by the Indian government to the United Nations Framework Convention on Climate Change, it has aimed to reduce the emissions intensity of its GDP by 33 to 35% by the year 2030 (from 2005 level) and achieve 40% cumulative electric power installed capacity from non-fossil fuel based energy resources[2]. The interim capacity targets for the year 2022[3] have been set at 175 GW, including 100 GW from solar power and 60 GW from wind energy.

[1] Executive Summary for July 2017, Central Electricity Authority

[2] India's Nationally Determined Contribution submitted to UNFCCC

[3] Targets as set by MNRE

1.1 Need for the Study

Among the key issues identified towards accelerating the pace of deployment of renewable energy projects in the country is the availability of land at affordable rates and within certain fixed timelines. India is the second most populous nation globally, supporting 17% of the global population, residing in only 2.4% of the global land area, leading to a high population density.

Both solar and wind energy technologies are land intensive in nature, and the 2022-targets would require huge amount of land. Considering the current land usage trends, about 1,50,000 hectares of land would be required to support 50 GW of ground mounted solar and 30 GW of wind capacity, considering land requirements of 2 hectares per MW for solar photovoltaic energy projects and 1.5 hectares per MW for wind energy projects.

With regard to ownership, land can be classified as forest and revenue land owned by the government, or its agencies, private land owned by individuals/ entities and community land owned by the Panchayat. For obtaining revenue land on lease, approvals are required at different levels of the government hierarchy. The procurement of private land requires negotiations with the land owners followed by land use change to non-agricultural/ industrial category.

Land, being a state subject under the Indian constitution, the procedure to procure or lease land is tedious and time consuming with each state having its own set of regulations and procedure. The issue related to the availability of land is expected to increase tremendously in the coming years, considering the competing demands from other sectors of the economy.

Over 65% of the Indian population reside in rural areas/ villages, mostly engaged in agriculture and associated activities for their livelihoods. Large scale land use changes brought in by solar and wind projects may impact the lives of local community. As such, there is a need to prioritize the use of barren and wasteland for setting up solar and wind energy projects, though the same is spread unevenly in the country, concentrated in few states and districts.

1.2 Objectives of the Study

TERI University, under grant support from the Shakti Sustainable Energy Foundation (SSEF), conducted a study to understand major issues in the context of land required for setting up renewable energy projects, focusing on solar photovoltaic and wind energy sectors, identifying best practices with regard to policy and regulations as well as field practices.

The outcome of this project is accelerated deployment of renewable energy capacity, through widely acceptable developmental models, with the outputs as under –

- Developing model guidelines on land procurement/ use for setting up renewable energy projects (focusing on solar and wind sectors)
- Best practices with respect to land procurement followed in RE projects
- Innovative business models to minimize the socio-economic impacts of RE development

1.3 Study Approach

As part of this exercise, wind and solar energy policies and the programs and regulations of the identified states were examined in detail. Applicable land use regulations pertaining to the renewable energy sector as brought out by the respective land and revenue departments of the state governments and relevant clauses pertaining to land in the renewable energy policies were analysed. Solar Park Guidelines were perused to understand different land procurement models employed across the states.

Land use pattern in the country was analysed with the help of 'Land-Use Atlas and 'Wasteland Atlas' indicating potential areas for setting up projects. This was analysed in conjunction with the amenable solar and wind locations as per the solar and wind potential assessment conducted by the government agencies.

As part of consultation, discussions were held with a number of stakeholders across the business spectrum – policy makers, state nodal agencies, independent power producers, financial institutions, sector consultants and civil society organizations.

This was conducted by way of administering questionnaires and follow-up meetings/ discussions with the representatives; refer Annexure-I for details.

Inputs were solicited from few of the prominent project developers, equipment manufacturing companies/ suppliers and EPC players to delineate the process of land procurement using different categories of land. This analysis covered the levels of approvals, statutory obligations and cost factors. Best practices as followed in land procurement were identified and are being highlighted in Chapter-10 of this report. This was followed by a 'Stakeholder Consultation Workshop' with an objective to share the key findings of the study and undertake deliberations on the proposed recommendations. Details are provided in Annexure -II.

With regard to socio-economic impacts on the community, environmental and social impact assessment (ESIA) reports of some of the large solar and wind projects, as available on the public domain, were studied. Ground realities were verified by undertaking field visits to wind farms, solar projects and solar parks; this included discussion with the local community and farmers; details provided in Annexure-III. Community business models, as vogue in some countries, were examined to explore the feasibility of similar themes in India.

1.4 Boundary Conditions

The following Boundary Conditions were observed for the study: -

1.4.1 Renewable Energy Technologies

The study was restricted to solar photovoltaic and wind energy sectors as these sectors have a major share in the Indian RE basket and would be contributing extensively to the Indian power system in the coming years as per the policy targets framed by the government.

1.4.2 Land Ownership Types

The study was limited to investigate issues with regard to use of private land and revenue land for setting up solar PV and wind energy projects. Forest land, Panchayat land and Tribal land were excluded from the study. The exercise also did not cover the

land procurement mechanism towards right of way for roads and power evacuation infrastructure.

1.4.3 Focal States

Land being a state subject under the Indian constitution, each state has its own set of governing policies and regulations. The study was focussed on four states, though land procurement related practices of some other states were also analysed.

Rajasthan: It is the largest state in India in terms of land area, which is endowed with renewable energy resources, both solar insolation and wind velocity. The state government is aggressively promoting the RE sector with several policy initiatives, including provision of land banks, ease in land procurement procedure, deemed land use change and setting up solar parks. The state also has a high share of wasteland, which can be suitably utilised for setting up RE projects.

Karnataka: The state is leading is terms of installed RE capacity supported by a conducive policy structure. It is having a large land area, blessed with adequate levels of solar insolation as well as wind velocity. The Solar Park being developed at Pavagada (district Tumkur) is one of largest parks in the world, where the land has been taken on lease from private land owners. The state government also came out with a scheme for farmers to set up solar plants on their fields. Both these cases use innovative models for land procurement.

Andhra Pradesh: The state is blessed with good levels of solar radiation and some districts experience appreciable wind velocities. It has employed unique strategy (land pooling) to aggregate land for its new capital city and is using e-governance systems to make the procurement procedure quick and transparent. It has come out with investor friendly wind and solar energy policies, including a single window facility at SNA level.

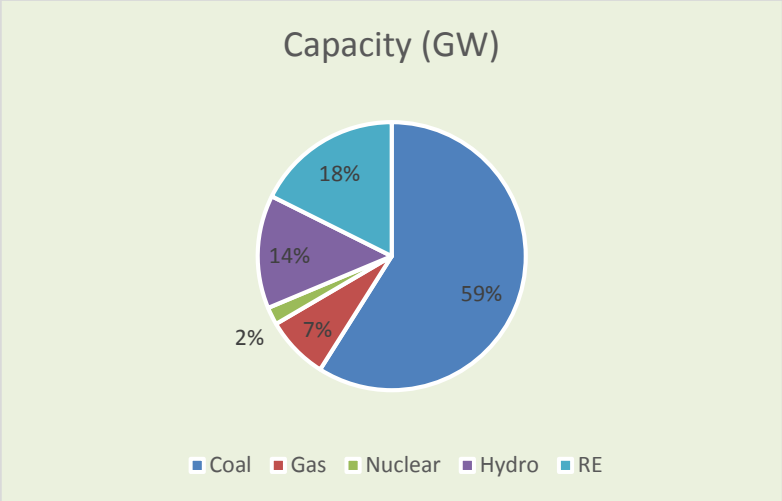
Punjab: The state is promoting solar sector with a number of policy interventions, including waiver of stamp-duty charges, deemed conversion of land and prompt pollution clearance approvals. Due to high cost of land, private land leasing scheme has been initiated, which has witnessed a good response. The government is promoting

land neutral projects in form of rooftops and canal top projects, easing pressure on land.

2.0 Indian Renewable Energy Sector

India's impressive economic growth in the recent decades has resulted in massive increase in its power generation capacity, with the installed capacity surpassing the 330 GW mark (as on 31.07.2017). Within this bucket, thermal based power generation sources account for about 70% share (coal– 60%, gas– 8%), with the remaining capacity shared between large hydro and renewable energy sources. The renewable energy sector, with an installed capacity of 59 GW (as on 31.07.2017), constitutes 18% of the total capacity and the same is depicted in the Figure 1. The total power generation was over 1200 billion units during the FY 2016-17, with about 7% contribution from RE sources[4]. Because of a large population base, the per capita electricity of India during the financial year 2016-17 was 1100 kWh[5], which is a third of the global average.

Figure 1: Indian Power Scenario



The RE sector in India has grown phenomenally over the last decade, witnessing over 20% growth on an annual basis, as shown in Figure-2[6]. Wind sector has got the maximum share in the Indian RE basket, with solar picking up since last three years[7]; detailed break-down is provided in Table 1.

[4] Executive Summary for the Month of July 2017, Central Electricity Authority

[5] Ministry of Power, Government of India

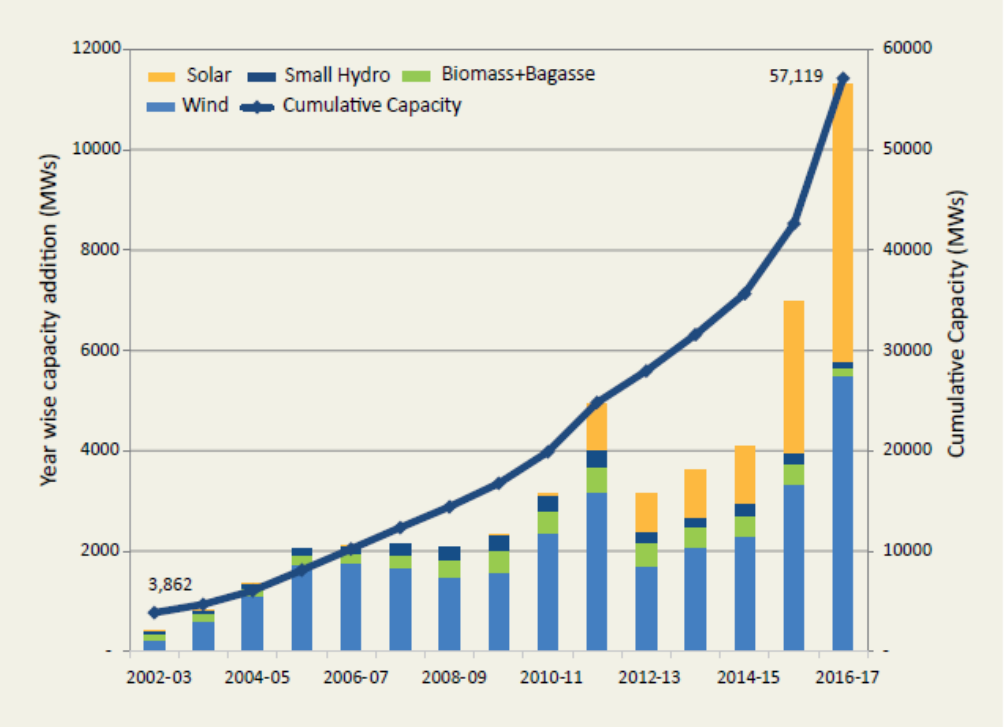
[6] 175 GW Renewables by 2022, Report by Prayas, July 2017

[7] Ministry of New and Renewable Energy, Government of India

Table 1: RE Installed Capacity- India

RE Technology	Installed Capacity (MW) (as on 31-07-2017)
Wind Power	32,562
Solar Power	13,652
Small Hydro Power	4,389
Bio-Power	8,182
Waste to Power	114
Total	**58,990**

Figure 2: Indian RE Sector Growth Trends



Being categorized among the top five greenhouse gas (GHG) emitters globally[8], India has been promoting renewable energy sector by way of several policy enablers. These include fiscal and financial incentives, preferential tariff, renewable power purchase obligations, generation based incentives as well as renewable energy certificates. As a result, India is among the top five nations globally in terms of installed RE capacity.

[8] Green House Gas Emissions Chart, World Resources Institute, 2017

2.1 Key Policies and Regulations

The Electricity Act, 2003 and several policies of the Government promote renewable energy in the country. Under Section 86(1) of the Act, it is desired to promote cogeneration and generation of electricity from renewable sources of energy. The National Electricity Policy 2005 stipulates to progressively increase the share of electricity from non-conventional sources needs.

The State Electricity Regulatory Commissions (SERCs) are taking steps to promote RE sources of energy within their area of jurisdiction. Various SERCs have issued orders/ regulations specifying a certain minimum percentage procurement of renewable power, separately for solar and non-solar sources. This includes offering preferential tariffs to wind project developers for a fixed number of years; though bidding has been introduced in the wind sector. With regard to the solar energy sector, auctions have been typically used to award projects to developers, with the tariff set by CERC/ SERC taken as the base value.

The Tariff Policy 2006 advices the Appropriate Commission to fix a minimum percentage for purchase of energy from renewable and the National Rural Electrification Policy advocates use of off-grid solutions based on stand-alone systems powered by renewable energy sources for supply of electricity.

Foreign investors are entitled to set up renewable energy based power generation projects in India with upto 100% foreign direct investment (FDI) allowed under automatic route.

In January 2010, the Government of India launched the National Solar Mission (NSM) as part of its National Action Plan on Climate Change (NAPCC) and set out a target to achieve 20 GW of grid-connected solar power by 2022. This target was revised to 100 GW by 2022 in late 2014. Of this, 60 GW has been targeted through grid-connected ground mounted systems and the remaining 40 GW would be coming from the rooftop solar PV based systems.

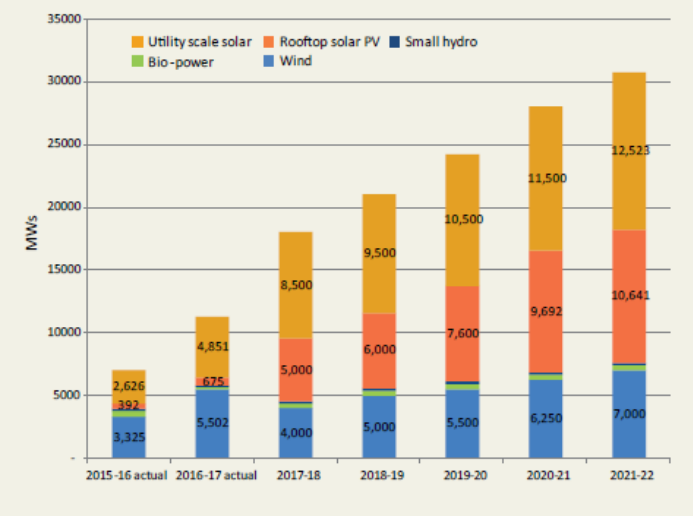
There is a carbon tax in the form of cess INR 400 per tonne on coal produced (or

imported) in India. This cess feeds the National Clean Environment Fund (NCEF), which is used for supporting clean environment initiatives in the country, including programmes run the by the Ministry of New and Renewable Energy.

At the Conference of Parties (CoP) held in Paris under the United Nations Framework Convention of Climate Change (UNFCCC), countries reached a historic agreement to combat climate change and to accelerate and intensify the actions and investments needed for a sustainable low carbon future. India has submitted as well as ratified its nationally determined commitments (NDC). These submissions state that India shall intend to reduce the emissions intensity of its GDP by 33% to 35% by 2030 from the 2005 level and achieve 40% cumulative electric power installed capacity from non-fossil sources by the year 2030, with the help of transfer of technology and low cost international finance including from Green Climate Fund. As part of interim targets, the Government of India has aimed to achieve an installed base of 175 GW by the year 2022[9], with year-on-year targets highlighted in Figure 3.

In the latest revision of the Tariff Policy, the Ministry of Power has issued Renewable Purchase Obligations (RPO) trajectory up to the year 2019, notifying uniform RPO levels across the country besides exempting wind and solar energy projects from payment of inter-state transmission charges and losses.

Figure 3: Indian RE Sector Targets



[9] Prayas Report based on MNRE Targets, 2017

3.0 LAND PROFILE OF INDIA

Land is the most important natural resource which embodies soil and water, and associated flora and fauna involving the ecosystem on which all human activities are based. Land is a finite resource covering only about 20% of the earth's surface. Land is crucial for all developmental activities, for natural resources, ecosystem services and for agriculture. Increasing population, growing needs and demands for economic development, clean water, food and other products from natural resources, as well as degradation of land and negative environmental impacts are posing increasing pressures to the land resources in many countries of the world.

India has to sustain over 17% of world's population with only 2.4% of world's total geographical area (3.287 million sq. km). It may be noted that the Indian population grew to 1210 million (2011 Census) from 345 million at the time of its independence (in the year 1947), resulting in a very high population density of 368 persons per square kilometre. The population to land ratio is what makes land accounting a matter linked to human development concerns.

India, being the seventh largest country in the world in terms of area, land resource management becomes very important. The developmental targets of India on one hand and the social, cultural and environmental aspects on the other hand demand land and the competing demands may lead to unfortunate conflicts.

India comprises seven climate regions, which have been further divided into 3 groups:

a) Tropical wet-humid group with tropical wet humid or monsoon climate, and tropical wet and dry or savannah climate
b) Dry climate group with tropical semi-arid (steppe) climate, sub-tropical arid (desert) climate and sub-tropical semi-arid (steppe) climate
c) Sub-tropical humid climate group with sub-tropical humid (wet) with dry winters climate and the mountain, or highland, or alpine climate

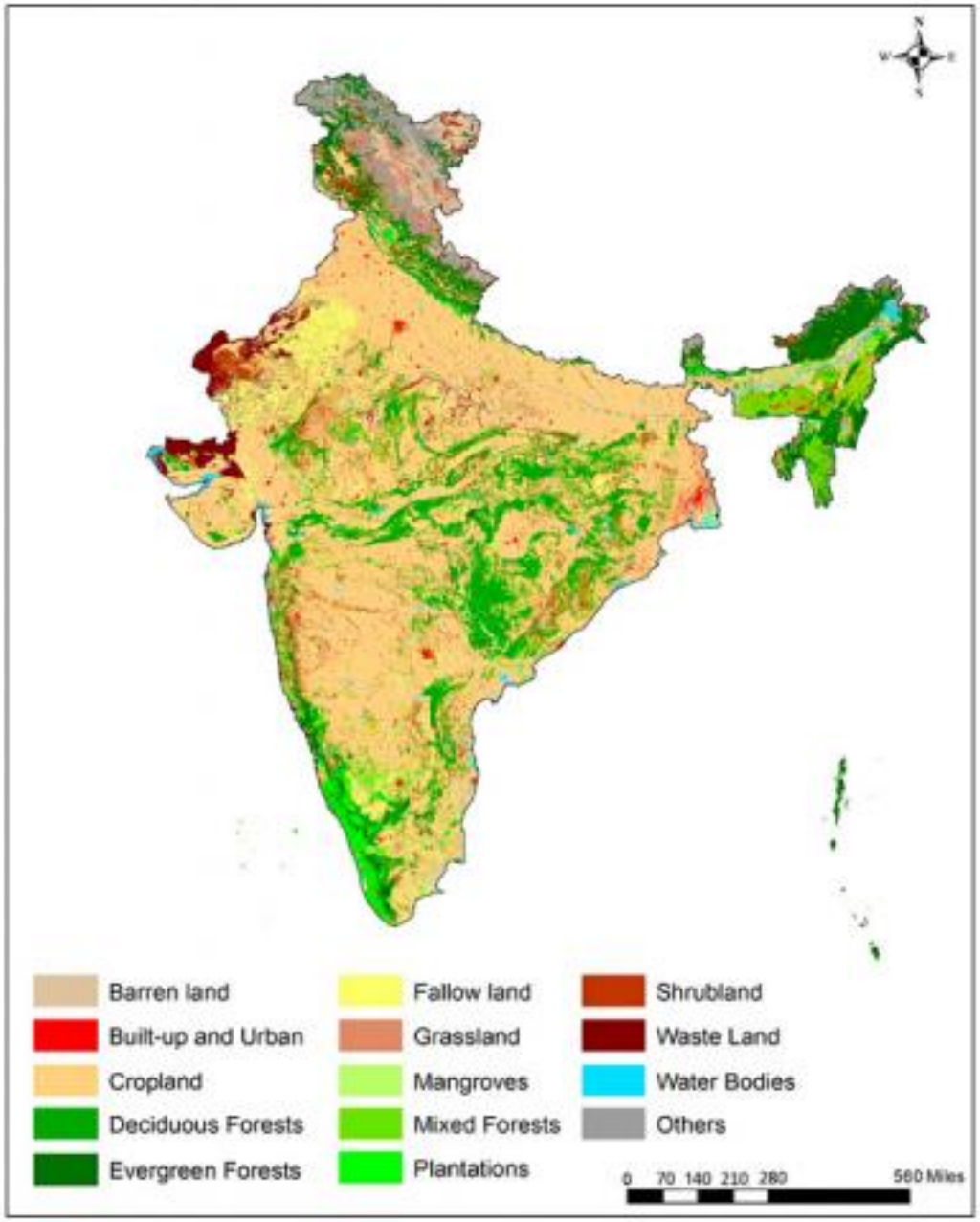
The country has also been categorized into nine bio-geographic regions, i.e. the Trans-Himalayan Region, the Himalayas, the semi-arid areas, the Western Ghats, the North-West Desert Regions, the Deccan Plateau, the Gangetic Plain, North-East India, the

islands, and the coasts.

3.1 Land Use Types

The land area in India has been classified into nine categories as depicted in Figure 4[10].

Figure 4: Land Use and Land Cover for India



[10] Land Use Codes, Ministry of Rural Development, Government of India

Forests: Forests are defined as all lands classed as forests under any legal enactment dealing with forests or administered as forests, implying those lands which need not have a tree cover. Forest area has increased considerably from 40.45 million hectares in 1950-51 to 69.0 million hectares in 1999-2000 recording a 70% increase in a span of half a century. However, 22% of forest land to the total reporting area is not sufficient for a tropical country like India where about 33% of the total land should be under forests. This will require massive tree plantations and vigorous restrictions on the reckless felling of trees.

Land for Non-Agricultural Use: It includes lands occupied by buildings, roads, and railways or under water and for non-agricultural purposes

Barren and Unculturable Land: These are lands like mountains, deserts, which cannot be brought under cultivation except at an exorbitant cost. The largest amount of land in this category lies in the states of Andhra Pradesh followed by Rajasthan, Madhya Pradesh, Gujarat, Uttar Pradesh and Bihar.

Permanent Pastures and Other Grazing Lands: These types of land use include all grazing lands where they are permanent pastures and meadows. Village common grazing land is included under this head. A total area of 11 million hectares is devoted to permanent pastures and other grazing lands. This amounts to about 4% of the total reporting area of the country. Grazing takes place mostly in forests and other uncultivated land wherever pasturage is available. The area presently under pastures and other grazing lands is not sufficient keeping in view the large population of livestock in the country.

Miscellaneous Tree Crops and Other Groves: The Miscellaneous types include all cultivable land, which is not included in 'Net Area Sown' but is put to some agricultural uses. Lands under Casuarina trees, thatching grasses, bamboo bushes, and other groves for fuel, which are not included under 'Orchards' are classified under this category. Land under this category declined sharply from 19.8 million hectares in 1950-51 to 3.62 million hectares or 1.2% of the total reporting area in 1999-2000. Odisa has the largest area in this category followed by Uttar Pradesh, Bihar, Karnataka, Andhra

Pradesh, Assam and Tamil Nadu.

Culturable Wasteland: This includes land available for cultivation, whether taken up or not taken up for cultivation once, but not cultivated during the last five years or more in succession including the current year. The lack of use of such lands may be due to constraints like lack of water, salinity or alkalinity of soil, soil erosion, water-logging, any unfavourable physiographic position, or human neglect. Such lands may be either fallow or covered with shrubs, which are not put to any use. Land once cultivated but not cultivated for five years in succession should be included in this category at the end of the five years.

Fallow Land Other Than Current Fallow: Fallow lands are defined as all lands, which were taken up for cultivation but are temporarily out of cultivation for a period of not less than one year and not more than five years. Fallow land is left uncultivated from 1 to 5 years to help soil recoup its fertility in the natural way depending upon the nature of soil and the nature of fanning. It has recorded an increase from 10.68 million hectares in 1950-51 to 14.79 million hectares in 1999-2000. The largest area of over 2.5 million hectares of 'fallow land other than current fallow' is in Rajasthan followed by 1.4 million hectares in Andhra Pradesh and over one million hectares in Maharashtra.

Current Fallow: The Current Fallow represents cropped area, which has been kept fallow during the current year.

Net Area Sown: The net sown are represents the total area sown with crops and orchards. Area sown more than once in the same year is counted only once. The net area sown has increased from 118.7 million hectares in 1950-51 to 159.59 million hectares in 2010-11 (figure in 1999-2000 was 141.2 million hectares).

Details of decadal changes in the land use types is highlighted in Table 2 and Table 3[11].

[11] Ministry of Agriculture and Farmers Welfare, Government of India

Table 2: All India Land Utilization (1950-51 to 1990-91)

Type of Land	1950–51	1960–61	1970–71	1980–81	1990–91
	Area in million hectares				
Forests	40.5	54.1	63.9	67.5	67.8
Non-agricultural uses	9.4	14.8	16.5	19.7	21.1
Barren and unculturable land	38.2	35.9	28.2	19.7	19.4
Permanent pastures and other grazing land	6.7	14.0	13.3	12.0	11.4
Land under miscellaneous tree, crops and groves	19.8	4.5	4.3	3.6	3.8
Culturable wasteland	22.9	19.2	17.5	16.7	15.0
Fallow land	28.1	22.8	19.9	24.8	23.4
Net sown area	118.8	133.2	140.3	140.0	143.0

Table 3: All India Land Utilization (2000-01 to 2009-10)

Type of Land	2000–01	2004–05	2008–09	2009–10
	Area in million hectares			
Forests	69.8	70.0	70.0	70.0
Non-agricultural uses	23.8	24.8	26.1	26.2
Barren and unculturable land	17.5	17.5	16.8	16.8
Permanent pastures and other grazing land	10.7	10.5	10.2	10.2
Land under miscellaneous tree, crops and groves	3.4	3.4	3.4	3.4
Culturable wasteland	13.6	13.3	12.8	12.9
Fallow land	25.0	25.7	24.5	26.2
Net sown area	141.3	140.6	141.9	140.0

Area under different types of land in states varies a lot with some states having a high percentage of wasteland while other states having large area used for agriculture purposes. Details for some of the large states are presented in Table 4[12].

[12] Niti Aayog Portal

Table 4: State Wise Pattern of Land Utilization (FY 2008-09)

States	Total	Forests	NA	Pastures	Miscellaneous	Wasteland	Fallow	Current Fallows	Sown Area
	Area in '000 hectares								
Andhra Pradesh	27507	6210	4797	569	299	650	1488	2624	10868
Karnataka	19050	3072	2163	923	290	413	516	1500	10174
Gujarat	18871	1833	3758	853	4	1976	19	623	9801
Madhya Pradesh	30756	8696	3401	1337	19	1160	621	582	14941
Maharashtra	30758	5213	3151	1246	248	917	1187	1370	17426
Punjab	5033	295	516	7	5	3	NA	37	4169
Rajasthan	34270	2728	4265	1699	18	4336	2108	1565	17551
Tamil Nadu	13027	2106	2665	110	259	333	1498	1013	5043
Uttar Pradesh	24170	1658	3268	65	374	440	540	1408	16417

3.2 Wasteland

The Department of Land Resources, under the Ministry of Rural Development, Government of India, has developed the Wasteland Atlas of India[13], giving the state wise land profile, categorized under different types of wasteland. An estimated 47.22 million hectares, accounting for 14.91% of the total geographical area of the country, has been mapped as wastelands during the period 2005-06. As per the Wasteland Atlas, the share of wasteland as a percentage of total land area has decreased from 17.6% in the year 2003 to 14.91% during the year 2006.

Within the total land categorized as wasteland, the maximum share is scrubland, degraded land and barren rocky land. States like Andhra Pradesh, Gujarat, Jammu & Kashmir, Madhya Pradesh and Maharashtra have a significant share of wasteland in their states. The Atlas depicts that 10 districts have more than 50% of their land categorized as wasteland and another 81 districts of the country have 20-50% of their land categorized as wasteland. Details of wasteland categories and their state-wise distribution is provided in Figure 5 and Figure 6.

[13] Wasteland Atlas of India - 2010, Ministry of Rural Development, Government of India

Figure 5: Distribution of Wasteland in India

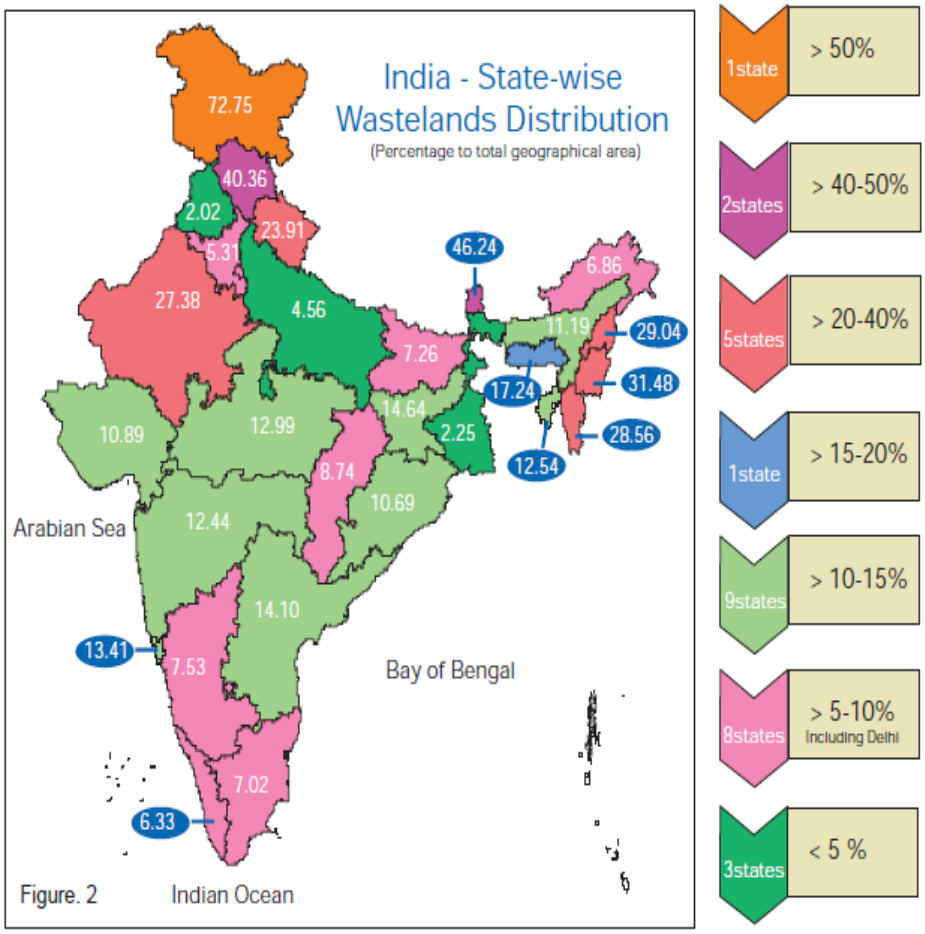
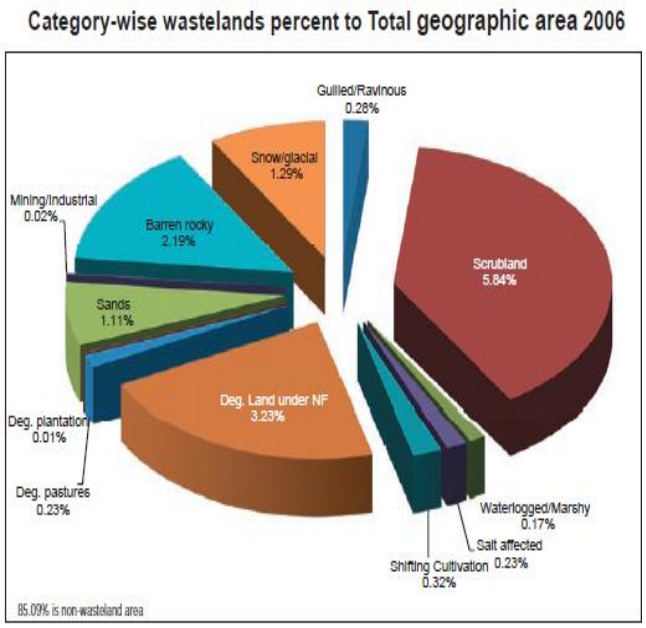


Figure 6: Wasteland Categories



3.3 Land Holdings

The total number of operational holdings in the country increased from 129.22 million in the year 2005-06 to 138.35 million in the year 2010-11. A large number of land holdings categorized are held by small and marginal farmers (below 2.00 hectares), resulting in small size agriculture farms, which leads to low yields and limited avenues for technological interventions.

Almost 85% of total number of land holdings are held by the small and marginal farmers, occupying 45% of the total sown area. The semi-medium and medium operational holding (2.00 –10.00 hectares) in 2010-11 were 14.29% with the operated area at 44.88%. The large holdings (>=10.00 hectares) were 0.70% of total number of holdings in 2010-11 with a share of remaining 10.59% of the operated area. Decadal trends are available in Table 5 and Table 6[14].

Table 5: Distribution of Agriculture Land Holdings

Year	Total		Average size	Distribution of holdings (%)				
	No. of holdings ('000)	Area ('000 ha)		Marginal	Small	Semi-medium	Medium	Large
1970–71	71,011	162,178	2.3	51.0	18.9	15.0	11.2	3.9
1980–81	88,883	163,797	1.8	56.4	18.1	14.0	9.1	2.4
1990–91	106,638	165,507	1.6	59.4	18.8	13.1	7.1	1.6
2000–01	119,931	159,435	1.3	62.9	18.9	11.7	5.5	1.0
2005–06	129,222	158,323	1.2	64.8	18.5	10.9	4.9	0.8
2010–11	137,757	159,181	1.2	67.0	17.9	10.0	4.3	0.7

Table 6: Share of Agriculture Land Holdings

Year	Total		Average size	Distribution of operational area (%)				
	No. of holdings ('000)	Area ('000 ha)		Marginal	Small	Semi-medium	Medium	Large
1970–71	71,011	162,178	2.3	9.0	11.9	18.5	29.7	30.9
1980–81	88,883	163,797	1.8	12.0	14.1	21.2	29.6	23.0
1990–91	106,638	165,507	1.6	15.0	17.4	23.2	27.0	17.3

[14] Agriculture Census, 2010-11, Ministry of Agriculture and Farmers Welfare, Government of India

2000–01	119,931	159,435	1.3	18.7	20.2	24.0	24.0	13.2
2005–06	129,222	158,323	1.2	20.2	20.9	23.9	23.1	11.8
2010–11	137,757	159,181	1.2	22.2	22.1	23.6	21.2	10.9

As per the 2011 Census, 68.84% of the country's population lives in 6,40,867 villages and the remaining 31.16% population lives in 7,935 urban centres. Although agriculture presently accounts for only about 14% of the Gross Domestic Product (GDP), it is the main source of livelihood for the majority of the rural population, and provides the basis of food security for the nation. The agriculture sector employs about 49% of the total workforce and 64% of the rural workforce[15]. Therefore, fertile agriculture land and clean water resources need to be protected effectively for providing and ensuring livelihood to rural population as well as towards the food security for the nation.

3.4 Land Utilization Analysis

Between 1950-51 and 2007-08, land utilisation in India underwent significant changes. The net sown area accounts for about 46% of the total reporting area of India against the world average of about 32%. This is much higher than 40% in the USA, 25% in Russia, 16% in Brazil and 6% in Canada. However, the per capita cultivated land has gone down drastically (about 70%) from 0.53 hectares in 1951 to 0.16 hectares in 2008. Moreover, the average size of operational holding declined to 1.15 hectares in 2010-11 as compared to 1.23 hectares in 2005-06. As such, there is an urgent need to increase the net sown area further for meeting the food and other requirements of rapidly increasing population in India; although there is limited scope for increasing area due to natural limitations such as topography, soils, climate, etc.

There has also been a marked decline in the area categorized as barren land (from 13.1% in 1950 to 5.6%) and culturable wasteland (from 22.9 million hectares in 1950-51 to 13.8 million hectares in 1999-2000). The decline in the wasteland can be attributed to several land reclamation schemes launched in India after Independence for ensuring food security. The wastelands are concentrated in a few states and districts of the country; state of Rajasthan has 4.9 lakh hectare of cultivable waste land, more than a third of the total waste land of India. Other states with considerable culturable waste

[15] Niti Aayog Report

land include Gujarat (13.6%), Madhya Pradesh (10.2%), Uttar Pradesh (6.93%) and Maharashtra (6.83%). Wasteland is ideal for setting up wind and solar energy based projects, though not all of its types can be used easily.

With a renewed focus of the India government on scaling up manufacturing facilities in India (Make in India) and massive plans to ramp up the highways and railways in the country, it becomes all the more important to utilize the available land with utmost prudence and care.

4.0 LAND RELATED LEGISLATION AND ACTS

According to Entry No. 18 of State List (List II) under Article 246 of the Constitution of India, land falls under the legislative and administrative competence of the States. The article states - "Land, that is to say, rights in or over land, land tenures including the relation of landlord and tenant, and the collection of rents; transfer and alienation of agricultural land; land improvement and agricultural loans; colonization".

There are several policies relating to land use, including the National Water Policy 2013, the National Land Use Policy Outlines 1988, the National Forest Policy 1988, the Policy Statement of Abatement of Pollution 1992, the National Livestock Policy Perspective, 1996, the National Agricultural Policy 2000, the National Population Policy 2000, the National Policy and Macro-Level Strategy and Action Plan on Biodiversity 2000 and the National Environmental Policy 2006.

4.1 Land Utilization Policies

Concerned with the issue of the optimal utilisation and scientific management of land resources, the Government of India had created (in the latter years of 1980's) the National Land Use and Wasteland Development Council (NLWC) under the Chairmanship of Prime Minister and the National Land Use and Conservation Board (NLCB) under the chairmanship of Deputy Chairman of the Planning Commission. The National Wasteland Development Board (NWDB) was simultaneously formed in the Department of Environment and Forests. The National Land Use Policy Outline (NLPO) was adopted by the National Land Use and Wasteland Development Council in the year 1986[16].

In 1974, the Ministry of Agriculture asked the State Governments for setting up the 'State Land Use Board' to provide policy direction, ensure close coordination among various departments and to achieve integrated planning for optimal use of available natural resources, which lead to the creation of State Land Use Boards (SLUBs) in the states in subsequent years.

[16] National Land Utilisation Policy (Draft), Department of Land Resources, 2013

It has been observed that these Boards have been not very effective, though in recent years, few of the state governments have taken steps to activate them. The Karnataka government has decided to revive its Board with an objective to bring 10 lakh hectares of wasteland under economic use. This has been necessitated because of the planned acquisition of a large quantity of farmland by the Karnataka Industrial Area Development Board's for setting up industrial townships across the State. Similarly, the government of Andhra Pradesh has planned to set-up the Andhra Pradesh Land Management Authority (APLMA), with powers to recommend land allotment and the government endeavours providing it with legal sanctity.

The Department of Land Resources, Ministry of Rural Development, Government of India, came out with a draft document on 'National Land Utilization Policy', in the year 2013. The document provided a framework for land use planning and management highlighting the need for optimal utilisation of land resources. As per the Policy, the lands in the country will be divided into Land Utilisation Zones (LUZs) based on the predominant use of those lands. Such LUZs will be subjected to land use planning in the form of Regional Development Plans and Development Plans. Various land uses will be reflected in these plans based on which further development will be guided. However, the government is yet to finalize this report. Further, the state governments also need to pro-actively work on developing their land use policy.

4.2 Land Ownership Types

Typically, based upon ownership, land can be categorized into the following-

Government land

(i) Forest

(ii) Non-forest, called as Revenue Land

(iii) Given on Patta to landless farmers

Community land

(i) Local community land (Panchayat)

Private land

(i) Agriculture (Transferable)

(ii) Non-agriculture (Transferable)

(iii) Tribal Land (Transferable only to tribals)

4.3 Land Procurement Acts and Legislations

Etymologically speaking, there is no distinction between the terms 'procurement' and 'acquisition'. While in the case of 'acquisition', the land can be acquired without the consent of all the land owners, 'procurement' usually refers to purchase of land through bilaterally negotiated means from the owners. A private entity cannot acquire land, but it can procure land. However, the government can acquire land for a private company meant to be used for public purpose.

If a private entity intends to purchase land from an individual, the same is allowed as a commercial transaction (at prevalent market prices, which shall not be lower than the circle rate) on consent basis. However, in case of a change in land use (say from agriculture to industry), approval needs to be obtained from the competent authorities.

Similarly, if a government agency wants to procure land from an individual (or, a group of individuals) for any purpose, the same can be undertaken by purchasing the land at agreed upon rates (not lower than the circle rate). In some of the cases, the government department procures land to create a land bank as an incentive for the investors.

Government revenue land can be leased to private entities on rental basis under the relevant policies of the concerned state (like industrial promotion policy, renewable energy policy, etc.). If the land is required by another government department, the land is transferred by the revenue department. Leasing of private land by farmers to project developers has also been initiated in recent months in areas having high cost of land. It helps the land owners earn assured returns by way of rentals, with an option to renegotiate the terms after the expiry of the lease period.

The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013 (LARR)

Under the Act, the government can acquire land for its own use, for public purpose, for public private partnership (PPP) with a public purpose or on behalf of private companies for a public purpose. The consent requirement from the affected families (those who own the land) is 80% in case of private companies and 70% for PPP model projects. No consent is required when land is for the government's hold. Public purpose

includes infrastructure projects (physical and social), which may include the renewable energy sector (within the power generation sector).

However, there is a ban on acquisition of irrigated multi-cropped land, and the same can be acquired only as a last resort, with a condition to develop equivalent area of culturable wasteland for agricultural purpose. The area of irrigated multi-cropped land to be acquired for all projects in aggregate during five years in a district shall not exceed 1% of the total irrigated multi-cropped land determined for the relevant block of 5 years. Further, the acquisition of agricultural land in aggregate for all projects in a district shall not be more than 5% of the net sown area in a district determined for the relevant block of 5 years.

The amount of compensation is arrived at after applying a certain multiplication factor upon the market value of the land along with the value of assets attached to the land or building. It is estimated that land acquisition under the LARR takes a minimal of four to five years.

Railways: In case of Railways, land can be acquired by the Central Government under the Railway (Amendment) Act 2008 for the projects classified as 'Special Projects' (like Delhi Metro and DFCC projects). This has helped expedite land acquisition as the acquisition cannot be challenged in any court. The amended Act ensured better deal for those whose land was being acquired by incorporating benefits under National Rehabilitation and Resettlement Policy 2007.

The National Highways Act: The National Highways Act, 1956 and National Highways Authority of India Act, 1988 were amended in 1997 giving land acquisition powers to a competent authority, who could be any person designated by the government. The authority's verdict on the land so acquired will be final and cannot be challenged in a court of law. The amount of compensation for the land is to be determined as per the market value of the land. For national projects like highways and roads, the centre notifies the area where land needs to be acquired. The state government is then directed by the Centre to start the land acquisition process and money is provided for the purpose. Apart from compensation, setting up of Land

Acquisition (LA) cells at its regional offices and increased delegation of authority to subordinate officers are also giving impetus to land acquisition. These LA cells also act as an interface between the central government and those farmers whose land is being acquired to try and ensure that potential disputes do not land up in courts.

Land Ceiling Act: To avoid concentration of land in a few hands (prevailing in the erstwhile Zamindari system), states have defined the maximum farmland holding which can be owned by an individual/ family under their respective Land Ceiling Acts (limits based upon type of land). The range of ceiling varies from state to state. For instance, in Andhra Pradesh, the level of ceiling for dry land ranged from 14.16 hectares to 21.85 hectares. Karnataka had the limit of 21.85 hectares for dry land, while Punjab had 20.50 hectares and West Bengal 7.00 hectares. For irrigated lands with two crops, the limit was lower; in Andhra Pradesh 4.05 to 7.28 hectares, in Maharashtra 7.28 hectares, in Punjab 7 hectares and in West Bengal 5.0 hectares.

Panchayat Raj Act: The 73rd constitutional amendment (Pancahyati Raj Act) empowers rural local bodies or Pancahyati Raj Institutions (PRIs) on decision making for clearing developmental projects by providing them legal status. Under the Panchayat Act, the PRIs or Gram Sabha at the village level has to be consulted by the project proponent before establishing a project in areas falling under its jurisdiction. This gives villagers/ locals the right to raise their project development linked concerns.

Panchayats (Extension to the Scheduled Area) ACT, 1996: The Act states that the Gram Sabha or the Panchayats at the appropriate level shall be consulted before making the acquisition of land in the Scheduled Areas for development projects; prior recommendation of the Gram Sabha or the Panchayats at the appropriate level shall be made mandatory for grant of concession for the exploitation of minor minerals by auction.

Land Pooling Policy: An additional instrument that the government agencies are using to make acquisition more acceptable to landowners is land pooling. The idea here is to purchase or acquire more land than is required for the project and eventually transfer each landowner a fraction of their land back from the excess land after the

project is complete. Because major public purpose projects such as highways/ airports raise the value of the surrounding land, the value of the fraction of the original piece of land returned could be higher than the value of the full piece prior to the completion of the project, the landowners may find such a deal attractive. Land pooling can be initiated by both private entities (as in the case of Haryana industrial zones and private residential colonies in Delhi) and public agencies (land for Amravati, capital to be built for Andhra Pradesh and the upcoming Navi Mumbai Airport).

Haryana- Land Pooling by Private Entities

In Haryana, a large number of private land aggregators have emerged who are helping businesses buy land. The process of getting administrative clearance for changing the end use of land (CLU, or change in land use) has been simplified. Backward blocks with low industrial penetration have been identified. Businesses buying land in these blocks get a full refund of stamp duty.

AP- Land Pooling by Public Entities

Andhra Pradesh government is identifying and acquiring land through a transparent and farmer friendly land pooling/acquisition policy. It wants to create a land bank of 10 lakh acres in order to attract investments. GIS will be used to create land inventory and update information of land parcels on real time basis. Key details and parameters about land parcels (e.g. soil type, distance from sea-ports, airports, railway stations etc.) will be made available online.

Environmental Legislations: Solar photovoltaic power and wind energy projects are not covered under the ambit of Environmental Impact Assessment (EIA) Notification, 2006 and no environmental clearance is required for such projects under the provisions thereof.

The Ministry of Environment, Forests and Climate Change, Government of India (MoEFCC), has developed criteria for categorization of industrial sectors based on the Pollution Index[17], which is a function of the emissions (air pollutants), effluents (water

[17] Classification of Industrial Sectors Under, Central Pollution Control Board, 2016

pollutants), hazardous wastes generation and consumption of resources. Under this index, solar power generation (through photovoltaic cell) and wind power have been placed under 'White Category' industries, which are not required to obtain 'Consent to Operate' from the concerned State Pollution Control Board (SPCB).

4.4 Land Records

During the later years of the decade of 1980, the Government of India, through the Department of Land Resources under the Ministry of Rural Development, launched the Computerisation of Land Records and Strengthening of Revenue Administration and Updating of Land Records to improve revenue administration and the land records in the country. These two programmes were merged into a single integrated programme called the 'The Digital India Land Records Modernization Programme (DILRMP)' in the year 2008[18]. The major components under this programme are computerization of all land records including mutations, digitization of maps and integration of textual and spatial data, survey/re-survey and updation of all survey and settlement records including creation of original cadastral records wherever necessary, computerization of registration and its integration with the land records maintenance system, development of core Geospatial Information System and capacity building.

Some of the state governments have been working towards modernization of their land records and achieved good results. These include the 'BHOOMI PROJECT' in Karnataka, Mee-Seva in Andhra Pradesh and Cadastral Survey in Gujarat. More details are available on the portal of Department of Land Resources[19].

[18] Department of Land Resources, Ministry of Rural Development, Government of India

[19] http://dilrmp.nic.in/testing/faces/rptPhysicalHome/rptStateGenericDetail.xhtml?id=./../master/physical.xhtml

5.0 SOLAR AND WIND ENERGY POLICIES

Most states in India have come out with state specific solar energy[20] and wind energy policies[21], with definite clauses related to land and the same is discussed as under.

5.1 Solar Energy Policies

Andhra Pradesh Solar Power Policy, 2015

Under the Andhra Pradesh Solar Policy 2015, it is the responsibility of the project developer to acquire private land. In case of land owned by Revenue Department, the land allotment shall be done as per the prevailing government policy and facilitated by the state nodal agency, New & Renewable Energy Development Corporation of Andhra Pradesh, NREDCAP. Solar projects are provided with a deemed Non-Agricultural (NA) status on payment of applicable fees. Solar PV power projects are also exempted by the AP Pollution Control Board from obtaining the 'Consent to Establish' (CTE).

Rajasthan Solar Energy Policy, 2014

Under the Rajasthan Solar Energy Policy, revenue land may be allotted to solar park developers as per the provisions of Rajasthan Land Revenue Rules 2007 (Allotment of land for setting up power plant based on renewable energy sources). Further, the solar park developers are empowered to sub-lease the land. The process requires the state nodal agency, Rajasthan Renewable Energy Corporation (RREC), to make a recommendation for allotment of government land to the concerned district collector (DC). The Policy specifies the technology wise land area to be allotted to project developers for setting up solar projects as in Table 7.

Table 7: Land for Solar Projects in Rajasthan

S No	Technology	Maximum Permitted Land
1	SPV on Crystalline Technology	2.5 hectare/ MW
2	SPV on Crystalline Technology with Tracker	3.5 hectare/ MW
3	SPV on Thin film /Amorphous Technology	3.5 hectare/ MW

[20] Extracted from State Solar Energy Policies

[21] Extracted from State Wind Energy Policies

Private sector solar park developers are allowed to purchase agriculture land from the land owner (referred to as Khatedar) for developing solar parks in excess of land ceiling limits (in accordance with the provision of Rajasthan Imposition of Ceiling on Agriculture Holding Act, 1973)[22]. Khatedar is also permitted to set up solar power project on his holding and allowed to sub-let his holding for setting up such projects without the requirement of land conversion (in accordance within the provisions of Rajasthan Tenancy Act 1955 and Rajasthan Land Revenue Act 1956). In this case, the Tehsildar and RREC are required to be informed about such intended use of land within 30 days and no land use conversion is required (under a recent amendment made by the Rajasthan Revenue department).

Government land is allowed to be allocated to private sector solar park developers for development of solar parks. RREC will recommend to concerned district collector for allotment of such land. The project developers are also allowed to sub-lease the land allotted to them for the purpose of setting up solar/ wind project and the transferee is required to pay 50% additional lease rent annually. This requires the approval of Collector which is to be made on the recommendation made by RREC. Farmers can lease their agricultural land to power generation companies (solar and wind energy) for 30 years and the annual rent shall be charged at 5% per annum of the premium for 2 years from the date of allotment (to be enhanced by 5% every year).

Karnataka Solar Policy (2014-21)

The Government of Karnataka has amended the Karnataka Land Reforms Act, 1961 and formulated a policy to facilitate setting up of Solar Parks. The Policy contemplates time bound permissions to project developers and has empowered Deputy Commissioners to approve purchase of agricultural land for development of solar projects (u/s 109 of Land Reforms Act).

Under the Karnataka Land Reform (Amendment) Act, 2015 occupant of any agriculture land can divert such land for the purpose of setting up of solar power generation. The permission applied for conversion of such land shall be deemed to

[22] Rajasthan Land Revenue Rules

have been granted and the developers can start project execution work without waiting for a formal approval on their application for conversion of agricultural land. Necessary amendments have also been made in sections 79(a), 79(b) and 80 of the Karnataka Land Reforms Act to enable RE developers purchase private land directly from the owners of the land. It has also empowered Deputy Commissioners to allot land upto 108 acres of land (raised from the earlier limit of 55 acres).

The state government has proposed to develop a district wise inventory of land lying unused with Gram Panchayat, private waste lands and other unproductive single crop agricultural lands for setting up RE projects. It further intends to provide land for developing RE projects u/s Sec-71 of Land Revenue Act to Karnataka Renewable Energy Development Limited (KREDL)[23].

The Solar Policy of the state provides for creation of private land bank owned by individual farmers/ group of farmers/ associations for development of solar projects on long term lease basis (up to 30 years subject to renewal after lease period) at lease rates fixed by the state government from time to time, in coordination with revenue department. Moreover, a cell has been created at KREDL for creation of land bank comprising both private and publicly owned land for setting up solar projects on lease basis.

To ensure equitable development, the State Solar Policy promotes solar parks on wasteland in backward districts. It also ran a programme which enabled land owning farmers to set up solar plants (1-3 MW) for sale of power to the utility at a tariff determined by the Karnataka State Electricity Regulatory Commission. Moreover, the state government has restricted the solar capacity per taluk at 20 MW to ensure that the projects are spread evenly across the state. Solar PV projects have been exempted from obtaining clearances from the state pollution control board.

New and Renewable Energy Policy, Government of Punjab, 2012

Under the Policy, the state government provides 100% exemption to project

[23] Karnataka Land Revenue Act

developers from payment of fee and stamp duty for land registration/ lease deed. Further, agriculture land is allowed to be used for setting up renewable energy projects and no charges are levied towards change in land use (CLU). Solar PV projects are also exempted from obtaining any NOC/ Consent laws from the state pollution control board.

Madhya Pradesh Solar Power Policy, 2012

The New & Renewable Energy Department, Government of Madhya Pradesh, takes possession of land from the Revenue Department and leases it to renewable energy project developers for project development activity. Revenue land to be used for setting up projects is allotted on the basis of maximum free energy offered to the state. The upper limit for allocating revenue land for setting up solar based projects is three hectares per megawatt.

In case a developer who has been given permission for land use for setting up of solar project, intends to set up the solar project along with the third-party participation, then land use permission for the party on which is solar project to set up by the third party, will be given to third party on the same terms and conditions of the revenue department on which permission is given to the developer. With regard to private land, the state government provides an exemption of 50% on stamp duty towards purchase of private land for the project.

Solar Parks Scheme

To circumvent project implementation issues encountered by investors, which includes land procurement, MNRE, through its arm, the Solar Energy Corporation of India (SECI), rolled out the 'Solar Park Scheme' under the National Solar Mission (NSM). Solar Park is a large chunk of land identified for setting up of large number of solar power projects, wherein the project developers are made available land with necessary statutory clearances along with common infrastructure facilities to set up project under a 'Plug and Play' business model.

Under the Solar Parks Guidelines[24], the host state government needs to identify land for setting up Solar Park, preferably large size government owned wasteland with appropriate insolation levels. The Solar Power Park Developer (SPPD), as the Implementing Agency, is responsible for acquisition of land, getting land related clearances, besides developing the approach roads and setting up the transmission system. SPPD is typically a joint venture between SECI and host SNA. It is proposed to develop 34 solar parks spread over 21 states with a cumulative capacity of 20,000 MW; these targets have been revised upwards to 40,000 MW in the budget of FY 2016-17.

Salient features of Solar Park Scheme -

- Land identification by the State Government, at least 5 acres per MW
- Priority of using government wasteland to minimise acquisition of private land
- If land cannot be made available in one location, then land at few locations in close vicinity may be taken
- Exploring possibility of using cold and hot deserts, sides of highways
- SPPD to sell/ lease plots to project developers for 30 years
- Cost of land in the range of 2% of project cost

Developers are also involved in setting up private solar parks where they identify amenable sites which are then notified by the state governments to be used for setting up solar projects on a plug-n-play mode. This type of model is prevalent in the state of Rajasthan due to the availability of land with high insolation levels.

An analysis by ICRIER shows that the land intensity of solar PV project varies widely across states and even within a state; it ranges from 1.2 hectares per MW to 3.1 hectares per MW[25].

Four of the solar parks, which are in advanced stages of implementation, have been analysed on different aspects including mode of procurement and land intensity.

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[24] Solar Park Guidelines, MNRE/ SECI

[25] Harvesting Solar Power in India, ICRIER, August 2016

Ananthapuramu Park (Andhra Pradesh): A substantial part of the total land identified for the Park 11,000 acres has been taken on lease from the state government, while the remaining has been acquired from the local land owners.

Pavagada Park (Karnataka): Innovative private leasing model has been used. Land has been taken on lease from land owning farmers by the Solar Park Developer Agency (KSPDCL) for sub-leasing it to project developers. The rental has been fixed at INR 21,000 per acre per annum, with an escalation of 5% once in two years.

Bhadla Park (Rajasthan): The state government has provided its revenue land to the SPPD on lease.

Rewa Park (Madhya Pradesh): The state government has acquired the land for the 750 MW solar park coming up at Rewa by taking the consent of land owners and offering them premium over the prevalent market value of the land. About 1500 Ha has been procured including 300 Ha of private land procured under the Madhya Pradesh's Consent of Land Purchase Policy, 2014 and the balance 1200 hectares of revenue land.

Summary of the four solar parks analysed like the land intensity and lease rentals are provided in Table 8.

Table 8: Solar Park Analysis

State	Park	Area (Acres)	No of Villages	Mode of Procurement	Land Intensity (acres/ MW)	Lease Rentals
Andhra Pradesh	Ananthapuramu 1500 MW	11528	2	Land Acquisition	7.68	NA
Karnataka	Pavagada 2000 MW	11000	5	Farmer's land leased	5.5	INR 21,000/ Acre
Rajasthan	Bhadla Ph-II 680 MW	4446	1	Revenue land Lease	6.52	Rs 81,000/ Acre (DLC rate)
Madhya Pradesh	REWA 750 MW	3828	-	Acquisition under state Consent Policy	5.10	NA

CERC Land Cost Benchmarks

Central Electricity Regulatory Commission (CERC), while determining tariff for solar PV projects, considers land requirement at 5 acres per MW. The parameters include technology (Crystalline, Thin film), conversion efficiency and solar radiation incident in respective area. With regard to type of land, CERC assumes use of arid/ barren land having minimal commercial value. The cost of land in the tariff order for the FY 2016-17 was INR 25 Lakh/MW, which was same as considered during the FY 2015-16. For the FYs 2014-15 and 2013-14, the cost was INR 16.80 Lakh/MW. This figure was INR 16 Lakh for FY 2012-13 and INR 15 Lakh for the preceding two years (FYs 2011-12 and 2010-11).

In the CERC tariff consultation process undertaken for solar PV technologies (FY 2016-17), some stakeholders suggested to consider the land price variation across states and the mode of procurement (purchase of private land or, lease of revenue land). Many stakeholders suggested increasing the cost due to higher compensation mandated under the Land Acquisition Act, 2013. Another suggestion was to specify norms based on the location of a project (based on the latitude of the place) and type of technology used (trackers/ seasonal tilt mechanism generate more power, but require larger area). It was also opined that land levelling required in arid and rocky locations increases the project implementation cost, thus, offsetting the low cost of land procurement in these areas.

The summary of the land related aspects of solar policies as brought out by the states under consideration is provided in Table 9.

Table 9: Summary of State Solar Policies

State	Policy	Land – Private	Land – Revenue	LUC	Pollution Clearance	Agriculture Land	Land Bank	Stamp Duty	Land Ceiling
Andhra Pradesh	Solar Policy 2015	Project developer to acquire land	SNA to facilitate land	Deemed NA status for solar projects	Solar projects exempted from NoC/ Consent	deemed NA status			
Karnataka	Solar Policy, 2014-21	Creating private land banks owned by farmers for development of solar projects on lease	Solar parks on waste land in backward districts	Deemed conversion of land for solar projects; developers can start execution without waiting for approval	Solar projects exempted from obtaining clearance	Allowed purchase of agriculture land for solar projects	Cell at KREDL for creation of land bank on lease basis; Govt to provide 4500 Ha Revenue land for RE projects		
Rajasthan	Solar Energy Policy, 2014	Khatedar permitted to sub-let holding for setting up projects	Government land to private developers at concessional rate for solar parks; sublease for 30 years	not required	Green Category; SPCB to issue CTE & CTO within 15 days of application	Allowed purchase of agriculture land for solar projects	GoR reserved 10,000 ha of government land in Jodhpur and 16,000 ha of in Jaisalmer as a land bank		2.5 Ha
Madhya Pradesh	Solar Energy Policy, 2012		Projects to be allotted maximum free energy offered per MW		SPV plants classified as 'White industries', and exempted from CTE/ CTO	acquire agriculture land given on lease		50% exemption	3 Ha

State	Policy	Land – Private	Land – Revenue	LUC	Pollution Clearance	Agriculture Land	Land Bank	Stamp Duty	Land Ceiling
Punjab	NRSE Policy		--very low quantum of revenue land		Projects are exempted from obtaining NOC from PPCB	Allowed purchase of agriculture land for solar projects		100% exemption	
CERC									5 Acre

It may be noted that even though the central government encourages setting up solar projects on wasteland, most of the states (as mentioned above) permit use of agriculture land by providing deemed land use change and other approvals.

5.2 Wind Energy Policies

MNRE Guidelines

In case of allotment of land or land use permission given by state government for the purpose of development of wind power project, MNRE suggests a maximum period of 4 years may be allowed for development and start of commissioning of the project after allotment/ permission to use land given by the Government. If the project is not developed within the given time frame the land allotment/ land use permission may be cancelled[26]. For existing project developers, where land is already allotted or land use permission has been already given prior to issue of these guidelines, 30 months may be given subject to an undertaking to develop the project within this period.

Karnataka Renewable Energy Policy 2009-14

For using revenue land, the developer has to approach Revenue/Forest/ Irrigation Department to obtain the land on lease basis. KREDL shall develop the land at its disposal (waste land) to facilitate establishment of RE projects. It will sub-lease the developed land to developers for a period of 30 years and lease rentals will be as per prime lending rate over current market price. At a particular time, not more than 3 sites shall be provided to a developer. In case of private land, developer has to acquire

[26] Guidelines for Development of Onshore Wind Power Projects, MNRE, October 2016

land and the cost towards diversion of agricultural land shall be INR 45000 per Hectare.

Andhra Pradesh Wind Power Policy, 2015

The Government of Andhra Pradesh may consider proposals for allotment of revenue land at the wind power potential areas on first come first serve basis, based on recommendation of the state nodal agency, NREDCAP, as per the provisions of New Land Allotment Policy.

To facilitate faster execution of projects, the District Collector shall handover advance possession of land, including pathways, to NREDCAP and the land shall be allotted in the joint name of NREDCAP and the developer. The DC shall permit the developer to start the construction and NREDCAP shall withdraw its rights from the land once the project gets commissioned. The allotted project needs to be commissioned within 18 months from the date of possession of land, otherwise, the site may be offered to any other developer by NREDCAP.

NREDCAP shall be responsible for capacity allotment for upto 40 MW and for higher capacity, approval needs to be taken from the state government. Deemed Non-Agricultural (NA) status for the land will be accorded on payment of applicable statutory fees. Wind power projects will be exempted from obtaining any NoC/Consent for Establishment under the pollution control laws from Andhra Pradesh Pollution Control Board. Wind power projects installed entirely or partly on government/ revenue land or forest areas, shall be required to sell power within the state only.

Madhya Pradesh Wind Power Project Policy, 2012

Permission for land use on Government revenue land shall be provided by New and Renewable Energy Department, which can be transferrable to a third party. Government land, if available, shall be provided for 30 years at a token premium of INR 1 per annum on footprint basis, approach road to the aero-generator, transmission lines, sub-station installation and for other affiliated uses.

Data of the sites where the SNA has installed wind monitoring masts shall be available

to applicants. If more than one application is received, allotment shall be on competition basis (premium offered by the bidder). No applicant shall be eligible for applying more than 100-Megawatt project against one-time advertisement on government land. Wherever required, private land shall be acquired by the Government and provided to the developer at acquisition cost. Developer shall be eligible for a rebate of 50% in stamp duty payable for procurement of private land.

Applicant shall have to ensure that wind turbine generator being installed at the project site proposed by them should be at a technically safe distance from the other nearest identified/ installed wind turbine generators. The prime lending institution shall have the right to substitute the developer for land use permission during the loan period. Project installation on lands owned by schedule tribes shall be carried out only under exceptional circumstances and on the basis of mutual consent and agreement.

Rajasthan Wind Policy, 2012

RREC will act as Nodal Agency for single window clearance of the projects for allotment of revenue land (limit of 5 Hectares/ MW) to Wind Power Developers as per provisions of Rajasthan Land Revenue (Allotment of Land for setting up of Power plant based on Renewable Energy Sources) Rules, 2007. It will recommend the case of land allotment to the concerned District Collector. Land shall be allotted at concessional rate of 10% of DLC rate (agriculture land). Sub-lease of land in favour of power producer shall be done by the concerned District Collector on recommendation of RREC.

Wind Power Developer is allowed to purchase private land from the land owner (Khatedar) at mutually agreed price in excess of ceiling limit prescribed in the Ceiling Act, 1973. Conversion of land to industrial use is not required before start of work as per an amendment in the Rajasthan Revenue department dated 08/10/2014.

The summary of the land related aspects of wind energy policies as brought out by the states under consideration is provided in Table 10.

Table 10: Wind Policy Summary

State	Policy	Land – Private	Land – Revenue	LUC	Pollution Clearance	Limit	Charges
Andhra Pradesh	Wind Policy 2012			Deemed Non-Agricultural (NA) status	Exempted		
Madhya Pradesh	Wind Policy 2012	Allowed	permission to use revenue land by NRE deptt			Footprint basis	50% rebate % in stamp duty payable for procuring private land
Rajasthan	Wind Policy 2012	Developer allowed to purchase private land from Khatedar for setting up wind plant in excess of ceiling limit	Land allotment as per Rajasthan Land Revenue Act at	Conversion of private land to industrial use required; conversion charges @ 10% charges			Concessional rate of 10% of the DLC rate (agriculture land) Sub-Lease in favor of Power Producer permitted Stamp duty levied on land cost only

6.0 LAND PROCUREMENT PROCEDURE

Land is scarce in India with competitive uses by various user segments. As such, land should be used in an optimal manner for the benefit of all stakeholders.

Land is one of the key parameters impacting the location of a renewable project and eventually its returns. The choice of a particular location for a project depends upon the availability of resource (solar radiation and wind velocity), its topography and terrain, soil strength, site accessibility, its market value (which depends upon ownership and its arability) and the returns it is generating currently. Other parameters include power evacuation infrastructure, availability of water and ease of land procurement.

In terms of ownership, land is classified as revenue land, private land and forest land. States have different policies for land purchase/allotment. The applicable policies and procedures with regard to land procurement/ acquisition / allotment may differ for forest, revenue and private types of land.

Revenue land and forest land are owned by government (either centre or state government) and are provided on lease basis. Project developers procure (purchase) private land from land owner(s), sometimes facilitated by a land arranger (termed as aggregator). This involves a commercial transaction at prevailing market/ circle rates with the consent of the land owner(s). Conversion of land use status, from agricultural to non- agricultural (industrial) is a prerequisite.

6.1 Private Land

Private land can be purchased directly from the owner of the land. Due to low level of land holdings, the identified site may be owned by more than one individual which may require negotiating with each of them. Lack of systematic land record keeping often leads to delays and, in few cases, litigations.

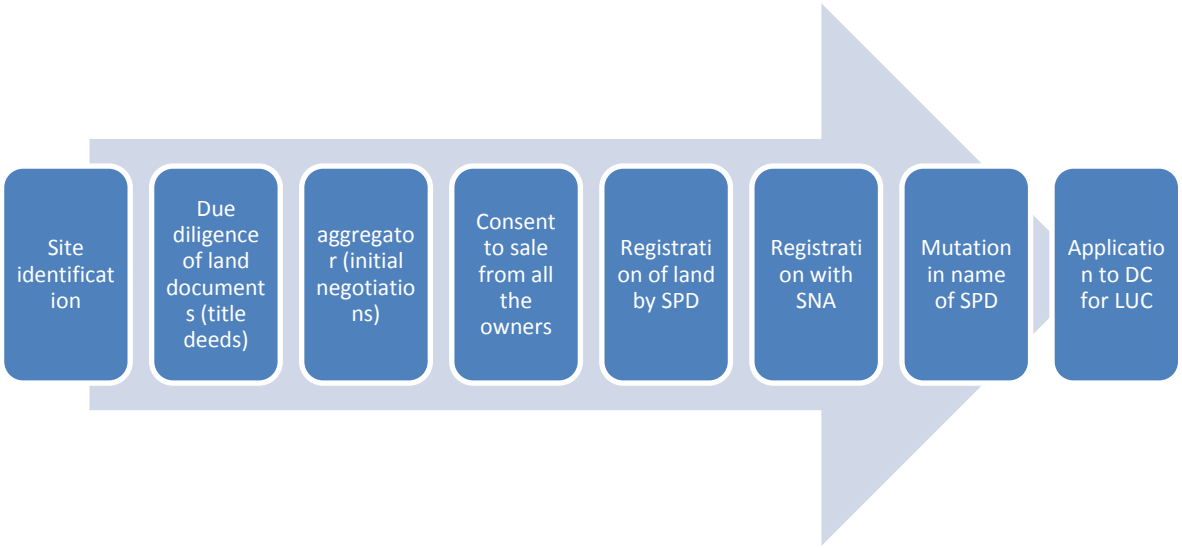
Details with regard to procurement of private land for setting up wind project is provided in Table 11.

Table 11: Steps in Private Land Procurement for Wind Project

Steps	Private Land Procurement – Wind Project
1	Identifying the land based on micro siting
2	Initial negotiations with land owner (through aggregator)
3	Title verification (in sub-register office)
4	Sale Deed proceedings with land owner
5	Application at DC office for conversion in the name of purchaser
6	DC forwards to Tehsildar, Town Planning Office and concerned local Development Authority (like Gram Panchayat, Municipal Commissioner)
7	NoC from Industrial Office & Pollution Control Board
8	Tehsildar forwards to Revenue Inspector and Taluk Surveyor
9	Tehsildar site inspection and recommendation to AC Office
10	AC site inspection and recommendation to DC office
11	DC raise the Demand Notice (Conversion Charge) and instructs Town Planning Office to submit final Plan/Layout
12	DC issues the Final Order Copy
13	Registration of land in the name of customer
14	Mutation in favor of company in revenue records
15	Payment for conversion of land (on Basic land value as per Sub Registrar Office data)

With regard to procuring private land for setting up solar project, the steps are highlighted in Figure 7.

Figure 7: Steps in Private land procurement–Solar project



Based upon the land type, land size and applicable regulations of the state government,

it takes about 4-8 months in procuring private land for setting up a solar project. This constitutes a significant portion of the total commissioning period of 12-15 months as available to the project developers.

Land Use Change

The end use classification needs to be changed to non-agricultural (industrial) category in case of private land for which the project developer submits a letter requesting the district administration for land use conversion of the proposed land along with the land purchase documents, NoC from village Panchayat, recommendation from local Sub-Divisional Magistrate /Tehsildar as well as the respective SNA. A fee is paid to the district administration. Some states are offering deemed NA facility to the developers, especially in case of solar projects.

After the land lease is made, Patwari visits the site for verification or Pattargarhi before registering the land. Mutation document is also made and finally the land is registered for industrial end use with the state revenue department. However, it has been observed that land use change is a complex procedure, which requires developers to hire agents and liaison officers.

6.2 Revenue Land

There are standard procedures to be adopted for allotment of revenue land. The government provides the revenue land on long-term lease basis to project developers at nominal charges. The request for allotment needs to be made to the District Collector with recommendation from the concerned SNA; same is explained in Figure 8.

Details with regard to procurement of private land for setting up wind project is provided in Table 12.

Figure 8: Steps in Revenue Land Leasing – Wind Project

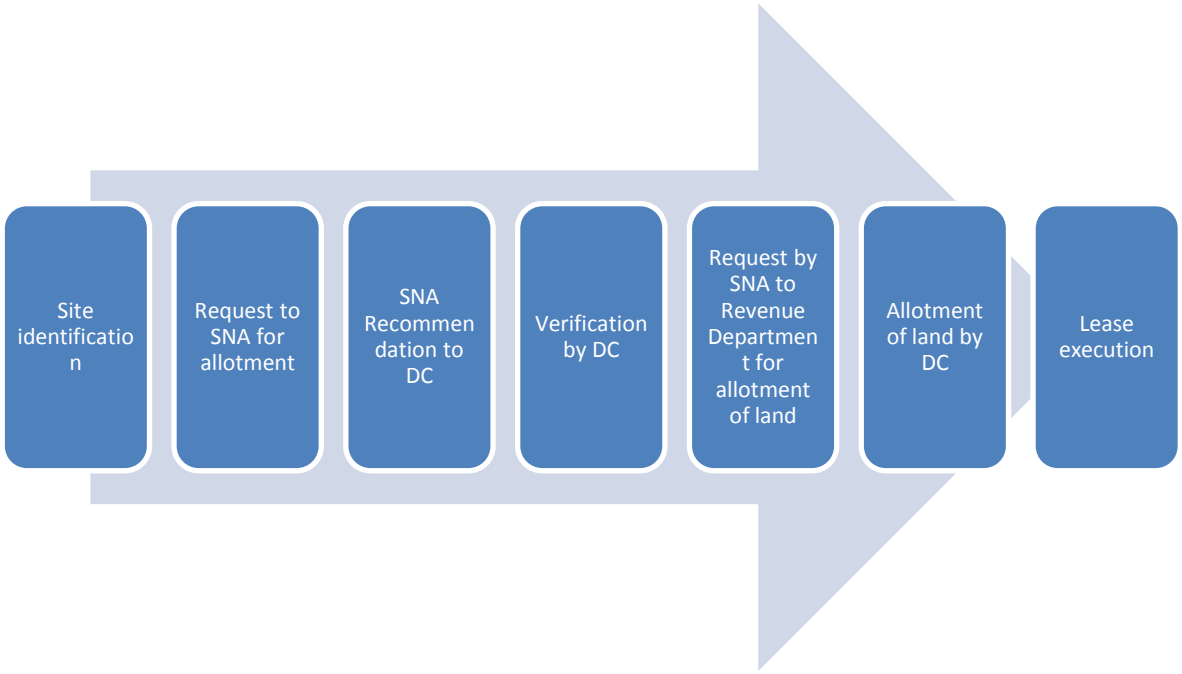
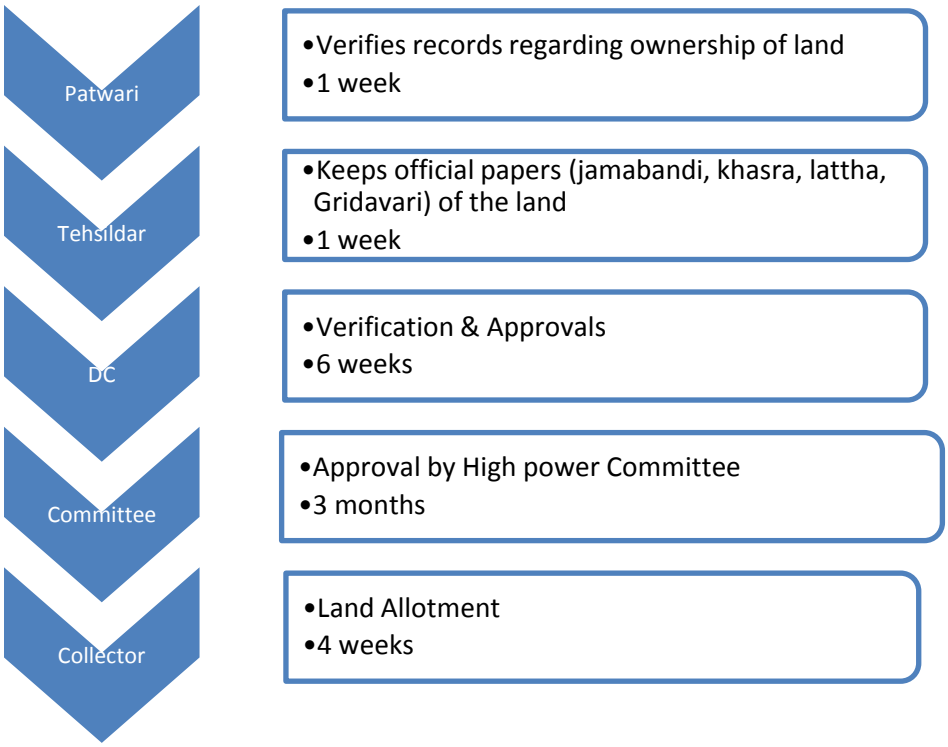


Table 12: Steps in Revenue Land Leasing for Solar Project

Steps	Revenue Land Leasing – Solar Project
1	Site Identification by solar project developer based upon resource availability and other parameters (terrain, approach, cost)
2	Registration of site for Allotment by SNA
3	Submission of application to DC for land allotment
4	Status Verification by DC (through to revenue authorities)
5	Verification by Patwari about land availability to DC (via Tehsildar & SDM)
6	Record examination by Patwari
7	Demarcation of land by Patwari in front of developer and villagers (process known as Pathadgarhi)
8	Request by DC for approval from state revenue department/ minister (through Patwari, Tehsildar, ADC)
9	Recommendation by DC (forwarded to Patwari with intimation to SNA)
10	Application for change of land use by SPD
11	Payment of lease & conversion charges
12	Recommendation by Revenue Department for lease of land (executed in the form of a lease deed by DC)

Based upon existing land use, its location, size and applicable regulations of the state government, it takes about 6 months for obtaining revenue land on lease; the time taken at various levels of administration is highlighted in Figure 9.

Figure 9: Typical Timelines in Land Leasing



6.3 Land Procurement Models

a. **Revenue Land on Lease:** In this case, the revenue land is allotted by the state government on lease based upon the recommendations of the concerned SNA. Many of the wind projects in states of Rajasthan and Gujarat have been set up on revenue land. Some of the upcoming Solar parks (like Bhadla Park in Rajasthan and Bundelkhand Solar Park in Uttar Pradesh) are planned on revenue land. The advantages include low lease rentals, utilization of waste-land and pre-approved land allotment. In many cases, the revenue land is barren/ wasteland, thus, obviating any need for human resettlement and avoiding use of fertile land. However, there may be issues related to livelihood of non-title users, accessibility and difficult terrain of the land. Further, wasteland and revenue land is concentrated in few states, this model may not be possible across the country.

b. **Purchase of Private Land**: This model has been in vogue since a long time. Land is purchased from land owners at a mutually agreed upon price to set-up wind and solar projects. This provides a clear title, which is preferred by the financiers. Project developers have the option to procure suitable land quickly. It leads to creation of a long-term asset, associated with an ever-increasing value. However,

there can be challenges with regard to high cost, multiple ownership and time required for land use change. Further, most of the private land is fertile, and as such may impact the long-term food security of the nation.

c. **Private Land on Lease:** This model is being currently used only in the solar sector, with Pavagadda Solar Park (Karnataka) a good example. Punjab government has also come out with a land leasing policy to encourage solar investors in the agrarian state associated with a high cost of land. This has been fairly successful, with a substantial portion of the total solar capacity coming under this route. Private leasing for setting up wind projects has been witnessed in countries like USA, Brazil and Denmark. The model assures a regular rental income to land owners besides facilitating land at a lower cost (over outright purchase) to the project developers. However, it may entail use of fertile land. For large size projects, it may take time for land aggregation due to multiplicity of land owners.

d. **Acquisition of Private Land:** This type of model is being used in solar parks, where the state government acquires land for further allotment to project developers to develop large scale projects. Examples include Solar Parks in Gujarat (Charanka) and Andhra Pradesh (Ananthapuramu). It has been observed that state governments have avoided using the Land Acquisition Act (LARR) to acquire land for setting up solar and wind energy projects. They procure land at market rates agreeable to the land owners. For the Rewa Solar Park, the Madhya Pradesh government used the 'MP Consent Land Purchase Policy'[27], to procure land. Under this policy, the state government agencies acquire land after obtaining consent of the land owners. The payment include amount for land as per the prevailing 'Collector Guideline Rates' plus an amount equal to value of immovable assets on the procured land. If in cases where the landowners refuse to provide their consent, their land would not be acquired, and the project is accordingly structured.

A comparison of the different types of land procurement models is provided in Table13.

[27] http://www.mprevenue.nic.in/en/policy

Table 13: Land Procurement Models

Model	Advantages	Challenges	Examples
Leasing of Revenue Land	Low rentals Use of waste land	Approval process Land use by non-title holders	Wind Projects Bhadla and Rewa Solar Parks
Purchase of Private Land	Clear title Asset creation	Use of fertile land Multiple owners High prices of land	Wind Projects Private Solar parks
Private Land on Lease	Annual rentals to land owners Lower cost to developers	Use of fertile land Multiple owners	Solar Projects in Punjab and Pavagadda Solar Park
Private Land acquired	Clarity on title Proper procedure	Time for consent Use of fertile land	Solar Parks in Rewa (Madhya Pradesh) and Ananthapuramu (Andhra Pradesh)

6.4 Land Cost

Wind Projects

The initial cost of land is low, but as and when the project implementation picks up, land owners get to know the value (worth) of their land as typically happens in any other project. With saturation of good windy sites, it has become hard to locate appropriate locations. However, with the advent of higher hub height turbines, which can generate at low wind speeds, wind projects are getting implemented at many other locations having modest wind resources.

The cost of procuring private land for setting up wind energy projects falls in the range of INR 15-25 Lakh per acre, making the share of land cost in the range of 3-5 % of the total project cost[28]. The Tamil Nadu Electricity Regulatory Commission, TNERC, in its wind tariff order for the year 2016, has considered cost of land as 5% of the total cost of a wind project. Perusal of few land lease documents for a few wind energy projects depicts lease rentals in range of INR 10,000-30,000 per MW per annum. Perusal of

[28] As indicated by some wind project developers

another document revealed that the land conversion charges were about INR 60,000 per hectare for a wind project being developed on wasteland in Gujarat[29].

Solar Projects

The rate of procuring private land for a solar project depends upon its alternate use as well as the terrain. In states of Madhya Pradesh and Rajasthan, land rates lie in the range of INR 5-10 lakhs per acre. In case of Odisha, the range is INR 7-12 lakhs per acre, while higher prices were reported in the states of Maharashtra, Gujarat, Andhra Pradesh and Telangana (INR 10-20 lakhs per acre). The northern states of Punjab, Haryana and Uttrakhand command the maximum rates due to use of multi-crop areas (INR 25-50 lakhs per acre). The cost of land varies from 5-20% of the total cost in a solar project.

Due to high cost of land in some states, leasing of private land has been started so as to contain the land procurement costs. In some cases, there is a direct leasing by private land owners to project developers while in other cases (like Solar Parks), government agencies like SECI acts as an intermediate player to take land on lease from land owners for sub-leasing it to solar project developers. The yearly lease rentals on a per acre basis vary from INR 50,000 in Punjab, INR 40,000 in Haryana, INR 15,000 in UP and INR 8,000 in Rajasthan. In many cases, lease rentals are negotiated according to prevailing market sentiments. The perusal of a land lease document of a solar project located in Rajasthan reflected rentals of INR 1000 per acre per annum, though these rates have been revised upwardly recently.

[29] As shared by sector consultants

7.0 LAND INTENSITY

The land utilization of any energy technology can be accounted for by two terms – land transformation and land occupation.

Land transformation is the overall land footprint of the technology across its lifetime, which includes directly transformed land area for setting up the power plant, mining fuel, fuel transportation, waste disposal and provision of space around the plant. In addition, it also accounts for indirect land transformations the land area that goes into upstream processes and secondary land disturbances, i.e. land degradation due to pollutants and effluents from the fuel and material cycles.

Land occupation is a measure about how a certain energy source affects the land qualitatively. It is calculated by multiplying the transformed land area with the time taken to recover to its initial state and hence is a measure of how a certain energy source affects the land qualitatively.

The parameter 'sqm per MW' (sqm is square meters) accounts for land area required to set up a typical power plant; it is the ratio of the area occupied by a typical power plant to its capacity of generation (nominal capacity). On the other hand, the parameter 'sqm per MWh' accounts for life-cycle land transformations, which include area that goes into setting up a power plant, fuel mining (in case of gas, coal and nuclear fuels), transportation (coal and gas) and waste disposal (for nuclear projects) across the lifetime of the power plant; it is the ratio of life-cycle land area transformed by a typical power plant to its lifetime energy generation.

7.1 Coal Power Plants

Land requirement for a thermal power project depends upon many factors - unit size and number of units, type of coal (indigenous or imported), location (pit-head or coastal) etc. Besides there are site specific issues which determine the land requirements which include: -

- Coal storage capacity planned depending on the location of plant and certainty of coal receipts
- Mode of coal receipt rail or conveyor

- Water storage capacity planned depending on source of water and its availability
- Type of condenser cooling system

Coal power plants not only transform land around the power plant, but they also require land for mining coal and transportation of the extracted fuel from the mines to the plant location. Mining for coal, and thermal power generation are both land-intensive. A typical 5 X 800 MW plant, based upon indigenous coal requires about 2770 acres of land, whereas, a similar capacity thermal power plant dependent upon imported coal requires 1530 acres[30]. However, this does not include the area required for coal mining, some of which can be made productive again after the mining activity is completed.

As estimated by the Niti Aayog under the various India Energy Security Scenarios (IESS), India would cumulatively produce between 25,750 and 44,350 million tonnes of coal between 2013 and 2047, requiring 309 to 1460 square km of land. Given that India's total land area is about 3.3 million square km, the total land requirement for coal production and coal-based power generation shall amount to 0.056% - 1.7% of India's total land area.

7.2 Solar Photovoltaic Plants

A typical solar PV project requires land in the range of 3.5 – 7.5 acres per MW. This depends upon module technologies (crystalline and thin film), terrain (flat/ undulated/ plateau), latitude (nearness to equator), use of tracking systems (require more land but leads to higher generation) and the design of the field (ideally rectangular). The land requirement depending upon the technologies / efficiencies of cell fall in the range of 3 to 9 acres per MW[31], as indicated in Table 14.

Table 14: Land Intensity of Solar Technologies

Cell Type	Efficiency of Cell	Land per MW (Acres)
Mono Crystalline Silicon	18-24%	3-4
Poly Crystalline Silicon	14-18%	4-5
Thin Film	6-14%	7.5-9

[30] Review of land requirement for Thermal Power Stations, CEA, September 2010

[31] IREDA note on land use by solar technologies

An analysis by the Centre for Science and Environment shows a large variation in land intensity of projects using different types of solar technologies between the actual land requirements and the figures considered by CERC in its tariff calculations; it varies from 1.4 to 5.34 hectares per MW, refer Table 15[32].

Table 15: Comparison of Land Intensity of Solar Projects

Cell Type	**Land Requirements taken by CERC**	**Actual Land Requirements**
	Acres per MW	Acres per MW
Mono Crystalline Silicon	5.4	3.4-4.9
Poly Crystalline Silicon	5.4	5.9
Amorphous-Silicon	7.9	13.1

Under the schemes launched by MNRE/ SECI, investors are required to provide details of the land as a pre-requisite at the time of application. The minimum requirement as per these schemes is 1.5 hectares per MW, which has not been revised since last five years[33]. However, the power capacity of a module (Wp/ sqm, using the same area) has increased tremendously over this period, from 280 Wp to 335 Wp[34], depicting an increase of over 25%. Further, there has also been no change in land intensity of solar technology based projects as considered by CERC in its tariff determination orders[35]. A comparison chart is provided in Table 16.

Table 16: Comparison of Module Capacity and Land Requirements

Year	**Poly-crystalline Module Capacity Area of 2 sqm[36]**	**SECI Land Hectare/MW *(Min)***	**CERC Acre/ MW**
2017	340 Wp	1.5	5
2016	310 Wp	1.5	5
2015	290 Wp	1.5	5
2014	270 Wp	1.5	5

[32] Facing the Sun, Centre for Science and Environment, 2012

[33] SECI Schemes under NSM

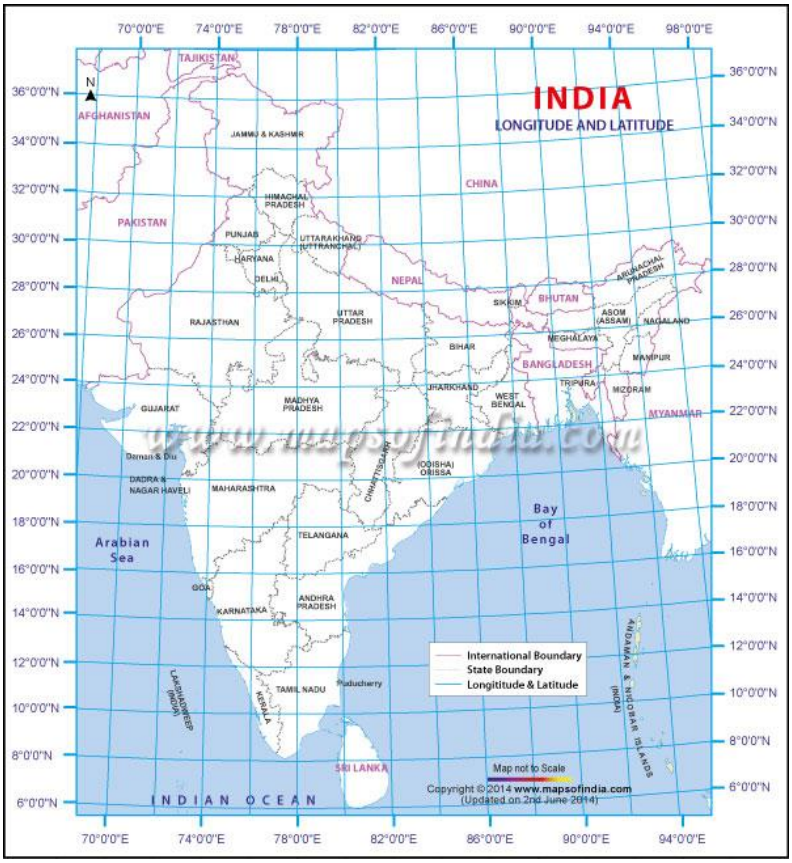
[34] Portals of leading solar module manufacturers

[35] Review of [35] CERC Tariff Orders on Solar Energy Technologies

[36] Referred from a leading module manufacturer

Another important aspect is latitude, which determines the spacing required between two rows of modules; higher the latitude, more is the spacing requirement.

Figure 10: Latitude Map of India[37]



The latitude of India varies vastly from 10 degrees N in northern states to 35 degrees N at the southern tip of the Peninsular India, which may require different quantum of land based on the project location; refer Figure 10. However, the investors are required to prove possession of land of a certain minimum size irrespective of the location. These factors highlight the need for rationalizing the use of land based on technology and location.

Solar Potential on Wasteland

As per a study conducted by the National Institute of Solar Energy (NISE), the total

[37] Maps of India Portal

solar potential in the country has been estimated as 750 GW[38]. The calculation has been made taking data from Census 2011 considering the Indian Waste Land Atlas 2010, developed by the Ministry of Rural Development, Government of India. The state wise solar potential is provided in Table 17.

Table 17: State Wise Solar Power Potential

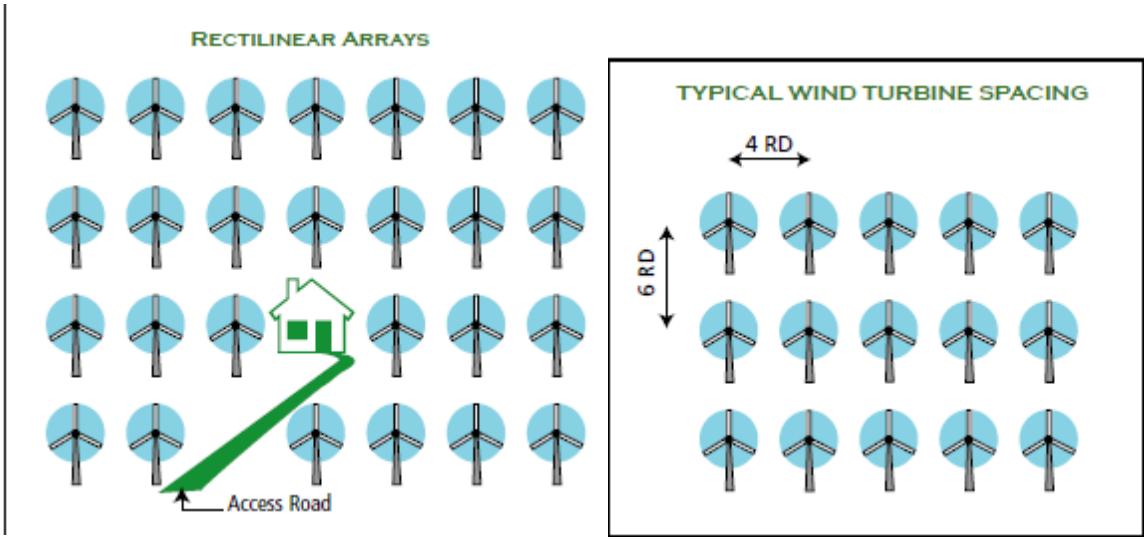
Sl No	States	Potential (GW)
1	Rajasthan	142
2	Jammu & Kashmir	110
3	Madhya Pradesh	60
4	Maharashtra	60
5	Gujarat	36
6	Other States	340
	TOTAL	748

7.3 Wind Energy Projects

Wind projects are land intensive and the requirement depends upon the wind speed in the region, turbine technology and land topography (terrain). The actual use of land is much smaller because each wind turbine is kept at a certain distance from the adjacent turbine. This spacing allows each turbine to capture the wind in the most optimum manner. Some land is required for service roads and for the foundations upon which the wind turbines stand. On a flat terrain, wind turbines are placed in rectangular arrays. Wind-farm designers specify the distance between wind turbines in rotor diameters. Initially, the investors purchased large contiguous land and installed wind energy generators, WEGs, with a separating distance of 5D x 7D, or, 3D X 5D, where D is the diameter of the turbine; schematic portrayed as Figure 11. This was associated with a land intensity of 7-17 MW per Ha.

[38] State wise Estimated Solar Power Potential in the Country

Figure 11: Wind Farm Outlay[39]



Due to scarcity of land in good wind regime areas and increasing cost of land, project developers have started procuring land on a turbine footprint basis, which includes approach road, transmission lines, sub-station and space for maintenance by crane. Currently, the commonly used 2-MW turbine model requires 100 X 100 square meters of land (equivalent to 1 hectare, or 2.47 acres). After taking into account area required for approach road and evacuation infrastructure, the effective land requirement is in the range of 1.25 - 1.5 hectares per MW.

Most wind power projects are implemented in large wind power estates developed by Manufacturer-Cum-Developers, who offer turnkey solutions. The turbine manufacturers create land banks by acquiring land in locations having good wind velocity though some of the large Independent Power Producers (IPPs) have also started developing land banks by themselves. WEG manufacturers develop the complete infrastructure and obtain all the necessary clearance/permissions for developing the wind farm. On completion of the basic infrastructure, the manufacturer offers one or more turbines to prospective investors. After receipt of a firm order from investor, the foundation is constructed; turbines are dispatched to site, erected and commissioned within 3 to 6 months, based upon the capacity of the wind farm.

[39] For Illustration Purposes

As can be seen from Table 18, because of changes in turbine technology, the land area pee MW has been decreasing over the years, witnessing over 40% reduction during the last 5 years[40].

Table 18: Land Intensity of Wind Projects

Year	Capacity (MW)	Area per Turbine (Acres)	Land Intensity (Acres/ MW)
2016	3.0	3.0	1
2015	2.1	2.5	1.2
2014	2.0	2.5	1.25
2013	1.5	2.5	1.7

Wind Potential on Wasteland

The National Institute of Wind Energy (NIWE) has estimated the wind power potential of India at 100m height as 302 GW, considering 6 MW per square km. Within this potential, 153 GW can be developed using only wasteland areas, refer Table 19. The study has been performed with actual land availability and excludes roads, railways, protected areas, airports, areas with elevation more than 1500m and slope more than 20 degree.

Table 19: State Wise Wind Energy Potential

Sl No	States	Potential (GW)
1	Rajasthan	15
2	Tamil Nadu	11
3	Maharashtra	31
4	Gujarat	52
5	Andhra Pradesh	22
6	Karnataka	15
7	Others	7
	TOTAL	153

[40] As indicated by wind project developers

8.0 SOCIO-ECONOMIC IMPACTS

Large scale capacity addition targets envisaged for the solar and wind energy sectors would invariably require large tracts of land, which is a scarce natural resource with competing demands. In a land constraint country like India, with a high density of population, procuring large quantity of land may pose significant challenges, including conflict with the communities residing close to projects. There is also a related impact on use of agriculture land (both mono-crop and multi-crop), for setting up solar and wind energy projects, which may create socio-economic issues both at the macro level (food security) as well as at the micro level (livelihood)[41].

8.1 Benefits and Challenges

The key social and economic benefits associated with setting up of renewable energy projects include job creation, development of local infrastructure, provision of energy access, street lighting systems, skill development of youth, water and sanitation facilities besides payment of financial compensation/ lease rentals to the land owners. Employment generation is in terms of both direct and indirect jobs like labour work, security staff, panel cleaning, transportation vehicles and drivers, project maintenance and lodging and boarding facilities[42].

The setting up of a solar / wind project invariably leads to development of road infrastructure in the vicinity of the project location, leading to heighted movement of traffic and prosperity of the local community. As the project is of long term nature (20/ 25 years), project developers develop amicable relations with the local community providing them sops in form of facilitate drinking water units and health camps for the local community. An indirect benefit is the use of hotels by the people working on the projects, which supplements the income of local people.

As with any infrastructure project, solar and wind projects too have some impacts upon the local community and their economy; these include-

[41] Resettlement Policy Framework - Solar PV Park, MNRE, December 2015

[42] Developmental Impacts and Sustainable Governance Aspects of Renewable Energy Projects, MNRE, September 2013

- Opportunity cost to villagers due to land diversion and inadequacy of compensation offered; it is high if the diverted land has good productivity
- Livelihood impact on land owners as well as non-title holders like tenants, landless labourers and contract cultivators
- Accessibility and in some cases, reduction in availability of common property resources at the site for the local population like water
- Relocation of built up structures
- Ecological impacts like soil erosion, tree cover loss and natural habitat loss.

8.2 Regulations

Wind and Solar Photovoltaic Power Projects are not covered under the ambit of EIA Notification, 2006 (as per MoEFCC) and no environment clearance is required for such projects under the provisions thereof. Further, they have been categorized under 'White Category' of industries, and exempted from obtaining the 'Consent to Operate' from the concerned state pollution control board (SPCB).

It has been noted that due to the conditions put in by some of the international funding agencies supporting the Indian RE sector, the beneficiary agencies/ investors have undertaken ESIA assessment of the projects being funded/ developed by them.

The Performance Standard 5 of the International Finance Corporation (IFC) talks about 'Land Acquisition and Involuntary Resettlement' with the following objectives:

- Avoid or minimize involuntary resettlement whenever feasible by exploring alternative project designs.
- Mitigate adverse social and economic impacts by providing compensation for loss of assets at replacement cost and ensuring that resettlement activities are implemented with appropriate disclosure of information, consultation and informed participation of those affected.
- Improve or at least restore livelihoods and living standards of displaced persons.

- Improve living conditions among displaced persons through provision of adequate housing with security of tenure at resettlement sites.

8.3 Analysis of ESIA Reports

Perusal of Environmental and Social Impact Assessment (ESIA) reports of solar parks available on public domain indicated the key reason for sale of land as non-remunerative returns from agriculture. These reports highlighted the scepticism of non-title holders about the loss of their livelihoods. The expectations of the local community included employment creation and provision of power supply. They felt about the potential increase in land prices and improvement in their welfare conditions[43]. A study by TERI on the Charanka Solar Park located in Gujarat highlighted limited agricultural activity as the reason for sale of land.

With regard to the Madhya Pradesh Rewa Solar Park, the ESIA report highlighted the fact that only barren and less agricultural land was identified for acquisition purposes. The owners intended to use the compensation towards purchase of land/ property, construction/ repair of house, conducting marriage, investing in business and for paying-off their debts. The locals expected the project to generate employment (in project related activities) based on skill development, provision of infrastructure, roads health facilities and subsidised electricity, advisory on improvement in agricultural practices. They also felt indirect benefit in terms of increase in land prices. The local officials suggested introduction of smokeless chulhas for schools for preparation of mid-day meals and installing biogas plants as the local population own livestock. Compensation has been worked out based on the prevailing market value (known as the Collector Guideline Rate) plus one-time solatium. However, the land owners were not aware of what the existing market rates are, or if the Collectorate rates are higher or lower in comparison to market rates. Some of the studies have propounded sharing of benefits with the local community in form of a certain percentage of the total revenue, say 1-3 paisa per unit of electricity generated from the project. The solar park guidelines also call for setting-up of local area development fund (LADF) with contribution from the project investors,

[43] ESIA Reports of Pavagadda and REWA Solar Parks being developed by SECI

equivalent to 1% of the total investment. It also asks for facilitating training facilities for development of entrepreneurship bodies technical and professional skill enhancement for employment of local people in the projects.

A review of ESIA report of a 194 MW wind farm project located in Andhra Pradesh showed that land being used was a single-crop rainfed land. The landowners sold their land willingly using the compensation for purchasing agricultural land in nearby areas besides repaying their debts and supporting education of their kids.

8.4 Employment Generation Prospects

With regard to employment creation, the job requirement in a typical solar and wind project tapers steeply when the project moves from the implementation to the commissioning phase. A report by CEEW indicated that a 20 MW solar project located in Rajasthan created 17.5 full time equivalent (FTE) jobs for skilled personnel and 118 FTE jobs for unskilled labour during the first year of project operation. This figure tapered to 37 FTE jobs (both skilled and unskilled, on an annual basis) post-commissioning of the project[44].

Similarly, assessment of a 85 MW wind project in Maharashtra showed that it created 438 FTE jobs during the first year of operation, with 102.5 FTE jobs created per year post-commissioning for the entire lifespan of project[45]. The nature of jobs included 15% for skilled personnel, 61% for semiskilled and 23% for unskilled people.

An ESIA report of a 50MW solar project described creation of 8-10 technical jobs and 25-40 unskilled/semi-skilled jobs like cleaning, housekeeping, cooks, drivers and security personnel[46].

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[44] Solar Power Jobs: Exploring the Employment Potential in India's Grid-Connected Solar Market, CEEW, August 2014

[45] Creating Green Jobs: Employment Generation from Wind Energy in India, CEEW, August 2014

[46] Social Due Diligence Report of a 50 MW Solar Project, accessed on Portal of IIFCL

8.5 Corporate Social Responsibility

The Corporate Social Responsibility (CSR) programmes of few leading IPPs were reviewed[47]. It was observed that many of them are undertaking CSR activities in the areas/ villages adjoining their projects. The activities included construction of sanitation facilities, training on use of solar powered systems, health camps, potable water supply systems, awareness on drip irrigation, water recharging and harvesting structures and plantation drives. Besides, some companies have been undertaking skill development programs for local youth and augmenting the school infrastructure like drinking water and computer systems.

[47] As available on the portals of few leading IPPs

9.0 Challenges

9.1 Lack of Land Utilization Policy

As land is constitutionally placed in the state list, its conservation and management is the responsibility of the respective state governments. However, most states are yet to come out with a comprehensive state level 'Land Utilization Policy' to balance the land requirements of different sectors in a prudential manner. Similarly, the Department of Land Resources, Ministry of Rural Development, Government of India is yet to finalize the 'National Land Utilisation Policy'.

9.2 Poorly Maintained Land Records

There is a lack of authenticity and documentation in land revenue records in many states due to irregular land use surveys leading to incongruities of land records with the ground realities. The maximum time in the overall land procurement process is required at the level of Patwari, whose job includes examining/ reconciling records to ascertain the availability and applicability of the land and physically demarcating the land in presence of project developer and land owners; this process is called Pathadgarhi. It takes several weeks, and sometimes months, to finalize the exact land coordinates and identify the rightful owners to undertake commercial negotiations. Even though many states have initiated digitization of their land records, the same needs to be expedited.

9.3 Preference for Land Procurement

Most of the project developers favoured purchase of private land over taking revenue land on lease due to efforts in securing the approvals from several agencies. This land, owned by the developer, creates a long-term appreciable asset, which may be re-deployed after the lifetime of the project. The purchase of land from private entities does not require multiple approvals as is the case of revenue land. Further, there is a clarity in terms of ownership title of the land enabling mortgage creation, as is preferred by the banks and financial institutions.

9.4 Land Ceiling Limits

There are restrictions under the Land Ceiling Acts as legislated by the state governments, with certain upper limits. Due to increasing ticket size of projects,

spanning over several hundred acres, it poses a challenge for the investors to procure land under names of different companies. Though some states have provided relaxation in 'Land Ceiling Act' to accommodate projects of larger capacity, the same needs to be undertaken by other states to streamline the process. Moreover, as the land is owned by several individuals, help of local land aggregators who have the ability to convince the land owners to sell their land, is also required.

9.5 Concentration of Revenue Wasteland

There has been a concentration of revenue wasteland in a few states like Rajasthan, Madhya Pradesh and Gujarat, thereby, leading to unequitable distribution of projects in these regions. A related issue is the time taken for creation of mortgage in case of lease land, which needs to be reduced/ streamlined. In many states, permission is required from the local panchayat for setting up projects, which further increases the effort on the part of developers.

9.6 Technological and Local Parameters

Locations within India have varying levels of insolation as well as latitude angles. One factor determining the size of the solar field is the latitude of the site, which leads to varying degree of module inclination and spacing within them. The latitude increases as we move away from the equator towards north. Chennai has latitude of 13 degree as compared to 29 degrees in case of Delhi. As such, more land is required in the northern part of the country on per MW basis, other parameters remaining constant.

Besides the location, land requirement also depends upon the terrain of the land (topography) and the shape of the solar field. A square shape plot is ideal for planning and setting up a solar project and requires the minimum land requirement. Availability of contiguous land would help in better designing of project over distantly located land parcels for a large size project. Similarly, a flat surface would require lesser space than an undulated land.

In many of the schemes, projects are allotted on AC capacity (Inverter rating in MVA) without any cap on DC capacity (nameplate capacity of modules in kWp). As such, project developers put up higher capacity of solar modules as the inverter can absorb

all the power generated after accounting for cable losses. This also leads to increased land requirement by the project. Bridge to India, in its analysis of utility scale solar tenders in India, has indicated the DC:AC ratio of 1.15[48].

Another important aspect in determining the land area for the project is the efficiency of solar modules. There has been a rapid enhancement in efficiency of solar modules and the current efficiency levels of the commonly used poly-crystalline modules has surpassed the 16% mark from the 14% efficiency levels available a few years back.[49].

9.7 Use of Fertile Land

Prime agricultural land is fast disappearing, mostly for use by industrial projects. It has been reported that India's cultivable land area shrank by about 400,000 hectares to 182 million hectares in the three years to March 2011, with the states of Punjab, Haryana and Uttar Pradesh (known as nation's granaries), reporting the biggest declines.

Developers prefer fertile areas near urban centers over distant arid locations for market as well as availability of transmission grids. The farther projects are located from urban areas, the higher the costs to build transmission lines to the grid and the more power is lost in transmission. Most of the states have done away with restrictions on use of agriculture land for setting up wind and solar projects. Land cost being a small proportion of the total project cost, between 2-5%, the investors are inclined to procure the land. Further, purchase of land from private entities does not require multiple approvals as is the case of revenue land.

The willingness of farmers to sell their farms encourages the project developers to acquire fertile arable land. Agriculture as a sector is supporting over 60% of the Indian population, but its share in the country's GDP is only 15%. Farming as a livelihood is facing numerous challenges on account of droughts, floods as well as

[48] Analysis of utility scale solar tenders in India, Bridge to India, March 2017

[49] Photovoltaics Report, Fraunhofer Institute for Solar Energy Systems, ISE, July 2017

market imperfections. This makes it easier for the developers to purchase fertile land from the farmers, thereby, impacting the food security of the nation in the long run.

9.8 Limited Employment Potential

Though wind and solar energy projects create employment for the local community, it is mostly of unskilled nature like security personnel, transport drivers and module cleaners. Moreover, the jobs tapers down steeply, from the project commissioning phase to the O&M phase. This has been discussed in detail in Chapter-8 covering Socio-economic Impacts.

10.0 BEST PRACTICES

National

10.1 Land Procurement and Allotment

The land procurement procedure can be streamlined by providing relevant information with regard to land availability for setting up solar and wind projects as well as minimizing the number of approvals required.

RREC (Rajasthan Renewable Energy Corporation), has provided a district-wise list of villages where revenue land is available for setting up solar PV projects. This data has been obtained from the district collectors. RREC facilitates allotment of revenue land by recommending it to the concerned District Collector. The developers are further permitted to sub-lease the land. The state government of Rajasthan permits solar and wind energy project developers to purchase agriculture land directly from the owner (Khatedar) in excess of ceiling limits in accordance with the provision of Rajasthan Imposition of Ceiling on Agriculture Holding Act 1973.

In case of land owned by the revenue department or any other state government department, the New & Renewable Energy Department of Madhya Pradesh takes possession of land and gives permission for its use to the developer. The Madhya Pradesh Trade & Investment Facilitation Corporation Limited has also initiated an online land booking facility for certain category of industries including for the solar sector[50]. The portal provides details of land parcels available across different districts of the state.

With regard to acquiring land from private land owners, the state government has come out with the Madhya Pradesh's Consent of Land Purchase Policy. Under this Policy, the state government agencies acquire land after obtaining consent of all the land owners, paying them as per the prevailing 'Collector Guideline Rates'. The Policy also has the provision to re-design the project in case of refusal of landowners to provide their consent.

[50] http://www.invest.mp.gov.in/

Under the Karnataka Solar Policy, the concerned SNA (Karnataka Renewable Energy Development Limited, KREDL) is required to identify land banks in each district with help of Collectors, which may be used for setting up solar projects. The Policy also provides for creation of private land banks for development of solar projects on a long-term lease basis.

With regard to delegating of responsibility, Gujarat has empowered the district collectors to allocate land for solar and wind projects. Similarly, Karnataka has vested district collectors (DC) with powers to approve purchase of agricultural land for development of solar projects. The state government has issued necessary amendments enhancing the land ceiling limits for solar projects to 108 acres against the earlier limit of 55 acres.

Under the 'Land Allotment Policy', the government of Andhra Pradesh has made provision to allot revenue land for solar and wind energy projects. The possession of revenue land including pathways is provided by the District Collector in advance to the wind project developers to facilitate faster execution of projects.

10.2 Land Use Change and Environmental Approvals

Under the Karnataka Land Reforms (Amendment) Act, 2015, the occupant of any agriculture land can divert such land for the purpose of setting up of solar power generation and the permission applied for conversion of such land shall be deemed to have been granted. Further, the project developers are allowed to start project execution without waiting for a formal approval on filing application for conversion of agricultural land.

The government of Andhra Pradesh provides deemed 'Non-Agricultural' (NA) status for solar and wind energy projects, obviating the need for a specific approval. In case of Punjab, agricultural land is allowed for setting up of Renewable Energy Power Projects in the state. The state government has also exempted payment of fee and stamp duty for registration and lease deed charges for the land required for the project. Under the Madhya Pradesh Solar Power Policy, an exemption of 50% on

stamp duty is available to project developers towards purchase of private land for their project

In Rajasthan, private land owner is permitted to set up solar power project on his holding or to sub-let his holding for setting up of such projects without the requirement of land conversion in accordance within the provisions of Rajasthan Tenancy Act 1955 and Rajasthan Land Revenue Act 1956. The Tehsildar as well as the SNA needs to be informed, with no requirement for land use conversion.

The Ministry of Environment, Forests and Climate Change (MoEFCC) has placed solar photovoltaic and wind power projects under 'White Category' of industries, under they are not required to obtain 'Consent to Operate' (CTO) from the respective state pollution control board (SPCB / PCC) and an intimation to them would suffice. Necessary directions in this regard have been issued by CPCB to the SPCBs and PCCs for compliance.

Indian regulations do not stipulate conducting of 'Environmental and Social Impact Assessment' (ESIA) for solar photovoltaic and wind energy projects (irrespective of their capacity). However, international funding agencies (like World Bank, IFC, KfW, JICA) require ESIA reports before committing their funding support. These assessment reports[51], aid in screening, assessment and management of environmental and social impacts at an early stage in project planning.

10.3 Single Office Facility

The government of Andhra Pradesh has started a single window clearance facility for solar and wind power projects. Under this mechanism, investors get all the approvals by uploading necessary documents using the portal. Relevant application formats are also available, and the work process is explained with the help of flowcharts. Similarly, the government of Punjab has set up 'Punjab Bureau of Investment

[51] ESIA reports of a few solar and wind projects, as available on public domain, were reviewed

Promotion' which is vested with regulatory powers to provide approvals for setting up industries including solar in the state of Punjab[52].

The government of Madhya Pradesh provides for a time bound clearance from the concerned agencies - revenue department for land procurement, SNA for project allotment and transmission utility for power evacuation; the requests for these approvals are filled simultaneously, thereby saving considerable time.

10.4 Setting Land and Project Capacity Limits

In Andhra Pradesh, land is allocated on footprint basis for setting up wind project at a rate of one hectare per MW. In Madhya Pradesh, the government land is provided for establishing aero-generator on footprint basis which includes approach road, transmission lines, substation and other affiliated uses.

For solar project, the respective land limits in Rajasthan and Madhya Pradesh are 2.5 hectares and 3 hectares per MW respectively. The government of Karnataka has restricted the solar capacity per taluk to 200 MW (excluding rooftop projects) to ensure that the projects are spread evenly across the state.

10.5 Using Brown-Field and Under-Developed Sites

It has been estimated that over 2000 MW of vintage wind projects using lower capacity turbines were setup before the year 2000 in areas experiencing high wind velocity. These wind farms can be suitably repowered to put up larger turbines upto 3 times capacity using the same land area. MNRE has also come out with a wind repowering policy to promote such projects. This shall enable use of existing land allocated to wind projects for putting up additional wind capacity and obviate use of procuring new land.

Under the Gujarat and the Madhya Pradesh wind energy policies, the SNA can forfeit bank guarantee in case of delay in project commissioning. Karnataka has recently

[52] http://investpunjab.gov.in/

cancelled land allocated to wind energy companies who have failed to set up projects within the stipulated time. The cancellation impacted over 5000 MW wind capacity[53].

In Andhra Pradesh, revenue land is allotted jointly in the name of developer and the SNA, NREDCAP. The land is leased in the name of developer upon commissioning of project. However, in case of delay in execution, the government takes back the land for re-allotment to other companies.

10.6 International Best Practices

United States

The Bureau of Land Management offers renewable energy developers right-of-way authorizations laying out rental payments and fees tied to electric generating capacity[54]. Under the standard right-of-way grant, the Bureau explicitly reserves the right to change per-acre rents annually and the capacity-factor fee at any time to ensure a fair return to the U.S. taxpayers who own the land.

The projects developers are encouraged to bid on government-selected tracts with gusty winds and intense sunlight pre-cleared of major environmental conflicts. Under the proposed rule, companies are encouraged to vie for territory in U.S.-designated renewable energy zones, with the end result being formal leases that could lock in some terms for at least 10 years and provide more developer protections. The Bureau has established 18 other designated leasing zones for solar power.

European Nations

In most of the European countries, the landowner leases their land to project developers for installing the wind turbines and gets in return a rent in range of $1,250-5,000 per turbine besides royalty equivalent to 2-6% of gross revenues.
In countries like Germany, Denmark, and the Netherlands, many wind and solar projects are owned jointly by the landowners themselves along with the developers; landowner may not own the wind turbines in their entirety but may own an equity

[53] KREDL Website

[54] Solar Energy Zones, Bureau of Land Management (BLM), The United States

interest shareholder[55]. They receive a royalty for land rent plus a percentage of returns from the business.

[55] http://www.communitypower.eu/en/

11.0 PROJECTIONS OF LAND REQUIREMENTS

11.1 Base Case

In the base case, land requirements for setting up solar PV projects and wind projects have been considered to be 5 acres per MW and 3 acres per MW respectively, similar to the existing usage trends. With 50 GW of solar and 30 GW of wind expected to be commissioned up by the year 2022, the total land requirements would come to be 3,40,000 acres. Refer Table 20.

Table 20: Land Requirements-Base Case

Sector	Year 1	Year 2	Year 3	Year 4	Year 5	Total ('000 Acres)
(A) Solar PV	8	9	10	11	12	50
Acre/MW	5	5	5	5	5	
Total (A)	40	45	50	55	60	250
(B) Wind	4	5	6	7	8	30
Acre/MW	3	3	3	3	3	
Total (B)	12	15	18	21	24	90
TOTAL						340

11.2 Scenario - I

In this case, the watt peak capacity per solar photovoltaic module has been assumed to increase by 5% annually based on what has been experienced during the last 5 years, leading to reduction in area used per MW by 5% per year.

With regard to wind, due to increase in the hub-height and deployment of better technology turbines, the land requirement per MW is assumed to decrease by 5% annually.

Based on these projections, the total requirement of land gets reduced to about 3,00,000 acres. Refer Table 21.

Table 21: Land Requirements-Scenario I

Sector	Year 1	Year 2	Year 3	Year 4	Year 5	Total ('000 Acres)
(A) Solar PV	8	9	10	11	12	50
Acre/MW	5	4.75	4.51	4.28	4.07	
Total (A)	40	42.75	45.12	47.15	48.87	224
(B) Wind	4	5	6	7	8	30
Acre/MW	3	2.85	2.71	2.57	2.44	
Total (B)	12	14.25	16.24	18.00	19.55	80
TOTAL						304

11.3 Scenario - II

In this Scenario, over and above the assumption of Scenario-I, repowering and re-allocation of sites has been considered. Repowering of vintage wind sites leading to capacity addition of 1 GW per annum over the next five years has been taken into account.

MNRE as well as some of the state nodal agencies have been penalising developers who have been slow in project execution by way of cancelling their land allotment.

This Scenario considers re-allotment of sites to new project developers so as to expedite project implementation activity. It is expected to contribute a total of 5 GW in project capacity addition taking 1 GW addition per annum over the next five years, without requiring any new parcels of land for setting up wind projects. Based on these projections, the total requirement of land gets pruned to 2,77,000 acres.

Refer Table 22.

Table 22: Land Requirements-Scenario II

Sector	Year 1	Year 2	Year 3	Year 4	Year 5	Total ('000 Acres)
(A) Solar PV	8	9	10	11	12	50
Acre/MW	5	4.75	4.51	4.28	4.07	
Total (A)	40	42.75	45.12	47.15	48.87	224
(B) Wind	4	5	6	7	8	30
Effective	2	3	4	5	6	
Acre/MW	3	2.85	2.71	2.57	2.44	
Total (B)	6	8.55	10.84	12.85	14.64	53
TOTAL						277

11.4 Scenario - III

In this case, over and above the assumption of Scenarios I and II, promotion of hybrid systems and land neutral technologies has been considered. Co-locating solar projects within the existing wind farms identified for repowering, can save substantial land. Using a thumb rule of 20% solar capacity co-located within the wind farms, it is

expected to yield a total of 2 GW capacity during the period 2017-19 without any additional requirements of land.

Land neutral solar based projects set up on canal tops and floating on existing lakes and water reservoirs have been set up on pilot scale across several states and are improving their techno-commercial viability. Considering a 2 GW addition by these technologies during the period 2019-21 would obviate land required for setting up a similar size ground-mounted solar capacity. Based on these projections, the total requirement of land gets reduced to 2,58,000 acres. Refer Table 23.

Table 23: Land Requirements-Scenario III

Sector	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Total ('000 Acres)**
(A) Solar PV	8	9	10	11	12	50
Effective	8-1	9-1	10-1	11-1	12	
Acre/MW	5.00	4.75	4.51	4.28	4.07	
Total (A)	35	38	40.59	42.8	48.84	205
(B) Wind	2	3	4	5	6	30
Acre/MW	3	2.85	2.71	2.57	2.44	
Total (B)	6	8.55	10.84	12.85	14.64	53
TOTAL						258

It can be observed that the land requirement reduces by 25% in the Scenario-III over the Base Case.

12.0 RECOMMENDATIONS

The following interventions are suggested which may be taken into consideration to ensure expeditious procurement of land in a prudential manner with minimal impacts upon the local community. These are based upon assessment of relevant policies, project reports, field practices as well as the inputs shared by the sectoral stakeholders.

12.1 Policy

12.1.1 Developing Land Utilization Policy

As land is constitutionally placed in the state list, its conservation and management is to be taken care of by the respective state government. There are multiple claimants for land to utilize it for various purposes - Railways, Highways, Industrial Parks, Agro-processing Zones, IT Parks and SEZs, etc. As such, it becomes difficult to allot land without analysing the merits of each case.

This calls for a holistic policy on land utilization to be developed by each state government to balance the land requirements of different sectors in the most prudential and ecologically friendly manner. The land policy can map the existing use versus the intended use, based on parameters like employment generation potential, environmental sustainability, population density and change in land use. Each government department can present its land requirements, which needs to be assessed based on the overall benefits to the nation, the society and the local community. The State Land Board can play an important role in this exercise using information technology tools.

The State Nodal Agency, SNA, can share the Wind and Solar Atlas of the state with the Land Use Board to identify and earmark areas which can be used to set up solar and wind energy projects. These areas can then be offered under auctions to source green energy at lowest possible tariffs. There can be single window system for projects to get all approvals for setting up projects in the identified regions, similar to the system as followed in case of Solar Parks.

12.1.2 Digitization of Land Records

In most of the discussions, it came out that the maximum time required within the overall land procurement process is required at the level of Patwari, whose job includes examining and reconciling records to ascertain the availability of the land and physically demarcating the land in presence of the developer and land owners. It takes several weeks, and sometimes months, to finalize the exact land coordinates and identifying rightful owners to undertake commercial negotiations. In many cases, there are multiple owners of the same parcel of land. There is a lack of digitization of land records and inconsistency in updating them.

To expedite this procedure, digitization of land records is required in order to modernise the land record system. Under this programme, plot-wise details of ownership can be maintained in the computer database, to be periodically updated so that the owners as well as potential buyers can verify the ownership records. It is desirable for rationalisation, simplification and standardization of land records. The State Land Board can digitize the land records and undertake GIS mapping of the entire land within their respective state.

12.1.3 Prioritizing use of Wasteland

India has over 63 million hectares, or 20% of its total land, classified as wasteland. The state governments, can identify waste / barren land and superimpose it on the Solar and Wind Atlas to earmark areas for setting up of solar and wind projects. Subsequently, these areas can be allotted to project developers under open auctions to generate clean power at the lowest possible rates.

The states of Rajasthan, Andhra Pradesh, Gujarat and Madhya Pradesh have large tracts of government owned wasteland which receive good solar insolation. Incidentally, these states have lower density of population, high levels of solar insolation, above 5.5 kWh/sq.m/ day, and sufficient availability of wasteland, which can be utilized for setting up projects. States lacking wasteland may be permitted to set up projects in these states having to meet their RPO. The Central Electricity Regulatory Commission (CERC) has exempted payment of inter-state transmission charges and losses by solar and wind projects using the inter-state transmission

system. An example is the agreement between the Delhi Metro Rail Corporation (DMRC) and Rewa Solar Park in Madhya Pradesh for purchase of solar power using the inter-state transmission system (ISTS).

To curb the use of fertile land for setting up projects, deemed land-use change approvals can be limited to wasteland and mono-crop land.

12.1.4 Model Land Lease Policy

From an economic and social perspective, getting annual land rentals is preferable over an upfront payment of compensation as it provides a regular source of income to the land owners, besides bestowing the option upon the owner to get back the land after the expiry of lease period. Leasing has recently gained traction in areas associated with high cost of land (like Punjab). It improves the project profitably as the expenditure incurred towards procurement of land decreases. To increase the acceptance of lease models, government can develop a 'Model Land Lease Policy' taking into consideration the concerns of the stakeholders - land owners, investors and financiers.

12.1.5 Time limits for Project Development

Project developers create land banks across different states and regions, which are then offered to solar and wind project developers for investment purposes. Many times, the developers are unable to commission the project within stipulated period. In this regard, the respective SNAs need to ensure that the project development takes place within the earmarked time and no new sites are allocated to these companies before the development of all previously allotted sites.

Appropriate penalty clauses along with the requirement to submit bank guarantees may be incorporated in the solar and wind policies. If the developers are unable to develop the sites, the sites can be offered to other companies or taken back by the government for other developmental works.

12.1.6 Using Brownfield Sites

In India, coal production is expected to double by the year 2020-25 and 85% coal production is using opencast mines which require ground breaking, causing immense land degradation. In order to balance the environmental effects of open mining, the mined-out land of the exhausted coal mines should be restored to its pre-mined condition.

As the mined land gets degraded this land can be suitably utilized for solar and wind power projects based on techno-commercial feasibility. This will lead to generation of clean power besides creating local employment. Incidentally, many of the mining lessees are large industries like cement, iron & steel companies and power generating utilities, who have the knowhow and capability of power generation. The above would require changes in the 'Mining Reclamation Policy' to permit use of land for putting up solar and wind energy projects.

12.2 Technology

12.2.1 Land Zonation Exercise

There should be a nationwide zonation study to assess the potential of different renewable energy resources. This can identify probable sites for project development considering parameters like RE potential of the region, latitude, ecological sensitivity, availability of transmission infrastructure, roads, type of land and alternate land use potential. Based on such an exercise, the suitable sites can be identified and made available for project development. The project can be allocated in terms of maximum energy generation per area, say kWh per sqm. This shall ensure use of best class technologies by project developers, innovative project designs and good maintenance practices.

12.2.2 Use of GIS Technology

There should be clearly defined policy and mandatory usage of Geographical Information System (GIS) for land use, land cover analysis and identification of wasteland for projects while mapping the renewable energy potential over different regions. The Government could take into consideration renewable energy resource availability as well as land and water availability. Government can set-up an

independent and representative regulatory authority at the state level to ensure strict compliance of land-use norms. Regulation could also be used not only to mitigate negative impacts and maximise opportunities, but also to strengthen property rights and greater community consultation. The use of wasteland for setting up renewable energy plants may further be incentivised to lessen the diversion of land from agriculture and forestry.

12.2.3 Setting up Wind-Solar Hybrid Projects

Most part of the Indian sub-continent is conducive for solar projects. As such, the spare land between the wind turbines can be optimally utilized for putting up solar modules, based on a thorough techno-commercial assessment. Studies have listed out economic reasons to house solar modules within a large wind park. This includes use of existing evacuation infrastructure and land mass, improvement in profile of energy generated and optimum utilization of resources for maintaining the project. Dual use of the land for wind and photovoltaic energies may increase the effective energy yield per square meter and lead to better use of scarce land resources.

There are plans to repower vintage wind farms with larger capacity turbines. These areas can be initially looked upon for putting up hybrid projects. It is estimated that the 3500 MW vintage wind capacity complemented by 10% penetration by solar would obviate the need to acquire over 20,000 acres of land. MNRE has come out with policies on repowering and hybrid projects and these needs to be effectively rolled out to attract the investors.

12.2.4 Promoting Land Neutral Technologies

Land neutral solar projects can be set up on spare rooftop space of buildings, offices and homes, parking lots, central verge along the highways, train tops, metro and railway stations, roofs of cold storage plants and warehouses, airports and bus terminals, canal tops and floating systems.

MNRE is supporting many initiatives to tap the potential of land neutral projects under different business models. Across the globe, most of the solar installations are on building rooftops. In three of the top five countries with respect to solar capacity

(Germany, US and Japan), the rooftop installations outnumber the land based utility scale solar projects. Within the 100 GW solar targets, 40 GW have been earmarked for rooftop based projects. Most of the states have come out with their rooftop policies to encourage such projects and the same needs to be promoted.

Canal-top projects provide another opportunity to harness solar energy under a land neutral mode. Canal based solar projects generate more power than land based projects due to cooling effect of water on the modules, resulting in lower temperatures and also help in saving water by reducing the level of evaporation. Even though these projects are associated with higher capital investments, they are commercially viable on a long-term basis, which further gets enhanced after monetizing the water savings.

As per a study undertaken by the Punjab government, a solar plant capacity of 0.16 MW can be put up on every kilometre of canal. Based on this estimation, a total of 10 GW of solar capacity can be added on top of canals[56]. Incidentally, the states having large network of canals like Uttar Pradesh and Punjab have a significant portion of their land used for agriculture purposes. As such, encouraging land neutral systems like canal tops can effectively reduce the use of fertile land by solar projects in these states. Another upcoming technology is floating modules, wherein solar modules are put up on water bodies like lakes and reservoirs and the same has been piloted in a few locations.

In order to encourage land neutral technologies, potential sites need to be identified along with few pilot projects to stimulate the interest of the developer community. Subsequently, necessary policy support structure needs to be developed and rolled out by the government to create a large-scale impact.

12.2.5 Adopting New Technologies

One mechanism to increase the generation from solar projects is the use of trackers, which allow photovoltaic panels to track the sun from sunrise to sunset. It has been

[56] Canal Top Projects review report, MNRE

observed that using single axis trackers, which rotate on one-axis from east to west traversing the daily movement of the sun, increases the power generation by upto 25% at an additional upfront cost of 10% and O&M of INR 2 lakhs per year. As such, the payback of installing tracker system is less than 4 years, leading to increase in project returns by about 3%. However, the project requires additional land area, 6 acres in comparison to 5 acres required by a MW of fixed-tilt project, and is more beneficial for higher altitude locations. Therefore, project developers setting up projects in high altitude locations may be encouraged to use tracking systems. Comparison may be made on kWh generated per sqm of land used.

12.3 Social

12.3.1 Undertaking Social Impact Assessment

With a large capacity of solar and wind projects expected to be commissioned in the coming years, large swatches of land would be required. This may impact the local community in terms of livelihood generation. In this regard, it would be beneficial to undertake 'Social Impact Assessment' which can aid in screening, assessment and management of social impacts at an early stage in project planning. They can be taken up on a voluntary basis for large size solar and wind projects, with a capacity of 100 MW and above, besides all the Solar Parks. The reports can delineate provisions for community development including livelihood planning and skill development.

12.3.2 Exploring Community Business Models

One of the important interventions can be to involve local community in project development. Most of the project developers intend to purchase land and have limited interests in the welfare of the local community beyond payment of compensation and undertaking CSR activities. Community wind and solar farms have come up in several European countries, notably Germany, Scotland and the Netherlands. Participation from local people in projects can be in form of equity participation, or subscription of shares in the project. This shall facilitate land procurement while benefitting the local community by way of higher and regular returns.

In India, land leasing model has been initiated in states of Punjab and Uttrakhand by solar project developers due to high cost of land. The contract enables regular rental

income to the land owners. Solar Park at Pavagadda in Karnataka has also initiated a similar model.

Another possible business model can be the 'Limited Liability Partnership' (LLP), where land-owners become stakeholders in the company to the extent of their land value contribution and get commensurate returns. Details about some of the proposed community business models have been provided in Annexure-IV.

ANNEXURE I: QUESTIONNAIRE

As part of consultation process, inputs were solicited from a number of stakeholders across the business spectrum – policy makers, state nodal agencies, project developers, independent power producers, financial institutions, equipment suppliers, EPC players, consultants and civil society organizations. Structured questionnaires were administered to each type of stakeholders, which was followed up with meetings.

The discussants included the representatives of the following companies/ agencies-

Government	Bank/ FI	IPP/OEM	EPC	Consultant	NGO	Association
Niti Aayog	PTC Financial Services	Azure	Jakson	Bridge to India	CSE	IWTMA
MNRE	SBI-Caps	Suzlon	Lahmeyer	IDAM	Prayas	INWEA
NIWE	World Bank	PTC	Ray's Power	EVI	C-STEP	SPDA
SECI	Yes Bank	Renew		Green Strategy	IWMI	RSA
NREDCAP	IREDA	Sembcorp		Wind Force		SCGJ
PEDA	Tata Cleantech Capital	Welspun		CPI		
KREDL	IFC	Regen				
RREC		Inox				

Questionnaire: Project Developers and Investors

1) What are the focus areas and the types of services provided by your company?
2) Is the company involved in both solar parks and non-solar park based projects?
3) What is the mechanism for land procurement (approvals, timelines, cost, etc.)?
4) What are the issues encountered in land procurement for projects?
5) What has been the best practices followed with regard to land procurement?

6) What have been the trends with respect to land prices?
7) What have been the socio-economic impacts of RE projects on the community?
8) What are your recommendations to facilitate land procurement?

Questionnaire: State Nodal Agency

1) Kindly elaborate on procedure for land allotment (both for private & revenue) to RE project developers in your state. This can include the different stages of approvals, respective timelines & charges and land ceiling limits (per MW).
2) Based on the RE capacity targets set for the state, is there sufficient waste land available for putting up wind and solar projects to avoid use of fertile/ agriculture land for RE projects.
3) How much land/ RE capacity has been allotted to project developers (like wind OEMs) by the SNA and what has been the rate of development? Are there penal provisions on developers for delay in project development?
4) What is the mode for land procurement by SNA in case of solar parks (like acquisition/ purchase / lease/ pooling)?
5) What is the type of support required from government departments - like MNRE, Land & Revenue, Rural Development and Environment & Forest?
6) What are the compensatory norms in case of acquisition / purchase/ lease of land (%DLC/circle rates)? Are there compensation norms for users of revenue land?
7) Please comment on mode of payment for land procurement – cash / cheque, upfront / annual payments. Is there any capacity development of land sellers (mostly farmers) to use the money prudentially?
8) What are the expected timelines, approvals and related charges with regard to land use conversion?
9) Are there any norms (area and compensation, based on voltage levels) for acquiring/ purchase of land for RoW purposes?
10) Please cite some of the best practices followed in your state with regard to land being allotted to RE project developers.

Questionnaire: Banks and Financial Institutions

1) Land procurement for solar and wind energy projects has been identified as a key bottleneck by investors as it takes a significant percentage of the total project implementation period. From a lender's perspective, what are the major issues involved in land procurement? Please also suggest possible remedial measures?
2) What kind of due-diligence is undertaken by banks/FIs with respect to land before making sanctions/ disbursements for solar/ wind projects? What is the time taken for the aforementioned activity? Kindly suggest possible measures to reduce this timeline.
3) Please indicate the type of land as preferred by lenders – private land or revenue land? What is the comfort level for lending in case of private land taken on lease by developers (example - private land lease for solar projects in Punjab)?
4) It has been observed that many RE projects are coming up on fertile land. Do the banks/ FIs have any policy to discourage projects on fertile agrarian land and encourage use of barren / wasteland?
5) Community owned solar/ wind projects are prevalent in many European nations. MNRE and few state governments have come out with farmer's solar schemes, soliciting participation of local land owners in RE projects. Kindly share the level of comfort in lending for such kind of projects?

ANNEXURE II: STAKEHOLDER WORKSHOP

A workshop was organized to share the key findings of the study with the stakeholders and undertake deliberations on the proposed recommendations. The session was inaugurated by the Secretary, MNRE with participation from Niti Aayog, SECI and TERI. Representatives from some of the leading IPPs, EPCs, Consultancy groups and Civil Society Organizations shared their opinion on the subject and suggested mechanisms to expedite land procurement.

The following were the major observations made during the Workshop-

- Land an economic good, all types of land have a certain use
- Competing needs of land by different sectors
- Systemic planning of land use considering all SDGs
- Project economics to include socio-environmental costs
- Selection can be on kwh per sqm basis
- Promote Land neutral technologies like BIPV, solar tree, canal tops, floating, off-shore wind and hybrid; use of cold & hot deserts, barren land
- Raised module structures to support crops beneath
- Capacity development of regulators, developers, financiers
- Undertake Social Impact Assessment studies
- Community skill development by local ITIs
- Land lease document can incorporate safeguards
- Use of GIS in conjunction with Land Atlas, record keeping


teri university
SHAKTI
SUSTAINABLE ENERGY FOUNDATION
Addressing Land Issues for Utility Scale RE Deployment in India:
Stakeholders Consultation Workshop
September 1, 2017
India International Centre, Lodhi Road, New Delhi


Anand Kumar


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India International Centre, Lodhi Road, New Delhi
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Praveen Saxena
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Avijit Lala

ANNEXURE III: SITE VISITS

To corroborate the realities at the ground level as shared by the stakeholders and opined in the perused reports, field visits were undertaken to a few wind farms, solar projects and solar parks.

During these field trips, discussions were held with the personnel of the projects involved in maintaining or implementing the project. Views of the local community members including farmers were also ascertained.

Solar Park – Anantpur, Andhra Pradesh

Solar PV Project - Bhatinda, Punjab

ANNEXURE IV: COMMUNITY BUSINESS MODELS

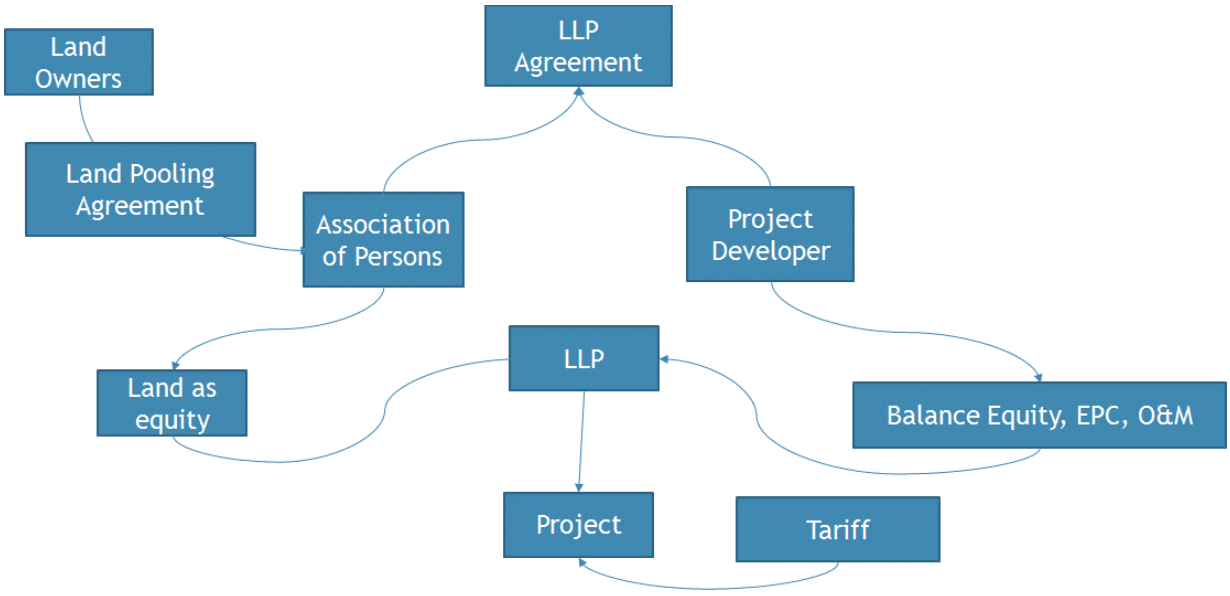
As the economy is expanding the electricity demand is going to grow further. Due to the renewable energy impetus, an increase in the development of wind and solar farms is expected in India. RE projects require land, which is a scarce resource. Since RE sector is growing fast, the land acquisition issues may rake up socio-economic conflicts.

To minimise the socio-economic impacts of RE projects due to land procurement, few community business models have been developed which are discussed below.

LLP Model

A Limited Liability Partnership (LLP) may be formed, where the land-owners become stakeholders in the LLP to the extent of their land value contribution. Refer Figure 12.

Figure 12: Schematic of LLP Business Model



The key aspects of the LLP model are as follows:

1) Landowners will be engaged in the business as equity shareholders. Value of equity shareholding will be corresponding to the value of land. Return on Equity therefore will be accordingly computed.
2) Capital value of land will be open to negotiation between the landowners and

the Project Developer. Landowners will get proportionate ownership and interest in the project. As per the prevailing regulatory norms the land value allowed is on an average 5-6% of the total project cost. A project is generally financed in 30:70 (Equity: Debt) ratio. The normative 5-6% allowed under the regulations, will form part of 30% of equity contribution and therefore will translate into 20% of equity in absolute terms. Project developer needs to deploy the balance equity.

3) EPC and O&M activities will be undertaken by the Project developer and would be duly compensated for the same. An Agreement will be executed between the landowners, represented as Association of Persons, and the Project Developer. Sufficient safe-guards will be incorporated in the Agreement to ensure time bound completion of the Project. The LLP Agreement would include indemnity clause to ensure that the land or its value is secured. In case of default, where the LLP is unable to service its debt and the LLP is taken over by a financial institution, the landowners will continue to have same returns and security as promised originally under the Agreement.

4) This model can be explored in Captive Generation Plants, by high demand consumers like industries and commercial establishments. In case there is no expertise, sub-contractors may be engaged for EPC and O&M activities.

END OF REPORT