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Socio-environmental De-Risking Instruments for Solar Power in India

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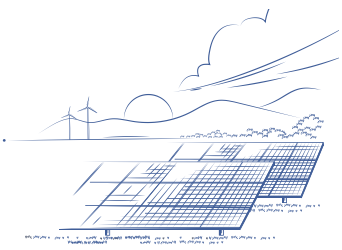

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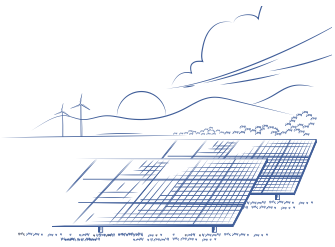


EXECUTIVE SUMMARY

India has an ambitious target of achieving 100 GW of solar-based electricity generation capacity by 2022. However, technical, financial, and socio-environmental risks hinder large-scale investment in solar energy in India. In order to reduce or eliminate the actual risks and risk perception of investors, India needs investment de-risking of its solar energy sector. The current project 'Multi-stakeholder Partnership on De-risking Investment in Solar Energy in India' aspires to contribute in two ways—(i) studying and mapping potential risks of investments in solar energy in India and (ii) suggesting recommendations to strengthen de-risking instruments for (foreign) investment in India's solar energy sector. This paper compiles findings from think tank analysis, publications, and common news stories, highlighting socio-economic and environmental challenges of solar power (investment).

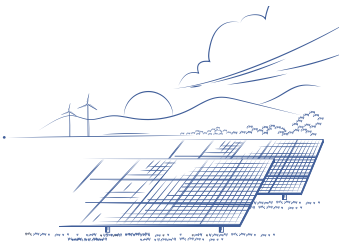
Solar energy has multifarious social, environmental, and economic benefits. The economic benefits include job creation and spin-off effect, which creates employment and revenues in other allied sectors. Despite having multiple positive effects, solar installations should be undertaken in a socially- and environmentally-viable manner. Large, centralized, and utility-scale installations of solar units should be taken up after analysing their potential complex impacts on the environment and social systems. A science-based assessment of social and ecological impacts of a solar project must be ensured considering proper opportunities for robust public involvement. It serves the sustainability of a solar project and hence, investment risks are reduced.

The present study identifies the following social and environmental investment risks of large-scale solar power plants:

Land issues: Solar power projects require large tracts of contiguous land. Thus, competing land requirement across sectors necessitates effective land-use planning and management. In India, land is closely associated with livelihood—as agriculture and allied activities and forests. To procure or lease a land, project developers need approval from concerned departments of the state government. It takes much time to acquire land for mega solar projects while project commissioning timelines are being shortened. The land-related complications result in investment risks. The complicated and delaying land acquisition processes mean uncertainty for investors that they might not be willing to cope with. The timeline as well as difficulties in the land acquisition process acts as a deterrent to potential investors, both domestic and overseas.

Rehabilitation and Resettlement (R&R): The solar project developer is responsible for providing compensation to displaced communities. The provisioning of alternative livelihood opportunities is involved, particularly if land acquisition takes place in tribal areas. The investors have to accept the circumstances and terms and conditions of R&R. And, the legal challenges in acquiring land and provisions of R&R may result in cost overrun for the investor. Overall, the uncertainties in R&R may be perceived as 'trouble' by investors and industries.

Livelihood implications: Land-use classification and establishment of solar power plants in 'wasteland' can have a bearing on the livelihood of local communities. Land-use change from agricultural to non-agricultural use by setting up of solar power plants could trigger farmers' distress and food security issues.



Water constraints: Though the water consumption level of solar power plants is fractional as that of coal, higher concentration of solar parks in water-scarce regions could pose a challenge. Water constraint is an important aspect that potential investors would want to assess and address before taking an investment decision. Though the solar power sector is water efficient as compared to the thermal power sector, risks associated with water is prevalent in drier regions of the country, which is a matter of concern for solar projects in arid and semi-arid regions.

Forest and biodiversity: In India, solar power projects need forest clearances, though environment impact assessment is not needed. As per the Ministry of Environment, Forest and Climate Change (MoEFCC) rules, a project developer has to identify a land contiguous to the forest land for compensatory afforestation in case the forest land is involved in a renewable energy project.

Against this background, the study identified the need for a social and environmental impact assessment (SEIA). The SEIA process could be useful in many different ways. Firstly, it could be useful in identifying potential problem areas before the onset of project processes. India has placed wind and solar photovoltaic (PV) projects under 'White Category' industries, which are exempted from the EIA process. Socio-economic impact assessment usually forms an integral part of the EIA process. By doing away with any assessment, the real cost of promoting solar power are waived off. Secondly, land acquisition, rehabilitation, and relocation of project-affected population could be benefited from the SEIA process as these potential challenges would be identified and would need to be addressed by the developers. Thirdly, the environmental and social assessment could be instrumental in bringing out better social and environmental outcomes by helping in better designing of projects, which could have bearing on the economic outcomes of a project. Examples rank from water availability assessments to fair relocation of communities. Lastly, the SEIA process could enable promoters to conduct public consultations, which could provide them awareness of the opportunities and challenges in commissioning and running the project. Moreover, most international financial institutions require social and environmental impact assessment studies for funding. There are sustainable finance investors who require environmental and social standards clearances to invest heavily in sustainable projects. Thus, well-designed projects with detailed information on environmental and social standards are needed to attract the attention of the investors.

The following are among the key suggested recommendations to tackle the social and environmental risks pertinent to investments (foreign) in large solar parks in India:

1. *Digitization and streamlining of land records:* The policy action is needed to modernize land records management, minimize scope of land/property disputes, enhance transparency in the land records maintenance system, and facilitate moving eventually towards guaranteed conclusive titles to immovable properties in the country.
2. *Land-use mapping:* A joint programme of the Ministry of New and Renewable Energy (MNRE), Ministry of Agriculture, and Ministry of Rural Development along with respective state departments could be conducted to map the land-use in the country.
3. A detailed capacity building programme for solar developers, renewable energy resource assessment officers, and state nodal officers is needed to utilize land-use maps—especially of wasteland. An atlas would identify potential vacant and encumbrance-free sites.

4. *Land zoning for industrial use could be conducted and facilitated by state governments:* State governments should consider identifying renewable energy zones (REZs) along the lines of special economic zones, which can be treated as preferential areas for installation of solar plants keeping in mind the environmental and social considerations.

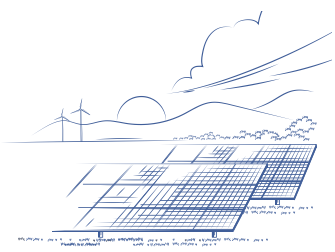
5. *Promoting decentralized agro solar through a public–private partnership (PPP) model on farmlands:* New business models need to be examined to promote agro solar that diversifies farmers' income sources.

6. Agro solar should be promoted in special schemes initiated by the government such as Kisan Urja Suraksha evam Utthaan Mahabhiyan (KUSUM) scheme to avoid conflict with land-based livelihood of farmers.

7. *Research is ongoing on the benefits of placing solar panels on raised structures:* Rresearch studies are underway to grow crops under solar panel placed on raised structures. It could make optimal use of agriculture land both for electricity and food production. The research could remove the trade-off between solar energy and farming, and could be beneficial to farmers who participate in schemes such as KUSUM.

8. State-specific policies aligning with the above national policy guidelines for identifying land parcels may be framed. The state policies could have similar contours as of the national policy.

9. The project developers should be encouraged to conduct both environmental and social impact assessment themselves, which enhances the confidence of investors and is a necessary step for the betterment of the project.



1. INTRODUCTION AND PROJECT BACKGROUND

India has an ambitious target of achieving 100 GW of solar-based electricity generation capacity by 2022. India has already achieved a total installed grid-connected solar capacity of 42.64 GW till July 2021 ,[1] which includes both ground-mounted and solar rooftop solar installations. The installation of solar photovoltaic (PV) in India has gained from dipping tariff of solar power. The solar tariff is determined by a competitive bidding process carried out by the Ministry of New and Renewable Energy (MNRE), Government of India. The tariff dropped to its lowest to ₹2.43 per kWh or $0.034 in December 2017[2] recovering marginally to ₹2.50 in the latest reverse auctioning process of June 2019. The factors including economies of scale, assured availability of land, and power evacuation system contributed in the price drop.

Numerous technical, financial, and socio-environmental risks and other barriers such as quality of solar technology, lack of technical know-how, and problems with network quality hinder large-scale investment in solar energy in India. In order to reduce or eliminate the risk perception of investors, India needs investment de-risking of its solar energy sector. The current project 'Multi-stakeholder Partnership on De-risking Investment in Solar Energy in India' aspires to contribute in two ways—(i) studying and mapping potential risks of investment in solar energy in India and (ii) formulating recommendations to strengthen de-risking instruments for (foreign) investment in India's solar energy sector. The 'multi-stakeholder partnership' approach envisages synergy between political decision makers, private sector, researchers, and civil society in the country. The partnership is extended to actors in Germany with an aim for German investment in solar energy in India.

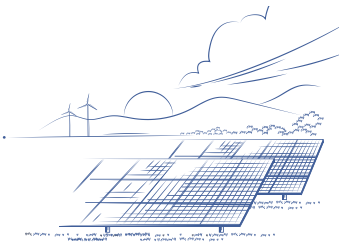
Since this policy brief intends to facilitate wider discussion among the stakeholders (CSO, government, investors, think tanks, etc.), it is to highlight some of the basic policy, regulatory, and implementation gaps that has led to slower growth of the solar industry (utility and rooftop), in order to eventually suggest policy recommendations for de-risking measures. This paper compiles findings from think tank analysis, publications, and common news stories, highlighting socio-economic and environmental challenges that solar power growth brings in.

1. Social and Environmental Investment Risks of Large-scale Solar Power Plants

India has enormous solar potential and its accordingly set ambitious solar targets need large investments. In order to attract potential (foreign) investments for solar power capacity addition and development of the solar sector, the country needs to overcome various constraints in the current policy and regulatory

1 Installed capacity of solar power in India. Details available at https://mnre.gov.in/the-ministry/physical-progress; last accessed on July 12, 2021

2 Tariff for grid-connected solar power. Details available at https://pib.gov.in/Pressreleaseshare.aspx?PRID=1555373; last accessed on July 12, 2021



environment. These can be classified as, among others, financial, political, technical, and legal investment risks. Thus, this paper focuses on identifying the social and environmental investment risks that are seen from the perspective of civil society and solar plants developers in order to conclude with recommendations on the social and environmental impact assessments and other relevant policies for de-risking foreign investment.

Solar energy is a promising alternative to fossil fuel-based energy. It holds the potential of reducing tremendous greenhouse gas emissions, air pollution, impacts on watersheds, and transportation of energy resources, resulting in climate change mitigation. It has several positive social implications including local employment, better health, technological advancement, among others. Consequently, it improves quality of life. The economic benefits include job creation and spin-off effect which creates employment and revenues in other sectors also.[3] Despite having multiple positive effects, solar installations should be undertaken in a socially- and environmentally-viable manner. Large, centralized, and utility-scale installations of solar units should be taken up after analysing their potential complex impacts on the environment and social systems. The following are some of the direct and indirect impacts of a solar project on society and environment:[4]

» The opportunity cost of land procured from villagers is high if it is a productive farmland. In most cases, the compensation received for land acquisition is inadequate.

» Land acquisition impacts the livelihood of not only land owners but also non-title holders such as tenants, landless labourers, and contract cultivators.

» Loss of accessibility of common property resources such as pastoral land due to partial/complete closure of the site for local population.

» Relocation of built-up structures.

» Ecological impacts including soil erosion, water scarcity, loss of canopy cover, and loss of natural habitation. Decrease in soil health is of particular importance in connection to climate change as the soil's capacity to hold moisture is reduced. It is due to loss of organic matter as a direct consequence of loss of tree and grass cover.

The PV panels consist of hazardous materials such as polymers, lead, and cadmium compounds, which need treatment before disposal to avoid negative environmental and health impacts, especially in case of large-scale infrastructure development. Also, it has been emphasized in a recent report that with growing capacity of solar installations, adequate attention on module recycling is not given. In other words, due to absence of a policy to deal with solar waste, it is either incinerated or land filled, which poses considerable environmental risks.[5] Thus, technological improvement is required to tackle the solar PV panels' waste that is estimated to grow to 200,000 tonnes by 2030 and around 1.8 million tonnes by 2050.

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3 Details available at http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.461.4230&rep=rep1&type=pdf; last accessed on February 23, 2021

4 Hernandez, R R, S B Easter, F T Maestre, M Tavassoli, E B Allen, C W Barrows, J Belnap, S Ravi, and M F Allen. 2014. Environmental impacts of utility-scale solar energy environmental impacts of utility-scale solar energy. Renewable and Sustainable Energy Reviews 29: 766–779

5 Managing India's PV module waste - https://bridgetoindia.com/backend/wp-content/uploads/2019/04/BRIDGE-TO-INDIA-Managing-Indias-Solar-PV-Waste-1.pdf

Therefore, a science-based assessment of social and ecological impacts of a solar project must be ensured considering proper opportunities for robust public involvement, so that high-quality and legitimate development decisions are made without controversy. Avoidance of such controversies, wherein negative impacts are minimized, serves the sustainability of a solar project and hence, investment risks are reduced.

The following sections discuss the common socio-economic and environmental considerations and challenges related to large-scale solar power plants.

1.1 Land-related issues

Land is a fundamental requirement of any enterprise. Thus, competing land requirement across various sectors necessitates effective land-use planning and management that could lead to optimal use of land resources. In India, land is closely associated with livelihood as the country's major population is dependent on agriculture and allied activities and forests. Therefore, any changes in land use affect a large part of Indian population. Moreover, areas directly transformed or affected by the solar installation and infrastructural design have implications on the landscape, which consequently affect its biodiversity.[6]

Appropriate land allocation for building an energy infrastructure and its efficient utilization is crucial—as solar power projects are land intensive and typically require land between 3.5 and 7.5 acres or (0.6–3.03 ha) per megawatt of generating capacity.[7] Though the land required for a coal-based power plant (indigenous or imported coal) is lesser (ranging from 0.42 to 1 acre),[8] land footprint for coal power plants is much higher if its mining area is included in the calculation. Thus, redevelopment or conversion of retired thermal power plants premises should be considered for a solar power plant establishment.

Land is a state subject while acquisition and requisitioning of property is in the concurrent list of the Indian Constitution. So, to procure or lease a land, project developers need approval from concerned departments of the state government (revenue, panchayat, forest and environment and state nodal agency or private land from industry, etc.). There is a lack of comprehensive land utilization policy to cater to the land requirements of various sectors in an optimal manner. Thus, absence of such a policy creates an impediment in the land acquisition process, becoming the single biggest challenge in setting up of solar power projects in the country. Developers face issues with land owners, local authorities, and government agencies. The lack of an organized and regulated real estate market leads to higher land prices.[9] Developing transmission lines is also an issue faced by developers. In such a scenario, the land acquisition process may delay a solar power project for 6–9 months.

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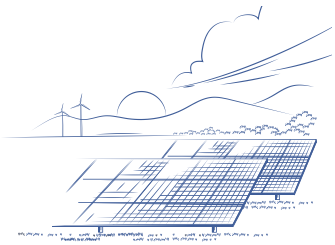
6 Hernandez, R R, S B Easter, F T Maestre, M Tavassoli, E B Allen, C W Barrows, J Belnap, S Ravi, and M F Allen. 2014. "Environmental Impacts of Utility-Scale Solar Energy Environmental Impacts of Utility-Scale Solar Energy." Renewable and Sustainable Energy Reviews 29 (November 2017): 766–79

7 Kumar, A and S Thapar. 2017. Addressing land issues for utility scale renewable energy deployment in India. Details available at https://shaktifoundation.in/wp-content/uploads/2018/01/Study-Report-Addressing-Land-Issues-for-Utility-Scale-Renewable-Energy-Deployment-in-India.pdf

8 The Report on the Land Requirement of Thermal Power Stations - https://cea.nic.in/wp-content/uploads/2020/04/land_requirement.pdf

9 Subramanian, V, P S Banerjee, V Kumar, and M Mukherjee. 2019. Addressing barriers to scaling-up renewable energy through industry involvement. Details available at https://shaktifoundation.in/report/addressing-barriers-to-scaling-up-renewable-energy-through-industry-involvement/; last accessed on July 12, 2021



In India, documentation of land deals is tough due to involvement of many agencies and authorities. This results in challenges in procuring land and constructing timely transmission/evacuation systems.[10] As the land records are yet to be digitalized, they lack authenticity, and irregularities are common in land deals in most states in the country. Irregular land-use surveys result in land records that are not in sync with ground realities.[9]

Solar power projects require large tracts of contiguous land. However, the Urban Land (Ceiling and Regulation) Act, 1976 puts an upper limit on how much land a person or an entity can possess. The limit varies depending on the land type and from state to state. For example, in Maharashtra maximum farmland holding is 27 acres[11] per farmer, and in Karnataka, the ceiling is 21.85 ha for dry land. It is to avoid concentration of land in hands of one or a few individuals. Owing to the land ceiling act, large-scale solar power project developers usually buy lands under different names of different companies, which is challenging.[12] The developers usually take help of land aggregators to purchase large tracts of land, which may give space for corruption at the aggregators' level.

Land acquisition is difficult for government agencies as well. For example, land required for solar parks established by governments gets competitive owing to the difficult acquisition process. It takes much time to acquire land for mega solar projects while project commissioning timelines are being shortened. In Karnataka, the process of obtaining necessary approvals to acquire large plots takes close to 24 months while the time given to commission a project (after its award) is only18 months.[12]

When it comes to land acquisition, developers perceive that government agencies play more of an administrative role than a facilitator's role. The agencies continue to tender and auction new solar projects without streamlining the land acquisition process and fixing transmission infrastructure. Mostly, it is up to the developers to do necessary due diligence and undertake risk profiling before participating in the auctions.[10]

On the flip side, acquisition of large land area for a solar power plant creates discontent among locals as well as provide ample opportunity for land grabbing and corruption. For example:

» In Ramanathapuram, Tamil Nadu, a company acquired 4000 acres of land to set up a 648 MW solar power plant. As per the firm, land required for the plant is 5 acres per megawatt which may require 3000 acres of land. The company seeks additional land for setting up new transmission lines. Thus, acquisition of such huge chunks of land could promote land grabbing by the developers.[13]

» The acquisition of 1600 bighas[14] or 213.7 ha of land to set up a solar power plant in Bhagwanpura village, Neemuch district, Madhya Pradesh is a case in point. In 2014, a company acquired a land originally inhabited by 200 families of nomadic/tribal communities of Gujjars and Bhils. As a

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10 Land is Still the Biggest Impediment for Large-scale Solar Development. Details available at https://mercomindia.com/land-impediment-large-scale-solar/; last accessed on July 12, 2021

11 1 acre = 4046.86 m2

12 Kumar, A and S Thapar. 2017. Addressing Land Issues for Utility Scale Renewable Energy Deployment in India. Details available at https://shaktifoundation.in/wp-content/uploads/2018/01/Study-Report-Addressing-Land-Issues-for-Utility-Scale-Renewable-Energy-Deployment-in-India.pdf; last accessed on July 12, 2021

13 Land grab in the name of solar power. Details available at https://www.theweekendleader.com/Editorials/4797/land-grab-in-the-name-of-solar-power-.html; last accessed on July 14, 2021

14 1 Bigha is equivalent to 0.33 Acres and 1 Acre is 0.404 Ha.

consequence, 70 farmers lost their agricultural as well as grazing land. Both the district administration and the company failed to provide cultivable land as promised to farmers in the region. All this led to deep resentment against the company and the solar park among locals[15].

In summary, these land-related complications result in investment risks. Namely, the risks for societies to lose their livelihoods are difficult for many foreign investors to accept. Additionally, complicated and delaying land acquisition processes mean uncertainty for investors that they might not be willing to cope with. The timeline as well as difficulties in the land acquisition process act as a deterrent to potential investors, both domestic and overseas. Along with this, multiple laws in the country are not well-defined and thus are the source of inordinate delays and litigations. Thus, de-risking instruments for land issues need to be implemented to raise the profile of solar investment for rapid increase in solar power generation in the country.

1.2 Rehabilitation and resettlement

In general, government can acquire land for its own use, for public–private partnership with a public purpose, or on behalf of private companies for public purpose. The public purpose includes infrastructure projects such as renewable energy generation projects. The Act prohibits acquiring irrigated multi-cropped land and if acquired as a last resort, then it says the equivalent area of cultivable wasteland needs to be developed for agriculture purpose.[16] The presence of solar power plants in remote areas may result in relocation of people living in those areas. Rehabilitation and resettlement (R&R) of those people is necessary providing them similar quality of life in a new location. R&R is guided by the Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013 (LARR).

The National Rehabilitation and Resettlement Policy, 2007 makes the developer responsible to provide compensation to displaced communities. The amount of compensation is calculated 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 at least 4–5 years.[16] The provisioning of alternative livelihood opportunities is involved particularly if land acquisition takes place in tribal areas. Consequently, it raises the project cost significantly, which is borne by the project developer.

Summing-up, this means that investors have to accept the circumstances and terms and conditions of rehabilitation and resettlement. And, the legal challenges in acquiring land and provisions of R&R may result in cost overrun for the investor. Overall, the uncertainties in R&R may be perceived as 'trouble' by investors and industries, as it is on top of the complex legal procedure at different levels of land governance. Thus, R&R provisions need not be a stumbling block in solar investment in the country.

1.3 Livelihood impact of land acquisition

Land-use classification and establishment of solar power plants in 'wasteland' has a bearing on the livelihood of local communities. For example, in case of Charanka Solar Park Project (with an installed capacity of 216 MW), which was launched in December 2010 and is functional since April 2012, 2000 ha of

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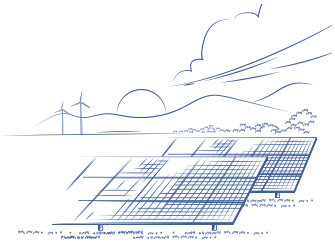
15 Solar betrayal - https://frontline.thehindu.com/the-nation/solar-betrayal/article9794731.ece last accessed on July 14, 2021

16 Kumar, A and S Thapar. 2017. Addressing land issues for utility scale renewable energy deployment in India. Details available at https://shaktifoundation.in/wp-content/uploads/2018/01/Study-Report-Addressing-Land-Issues-for-Utility-Scale-Renewable-Energy-Deployment-in-India.pdf; last accessed on February 24, 2021



land previously used for grazing and agriculture purposes was acquired. Charanka village in Patan district, Gujarat with a population of about 1500 is largely dominated by Rabaris—a nomadic pastoral community. The Rabaris lack land ownership and are highly dependent on pastoral land for their livelihood. The company concerned with the project describes 5384 acres across which the park is spread as 'unused' land. However, the project map available at the park's office shows close to 2000 acres out of 5417 acres are under cultivation and the rest is 'government land'.[17] The power plant impinges directly on the pasture-based livelihood system of Rabaris. Having lost access to the grazing lands, the inhabitants can no longer rear livestock. As a result, a community of pastoralists were forced to work as either labourers in agricultural fields in neighbouring villages or as cleaners in the solar project.

Another example of farmers' distress due to a solar power project can be seen in Pavagada in Tumakuru district, Karnataka. To set up the solar power project with 2000 MW installed capacity 12,700 acres of land was acquired on a 28-year lease basis by the state government. The project led to rising uncertainty especially for small farmers who had to move to Bengaluru to find alternate source of livelihood. Although Pavagada along with nine other taluks[18] fall in arid and drought-prone regions of Karnataka, but farmers feel that giving up their land meant giving up their way of life.[19]

Land-use change from agricultural to industrial use by setting up of solar power plants could trigger food security issues as it leads to lowering of large agricultural areas under cultivation, hence, impacting food production outputs.[20] This implies a risk of social unrest, which is a clear concern for a potential investor.

1.4 Water constraints

Though the water consumption level of solar power plants is fractional as that of coal, higher concentration of solar parks in water-scarce regions could pose a problem. Water constraints could hamper the country's solar development plans if large-scale solar projects are in water-scarce regions. Gujarat and Rajasthan that together house the largest capacity of solar installations in the country are both water-stressed regions.[21] Thus, it is important for India to consider the implications of its solar expansion on water demand. The Council of Energy, Environment and Water (CEEW) estimates that water requirements for operation and maintenance of a solar project could lie between 7000 and 20,000 litres per megawatt per wash if the solar panels are cleaned on a weekly basis. Comparatively, coal-based power plants require 3500 litres per hour per megawatt for their operation and maintenance.[22] And, average water requirement in coal-based plants

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17 Why India's solar push could kill the livelihood of pastoral communities. Details available at https://www.business-standard.com/article/economy-policy/why-india-s-solar-push-could-kill-the-livelihood-of-pastoral-communities-119080500090_1.html; last accessed on July 14, 2021

18 Taluk/Tehsil is an administrative unit which is usually a division of a district.

19 Towards an uncertain future: Why farmers are unhappy with Karnataka's big bet on solar. Details available at https://www.thenewsminute.com/article/towards-uncertain-future-why-farmers-are-unhappy-karnataka-s-big-bet-solar-93992; last accessed on July 14, 2021

20 Kumar, A and S Thapar. 2017. Addressing land issues for utility scale renewable energy deployment in India. Details available at https://shaktifoundation.in/wp-content/uploads/2018/01/Study-Report-Addressing-Land-Issues-for-Utility-Scale-Renewable-Energy-Deployment-in-India.pdf; last accessed on July 14, 2021

21 India's solar dream: Does the country have enough water? Details available at https://www.thethirdpole.net/2015/03/05/indias-solar-dream-does-the-country-have-enough-water/; last accessed on July 14, 2021

22 MoEFCC Notification 2015. Details available at https://www.pib.gov.in/newsite/PrintRelease.aspx?relid=133726

could reach up to 5000–7000 litres per hour per megawatt.[23] Though the water requirement varies with the plant's scale and location, and climatic conditions of the area where it is situated, high demand for water may affect the local ecosystem.

Water constraint is an important aspect that a potential investor would want to assess and address before taking an investment decision. Though the solar power sector is water efficient as compared to the thermal power sector, risks associated with water is prevalent in drier regions of the country, which is a matter of concern for solar projects in such regions. A water stress situation may lead to rising project cost and professional underperformance; therefore, potential investors need water resources mapped and water availability assessed before making investment decisions.[24] Thus, it is essential that authorities provide such information so that investors can make informed investment decisions. Additionally, minimizing the risk, investors can consider alternative measures such as water harvesting and conservation techniques.

Livelihood Implications of Solarization of Diesel Pumps in Salt Pans of Little Rann of Kutch

The Little Rann of Kutch is a remote desert area in Gujarat, which contributes nearly 76% of the total salt production in the country. The majority of the 13,000 salt farmers in the area use diesel pump sets in the salt harvesting process.[25] As a result, farmers end up spending as much as 40% of their annual revenue in purchasing diesel available at far-away places, hence, affecting their disposable income.

In 2013, Self-Employed Women's Association (SEWA) initiated a pilot programme with women salt farmers in this region. Under this, innovative financing solutions were provided to the farmers. The programme demonstrated that switching diesel pumps with solar-powered pumps or solar-diesel hybrid pumps can decrease the production cost and increase the net revenue by 94%, and result in improved livelihood prospect of salt farmers. Besides, the use of solar-powered pumps helps in reducing air pollution in the region.

With the rise in disposable income due to solar pumping systems, the salt farmers could afford children's education and pursue additional income-generating activities such as cattle rearing and owning small flour mills. Additionally, solar panels are being used to provide domestic power supply to the off-grid villages of the salt farmers. Thus, solarization of the region resulted in asset creation, ownership of farmers, social recognition, and financial inclusion. In other words, the solar pumping system which replaced diesel sets transformed life and livelihood of the women salt farmers.[26]

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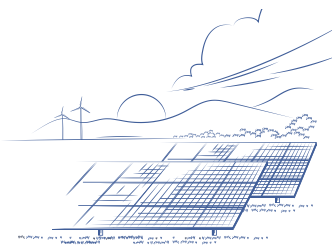
23 Assessment of water footprints of India's long term energy scenarios. Details available at https://niti.gov.in/writereaddata/files/document_publication/Report%20Assessment%20of%20Water%20Foot%20Prints%20of%20India's%20Long%20Term%20Energy%20Scenarios_TERI%202017.pdf, last accessed on July 15, 2021

24 Water use in solar power sector. Details available at https://bridgetoindia.com/backend/wp-content/uploads/2018/09/Bridge-to-India-Water-use-in-solar-power-sector-September-2018.pdf; last accessed on July 15, 2021

25 Solar pumping for irrigation: Improving livelihoods and sustainability. Details available at http://www.irena.org/-/media/Files/IRENA/Agency/Publication/2016/IRENA_Solar_Pumping_for_Irrigation_2016.pdf; last accessed on July 15, 2021

26 Worth their salt: Improving livelihoods of women salt farmers through clean energy in the salt pans of Gujarat. Details available at https://www.nrdc.org/sites/default/files/worth-their-salt-improving-livelihoods-of-women-salt-farmers-through-clean-energy-in-the-salt-pans-of-gujarat_2018-09-10.pdf; last accessed on July 15, 2021



1.5 Forest and biodiversity

In India, solar power projects need forest clearances, though environment impact assessment is not needed.[27] Any project being set up in a forest area needs forest clearance regardless of its status in Environmental Impact Assessment (EIA), 2006 provisions. However, the forest clearance process does not involve any EIA.[28] Besides, a forest land can be leased to solar project developers through a detailed process. As per the MoEFCC rules, a project developer has to identify a land contiguous to the forest land for compensatory afforestation in case the forest land is involved in an RE project. The rules permit afforestation activities in private lands as well.[29]

Extension of power evacuation infrastructure catering to remote solar power stations has led to construction of high tension power lines across protected wildlife sanctuaries. As a consequence, human interference in protected zones is enhanced through solar project installation activities. There are instances of animal conflict in solar installations—monkeys uprooting solar panels and blue bull,[30] rhinoceros, and elephants entering the premises. The primary cause of degradation of protected areas is change in land use and land cover. The protected areas are effective for wildlife when habitat along with the wildlife corridors is accessible at all times. However, land-use change due to solar installations could obstruct access for animals to the corridor, which would be detrimental to wildlife and plant diversity.[31] Numerous such projects have come up in eco-sensitive and wetland areas in Rajasthan, Madhya Pradesh, and Gujarat.

The potential investors would refrain from investing in projects that cause environmental damage. However, in-depth knowledge about environmental shortcomings resulting from the deployment of large-scale solar power plant is lacking. In the given context, the potential investors would like to identify, avoid, and minimize adverse impacts of such projects on biodiversity before making an investment decision. And, if there is lack of knowledge on vulnerability of biodiversity to large-scale solar installations, then investors would avoid biodiversity hotspots and protected areas to invest in such projects.

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27 Government eases environmental clearance rules for solar power projects, parks. Details available at https://www.livemint.com/Politics/QW4cJ9yjhmvUtOZCPyOt3J/Govt-eases-environment-clearance-rules-for-solar-projects.html; last accessed on July 15, 2021

28 Green norms for wind energy. Details available at https://www.cseindia.org/green-norms-for-wind-power-8006; last accessed on July 15, 2021

29 Environmental and social clearances for renewable energy projects in India. Details available at http://www.energetica-india.net/download.php?seccion=articles&archivo=H4NMaCAHJPPSmVZ6FyPRoVKA8rLyrBPz5cATfAboPr73CVwIIAZwWkx.pdf; last accessed on July 15, 2021

30 The blue bull, which is locally known as Nilgai, is the largest Asian antelope found in Northern India.

31 Solar energy development impacts on land cover change and protected areas. Details available at https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4640750/; last accessed on July 15, 2021

2. THE ROLE OF SOCIAL AND ENVIRONMENTAL IMPACT ASSESSMENT

The social and environmental assessment (SEIA) process could be useful in many different ways. Firstly, it could be useful in identifying potential problem areas before the onset of project processes. In India, solar power is not covered under the ambit of Environmental Impact Assessment Notification, 2006 and thus no environment clearance is required for such projects under the provisions thereof. The MoEFCC, Government of India, has placed wind and solar PV projects under 'White Category' industries, which are exempted from the EIA process. It implies that obtaining 'Consent to Operate' certificate from the concerned State Pollution Control Board[32] is no longer a requirement. Socio-economic impact assessment usually forms an integral part of the EIA process. By doing away with any assessment, the real cost of promoting solar power, accounting loss of essential ecosystem, rehabilitation, and impact on livelihood are clearly waived off.

The exemption given to the RE sector is derived from the notion that it is a responsible sector which needs no further nudging. Thus, the government has removed the layers of clearances and approvals. However, contrary to the norms set by the MNRE, various cases are reported on land diversion and use of private land, which in most cases is fertile land, for setting up of solar and wind projects. So, the SEIA process could clearly be useful in delineating potential pain points, which otherwise could go unnoticed.

Secondly, land acquisition, rehabilitation, and relocation of project-affected population could be benefited from the SEIA process. Furthermore, applicability of the SEIA process in land acquisition/sale of land could reduce adversity encountered by project developers and landowners. Moreover, it could counter land pooling,[33] practiced widely by several states to accelerate land acquisition undermining environmental safeguards.[34]

Thirdly, the environmental and social assessment could be instrumental in bringing out better social and environmental outcomes by helping in better designing of projects, which could have bearing on the economic outcomes of a project. For instance, combining solar power with storage solutions has social, environmental, and economic advantages that provide uninterrupted power supply without investing in a transmission and distribution infrastructure.

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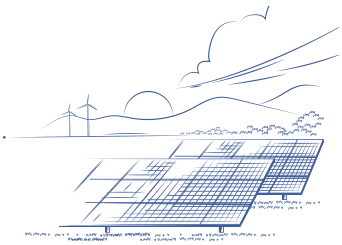
[32] Environment Ministry releases new categorisation of industries. Details available at https://pib.gov.in/newsite/printrelease.aspx?relid=137373; last accessed on July 15, 2021

[33] Land pooling allows purchase and use of agriculture land by change of land use to non-agriculture category thereby accelerating land acquisition for ground-mounted solar power plants.

[34] Addressing land issues for utility scale renewable energy deployment in India. Details available at https://shaktifoundation.in/wp-content/uploads/2018/01/Study-Report-Addressing-Land-Issues-for-Utility-Scale-Renewable-Energy-Deployment-in-India.pdf; last accessed on July 15, 2021



Lastly, the SEIA process could enable promoters to conduct public consultations, which could provide them awareness of the opportunities and challenges in commissioning and running the project. Goodwill in the communities and immediate neighbourhood could eliminate conflicts and other social hurdles. It could also promote community participation and provide a base for environmentally- and socially-sound projects.

Considering the fact that both the land owner as well as the developer are constrained in their own capacities and have to face real hardships when a land is being acquired/purchased by the latter, a simpler mechanism for transactions need to be devised. The Land Acquisition, Rehabilitation and Relocation Act (LARR) 2013 addresses some of the concerns. The pertinent provisions of the law are as follows:

1. A comprehensive social impact assessment became a reality, beginning with a study of all aspects of the project and its impact on the livelihood of affected families and on the facilities and amenities enjoyed by them. A public hearing and involvement of the local body (panchayat, municipality or Municipal Corporation) are also mandated.
2. The idea of minimum consent for public–private partnership (PPP) projects and for private companies for public purposes was introduced, wherein consent of 70% and 80% of landholders, respectively, is required.
3. Enhancement of the compensation for rural land was granted wherein solatium is four times the value of the average of registered sale deeds and for urban lands, it was increased twofold.
4. The rehabilitation and resettlement package covers both the landowner and landless whose livelihoods are affected, including constructed houses, if they are lost in the land acquisition.

2.1 SEIA as a necessity to attract international finance

Private sector has invested heavily in India's RE sector. As per the recent estimates by the MNRE, the total investment of around $100 billion[35] has occurred in the sector while another $14 billion is in the pipeline. However, another $65 billion is required for investment in RE sector.

According to a report by Shakti Foundation, India requires $28 billion annual investment to achieve its target of 100 GW solar by 2022.[36] The same report also highlights that the average investment in the country's RE sector in the last 8 years (2010–17) was around $14 billion only. It clearly underlines that the sector is in an urgent need to look beyond the usual sources of the national and international finances. Private equity or hedge funds[37] could be other sources of financing solar projects.

There have been researches for the sources and types of financial instruments through which international financial institutions have been investing in India's RE sector. However, diminishing margins and growing numbers of social and environmental concerns raised by all sections of the society has led most of the

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35 Details available at https://pib.gov.in/newsite/PrintRelease.aspx?relid=199247; last accessed on July 15, 2021

36 State of Renewable Energy in India. Details available at https://shaktifoundation.in/wp-content/uploads/2019/04/State-of-Renewable-Energy-in-India.pdf; last accessed on July 15, 2021

37 The fund hedges capital investment risks to that of market volatility. Details available at https://economictimes.indiatimes.com/definition/hedge-fund; last accessed on July 15, 2021

international financial institutions to enforce social and environmental impact assessment studies. The assessment studies are based on International Finance Corporation's (IFC) safeguard polices and performance standards.[38] These have become a mandatory step to be carried out on project-by-project basis. The most relevant example is the 750-MW Rewa Project in Madhya Pradesh.[39] The project is being funded by Clean Technology Fund and has received a concessional loan from the World Bank.[40] The environmental and social standards have been made mandatory for most of the foreign donors to follow four essential steps—first is the strategic analysis; second is the detailed analysis of the possible consequences; third being the rehabilitation, resettlement, and livelihood planning; and the final stage is the monitoring of a project from social and environmental performance standpoint.

There are sustainable finance investors who require environmental and social standards clearances to invest heavily in sustainable projects. Thus, well-designed projects with detailed information on environmental and social standards are needed to attract the attention of the investors. The World Bank group has environmental and social standards similar to IFC's safeguard policies and performance standards. International investors such as KfW Development Bank use SEIA through an environmental and social due diligence to anticipate and appraise the impacts and risks concerning the projects funded by them. The environmental and social due diligence process demonstrates and raises awareness on environmentally-sustainable and socially-responsible development approaches.[41] The KfW development bank uses the process as a management tool over the entire life cycle of a project. Similarly, Asian Development Bank conducts environmental and social impact assessment of solar projects as part of its Safeguard Policy Statement.[42] The assessment includes environmental and social management plan and recommendations to implement the suggested mitigation measures to avoid or minimize adverse environmental and social outcomes.

2.2 Requirements for policies, regulations, and laws

The project developers analyse the potential as well as market of solar power in India. The government provides push through various policies to accelerate the solar power capacity addition, which include increased percentage of RPO, 100% foreign direct investment, subsidizing and providing favourable environment for various joint ventures, technology transfer, and MoUs. These measures also attract solar power players from across the world for investment in India.

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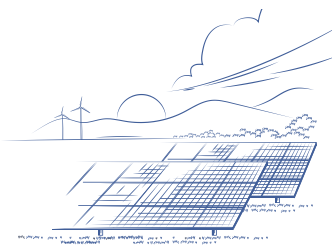
38 IFC performance standards on Environmental and Social Sustainability. Details available at https://www.ifc.org/wps/wcm/connect/co2c2e86-e6cd-4b55-95a2-b3395d204279/IFC_Performance_Standards.pdf?MOD=AJPERES&CVID=kTjHBzk; last accessed on July 15, 2021

39 Environmental Social Assessment of Rewa Solar Report - https://www.ireda.in/doc/writereaddata/ESARewaSolarReport_19_08_16_WB.pdf

40 Rewa solar power project starts in Madhya Pradesh. Details available at https://www.financialexpress.com/infrastructure/going-green-750-mw-rewa-solar-power-project-in-madhya-pradesh-starts-operations-to-serve-delhi-metro/1234201/; last accessed on July 15, 2021

41 Sustainability Guideline of KfW Development Bank. Details available at https://www.kfw-entwicklungsbank.de/PDF/Download-Center/PDF-Dokumente-Richtlinien/Nachhaltigkeitsrichtlinie_EN.pdf; last accessed on July 15, 2021

42 Environmental and Social Impact Assessment of Dahanu solar power project. Details available at https://www.adb.org/sites/default/files/project-document/60698/45915-01-ind-esia.pdf; last accessed on July 15, 2021



Among the policies, regulations, and laws that govern investment in India, SEIA is a prominent one. In order to avoid and minimize the RE sector's negative environmental impact, Indian Renewable Energy Development Agency (IREDA) formulated Environment and Social Management System (ESMS) which is aligned with Safeguard Policy Statement (SPS) 2009 of Asian Development Bank. IREDA appraises, screens, and categorizes all RE projects from environmental and social standpoint before making any financing decision. The recipients of IREDA funding follow a set of guidelines by the organization pertaining to the environmental and social impact.

The SEIA deals with a variety of issues including safeguarding natural ecosystem and avoiding adverse impacts on ecology, soil, water, air, and community. However, in case of solar power plants, ensuring land rights and fair compensation to local communities and earmarking land for solar power projects are the biggest socio-environmental challenges.

3. RECOMMENDATIONS FOR DE-RISKING INSTRUMENTS

In the next chapter, recommendations for policy regulations to meet these challenges with de-risking instruments are provided in order to help attract necessary (foreign) investment in the sector.

The following are the suggested recommendations to tackle the social and environmental risks pertinent to investments (foreign) in large solar parks in India:

Land-use-related policies

» *Digitization and streamlining of land records*: The policy action is needed to modernize land records management, minimize scope of land/property disputes, enhance transparency in the land records maintenance system, and facilitate moving eventually towards guaranteed conclusive titles to immovable properties in the country. For example, the Digital India Land Records Modernization Programme[43] aims to bring the registered landowners information at a digital platform, which can be accessed by solar developers or state solar authorities beforehand to check the legal status of a land to be acquired.

» Land-use mapping: A joint programme of the MNRE, Ministry of Agriculture, and Ministry of Rural Development along with respective state departments could be conducted to map the land-use in the country.

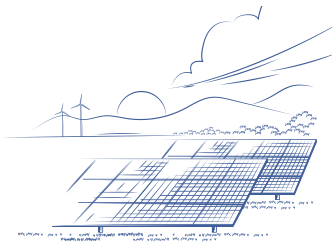
» The reason of putting digitization and land-use mapping as separate suggestions is that while the former provides a way to minimize legal difficulties by allowing easy access to land records/ownership rights, the latter looks in to establishing a scientific process to identify the most conducive land and discourage land-use conversion. For example, district-wise zoning atlas mentioning industries could be prepared to provide land-related information to promoters and propose candidate sites for solar power projects.

» Use of tools as mentioned above could help in identifying land parcels that not just factor in both potentials and an evacuation access and ease but also social and environmental values.

» A detailed capacity building programme for developers, RE resource assessment officers, and state nodal officers is needed to use maps—especially of wasteland/ATLAS, potential vacant and encumbrance-free sites.

» An alternative solution could be in the form of land zoning, particularly by state governments. To elaborate, state governments should consider identifying renewable energy zones (REZs) along

[43] Ibid.



the lines of special economic zones, which can be treated as preferential areas for installation of solar plants keeping in mind the environmental and social considerations. Significant planning and technical resources have already been developed by national agencies including National Institute of Wind Energy and National Institute of Solar Energy on RE potential. These preferential REZs should be designated by state governments and approved in advance for faster project deployment. This approach is well-suited for the development on government lands. Contaminated and degraded lands, such as retired minefields, old thermal power plants, closed landfills, and former industrial sites should be included in such REZs.

Agro solar

» *Promoting decentralized agro solar through a PPP model on farmlands*: New business models need to be examined to promote agro solar that diversifies farmers' income sources. For example, Mukhyamantri Kisan Aay Badhotri Solar Yojana that follows the PPP model was launched by the Delhi government in 2019.[44] As per the scheme, private companies under the Renewable Energy Service Company (RESCO) model can install solar panels on one-third of the total land owned by a farmer. The farmer is paid $1411.34 or ₹100,000 per acre annually with 6% annual increase for 25 years as land rent from the company. At this rate in the 25th year, the farmer could get $5701.83 per acre. Thus, the installation of solar modules could increase farmers' income by three to four times.

» In addition to this, the dual use of land areas could also promise success for the expansion of solar energy in rural areas. The 'agro solar' principle, in which plants are cultivated under the shade of solar panels, could potentially be worthwhile for flower and vegetable cultivation.

» State governments should encourage land lease agreement for 25-year period (equal to the life of a solar project) between farmers and project developers instead of land acquisition. The land leasing process has a time advantage which fits well with RE projects. A portion of the solar power tariff could be shared with the farmer who gives his/her land on lease for a solar project. At the end of the lease period, the land could go back to the farmer.

» Agro solar should be promoted in special schemes initiated by the government such as Kisan Urja Suraksha evam Utthaan Mahabhiyan (KUSUM) scheme to avoid conflict with land-based livelihood of farmers.

» Research is ongoing on the benefits of placing solar panels on raised structures. Ongoing research studies suggest growing crops with different crop heights so as to make best use of agricultural land. The research could remove the trade-off between solar energy and farming, and could be beneficial to farmers who participate in schemes such as KUSUM.

» The purchase value of land earmarked for solar installation should have a defined component for developing livelihood activities in that area for the people who have been deprived of it. This should be an obligation for the solar project developers. However, diversion of agricultural land for solar power generation should not be allowed to avoid livelihood versus electricity conflict.

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[44] Details available at https://www.eqmagpro.com/delhi-government-launches-mukhyamantri-kisan-aay-badhotari-solar-yojana/; last accessed on February 25, 2021

» A national policy with specific guidelines could be framed with clear criteria listed out for land selection for solar power plants. The criteria need to address issues that may lead to potential environmental, wildlife, and social conflicts. The guidelines could have the following components:

- *Kind of land selection*: Mention the land-use pattern of a land prior to its proposed acquisition
- Ownership details of the land
- Proximity of the land to known wildlife corridors and habitats
- Proximity of the land to biodiversity hotspots
- Community use of commons which is also linked to the land-use pattern

» The policy could have guidelines for community consultation and consent before land acquisition. This could be in the form of a social clearance from communities, or a social impact assessment report.

» Consultations with wildlife experts to seek their views on land, particularly those land parcels that fall within or close to wildlife corridors need to be part of such a guideline.

» Diversion of a forest land for solar installations should be avoided or minimized to the highest possible extent.

» Policy guidelines of government research bodies such as National Institute for Solar Energy need to factor in social and environmental values in their potential assessment tools.

» Guidelines to prioritize use of rooftops, abandoned mines, and old and obsolete thermal power plants for solar projects should be there so that controversial land acquisition can be avoided.

» Assessment of the land requirement for new transmission lines needs to follow the same process as that of siting of land for a solar project.

» Guidelines for partnering with farming communities, where necessary or desirable, for setting up large solar power plants should be there. For this, options of dual use of land and cultivation being promoted with higher mounted solar panels can be explored.

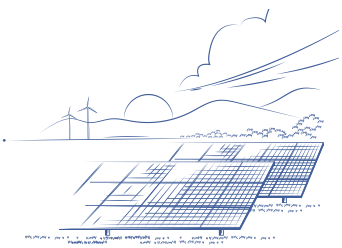
» The guideline may also include revenue-sharing models with farming communities to promote agro solar.

» Financial and investment guidelines could be issued to financial institutions for land siting for solar projects mandating submission of environmental and social risk assessment and risk mitigation aspects for large solar projects.

» *Setting up of an ombudsman or a compliance/oversight unit for solar projects*: An ombudsman could be appointed to deal with disputes and to oversee enforcement of social and environmental standards in solar installations.

» *Policy guidelines as a deterrence to land grabbing*: The policy guidelines could ensure that a land is acquired by a relevant state government department for solar projects by adhering to social and environmental aspects of suitable land parcels.

» State-specific policies aligning with the above national policy guidelines for identifying land parcels may be framed. The state policies could have similar contours as of the national policy.



Social Impact Assessment

» The social impact assessment should become necessary for solar projects above a certain capacity threshold. These impact studies could also explore livelihood and skill development planning for communities living in the proposed project.

The livelihood of communities depending on common property resources such as wasteland/ common land needs to be factored in while planning a solar project. Adequate rehabilitation and relocation of communities is essential. A solar power plant at the cost of livelihood and forced migration must be avoided. Recognition of land rights of communities need to be embedded in the policy governing solar power plant commissioning.

Environmental Impact Assessment

» Though the government has exempted the requirement of EIA and consultation with communities, in the interest of viability and sustainability of solar projects, the state agencies, promoters, and investors could undertake the SEIA process on their own without any hindrance.

» The project developers should be encouraged to conduct both environmental and social impact assessment themselves, which enhances the confidence of investors and is a necessary step for the betterment of the project.

» As most of the power plants are situated in water-stressed regions or unproductive lands without adequate supply of water, water-efficient technologies need to be deployed for cleaning solar panels. It would be in the interest of project developers to look into the water requirement aspect of solar plants while making investment decisions.

» A comprehensive mechanism is needed to use environmentally sustainable materials in manufacturing modules and to process the end-of-life module waste.