



POWERING AHEAD

**An assessment of the socio-economic and environmental
impacts of large-scale renewable energy projects
and an examination of the existing regulatory context**



HEINRICH BÖLL STIFTUNG / अंधार
INDIA



“Powering Ahead: An assessment of the socio-economic and environmental impacts of large-scale renewables energy projects and an examination of the existing regulatory context”

Report by **Asar Social Impact Advisors Pvt. Ltd.**
for **Heinrich Böll Stiftung**

Authors

Abhishek Pratap
Priya Pillai
Arundhati Muthu

Advisors

Kanchi Kohli
Manju Menon

Designer

Pallavi Baasri

Printing Press

<name>

Images

Freepik
Google Maps
Wikipedia

© India, 2019

Disclaimer: This publication was prepared with the support of the Heinrich Böll Stiftung India. The views and analysis contained in the publication are those of the authors and do not necessarily represent the views of the Heinrich Böll Stiftung.

About Heinrich Böll Stiftung

Heinrich Böll Foundation (HBF) is a German foundation, part of the green political movement that has developed worldwide as a response to the traditional politics of socialism, liberalism, and conservatism. HBF is a green think-tank and an international policy network. Its main tenets are ecology and sustainability, democracy and human rights, self-determination and justice.

It places particular emphasis on gender democracy, meaning social emancipation and equal rights for women and men. It is also committed to equal rights for cultural and ethnic minorities. Finally, it promotes non-violence and proactive peace policies. To achieve its goals, it seeks strategic partnerships with others who share its values. Its namesake, Heinrich Böll, personifies the values it stands for: *protection of freedom, civic courage, tolerance, open debate, and the valuation of art and culture as independent spheres of thought and action.*

About Asar Social Impact Advisors Pvt. Ltd.

Asar works on social and environmental issues by conducting research, ground truthing, and understanding local contexts in order to build innovative strategies that are rooted in reality. Asar convenes conversations and helps build relationships between various stakeholders to be able to sustain collaborations essential to catalyse momentum and result in change. For further enquiries, please contact Vinuta Gopal at vinuta.gopal@asar.co.in.



Table of contents

1.0

Introduction

1.1 India's Power Sector:
State of Play

1.2 Renewable Energy
Growth Story

1.3 About Study

2.0

Policies, Guidelines, and Regulatory Provisions

2.1 Central Government
Policies

2.2 Legal Obligations

2.3 State Government
Policies

3.0

Social and Environmental Issues

3.1 Land Diversion

3.2 Water Extraction

5.0

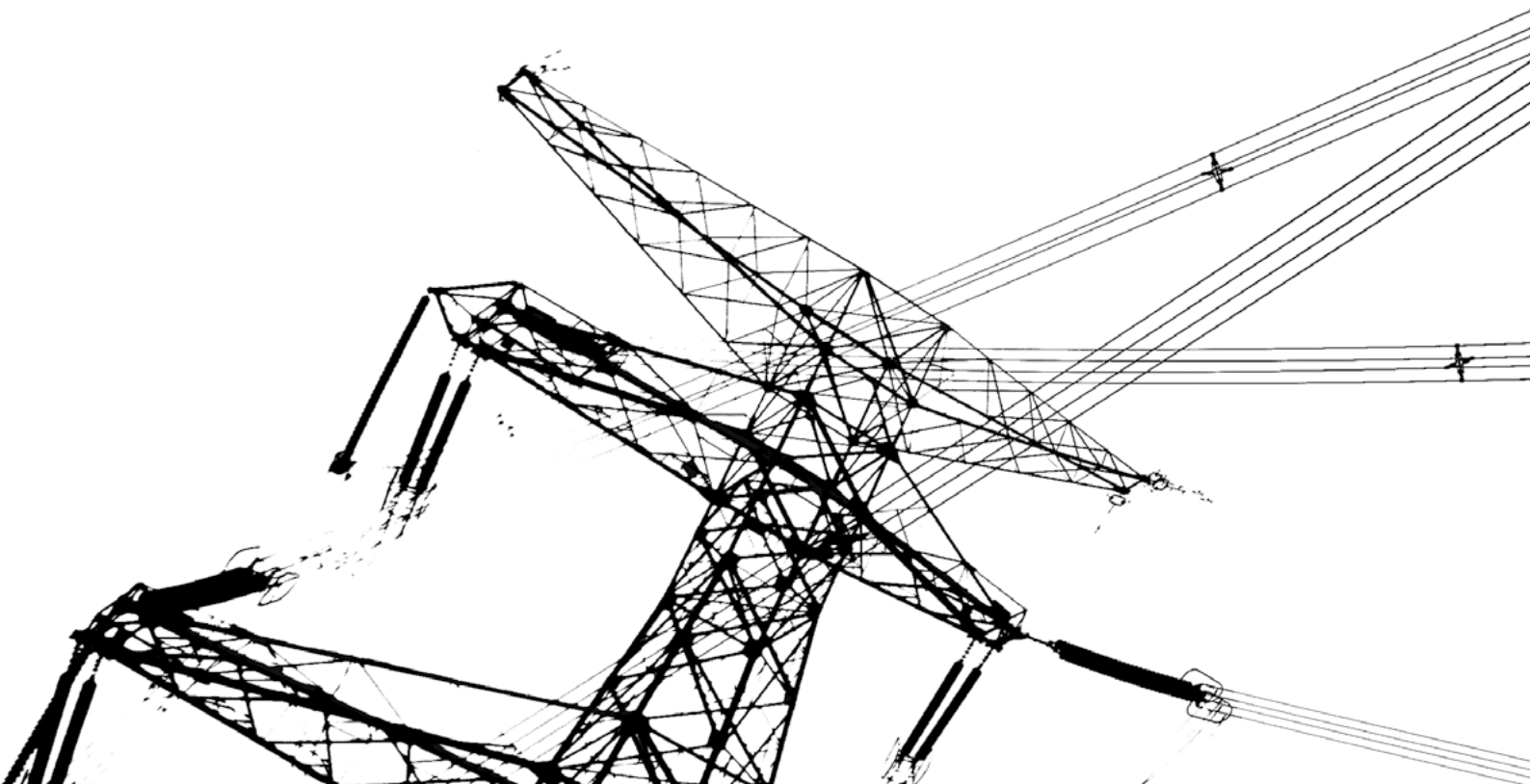
Recommendations and Conclusion

6.0

List of Abbreviations

7.0

Endnotes

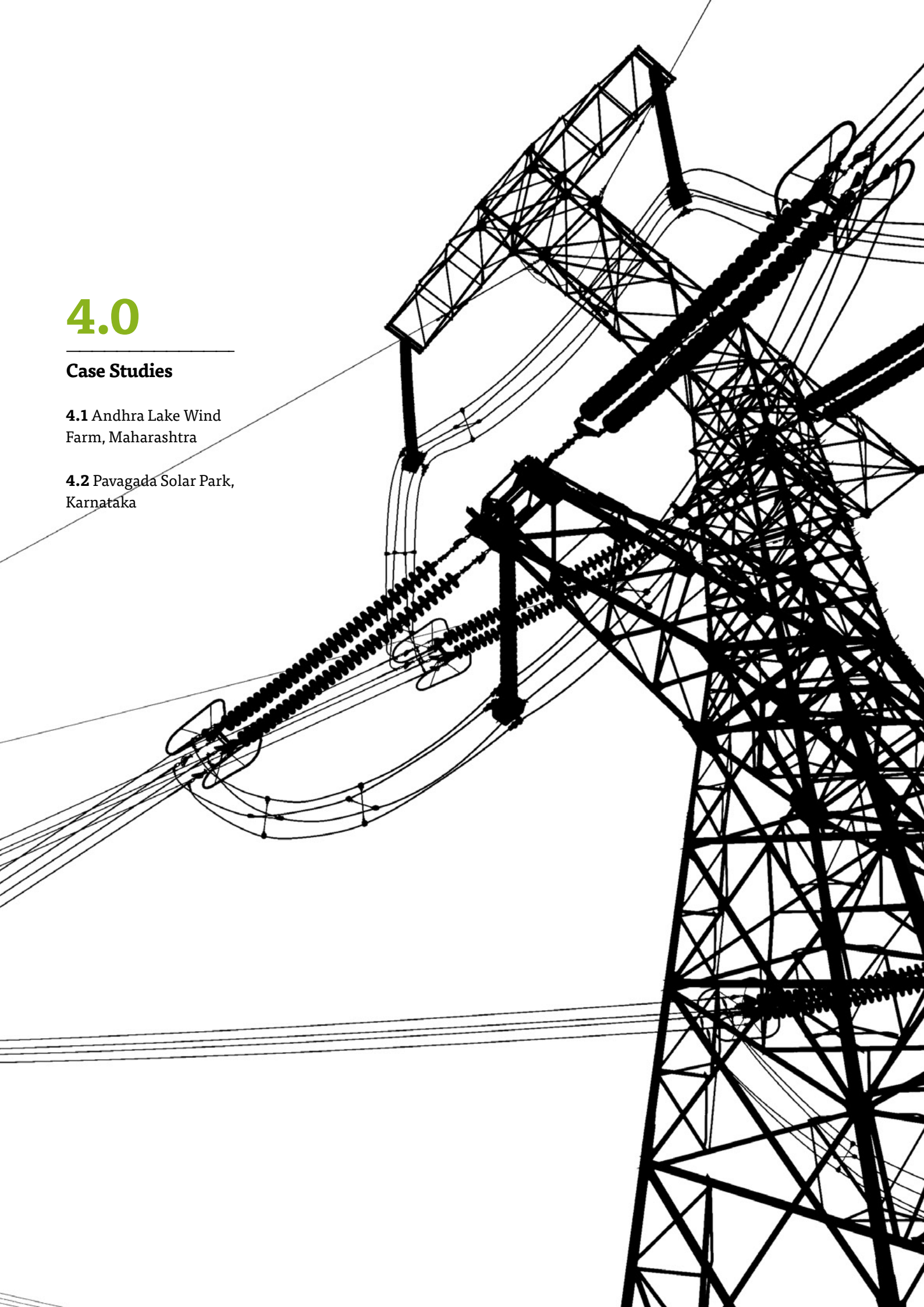


4.0

Case Studies

4.1 Andhra Lake Wind Farm, Maharashtra

4.2 Pavagada Solar Park, Karnataka



1.0

—

INTRODUCTION

1.1

India's Power Sector: State of Play

India has set itself an ambitious renewable energy installation target of 175 GW by 2022

India, the world's fastest growing large economy, still has some way to go before it produces sufficient power to meet the country's aspirations. Despite claims of 100% electrification of India's households, challenges remain: providing all citizens with access to reliable power, and meeting industrial and commercial needs. Interestingly, with 345 GW of installed power capacity¹, India is both the world's third largest power producer and consumer².

The Central Electricity Authority (CEA) advises the central government on electricity related policy matters and formulates plans for the development of electricity systems. In its National Electricity Plan (NEP) 2018³, it projects peak power demand for 2021–22 to be 225.75 GW. This is 20% lower than its previous projection in the 18th Electric Power Survey (EPS) report published at the end of 2011. Considering a combined 50% average Plant Load Factor (PLF) for conventional power sources and Capacity Utilisation Factor (CUF) for renewable sources, India may require around 500 GW of installed capacity by 2021–22. NEP also projects 298.77 GW of peak power demand in 2026–27, 38.4 GW lower than the corresponding 18th EPS projection. This translates to roughly 650 to 700 GW of installed capacity in 2026–27. However, it's important to keep in mind that all previous power demand projections have been considerably inflated.

Some steps that have contributed to downward revisions of future power demand projections are implementation of demand side efficiency measures, and differential peak load management. Other factors also contribute to depressed demand, current and future: distribution companies (DISCOM) continue to be in poor health, and the economy is flagging. A change in these conditions may push up power demand. Key drivers could be:

- * Rapidly increasing urbanisation with an additional 315 million people expected to be in cities by 2040⁴
- * A turnaround in the economy and the possible attendant higher rural urban incomes
- * Improvement in DISCOM health
- * The imperative to provide quality energy access for all citizens
- * Expected proliferation of electric vehicles

An anticipated economy-wide shift from service to manufacturing was expected to significantly push up power demand. This now appears increasingly unrealistic and unlikely to happen.

India has offered itself as a global climate action leader, leaving behind its earlier position of pitting economic development against low carbon growth. Over the last two years, it has also faced a situation of overcapacity and a power glut. However, this is likely to be temporary; a consequence of the economic slowdown, and depressed power demand from financially stressed power utilities struggling

to purchase power. India has set itself an ambitious renewable energy (RE) installation target of 175 GW by 2022. Between 2021 and 2027, no coal addition is projected, excluding projects already in the pipeline. 116.8 GW of non-fossil power is expected to be added. The NEP 2018 projects that coal based capacity will form less than half the total installed power capacity by 2026–27. RE based capacity will form one-fourth of the total installed capacity, an indicator that India's energy transition is well underway. These ambitions have been accompanied by a steady inflow of investment and technical knowhow into the sector.

Since 2017, renewables have overtaken coal in the pace of power capacity addition. This surge can be attributed to policy provisions by the current government. Solar energy tariffs are plummeting, and RE is now more competitive and attractive than new coal plants. India has aggressively ramped up its solar ambition from 20 GW to 100 GW by 2022. The wind energy target has been revised to 60 GW, and the overall RE target for 2022 has been set at 175 GW. The NEP 2018 aims to achieve 275 GW by 2027.

Positioning itself as a leader in renewables, India played a prominent role in the setting up of the International Solar Alliance (ISA) comprising 122 member countries. The ISA's goal is expanding solar energy proliferation to enable a shift away from fossil fuels. India has also announced a massive push for electric vehicles (EVs). It hosted a global summit on the mobility revolution in 2018.

TABLE 1 | Source-wise installed capacity between 2014⁵ and 2018⁶

ELECTRICITY SOURCE	INSTALLED CAPACITY (GW), 2014	INSTALLED CAPACITY (GW), 2018	GROWTH IN 4 YEARS
COAL	145.27	196.01	34.92%
GAS	21.78	24.87	14%
DIESEL	1.2	0.84	-30%
LARGE HYDRO	40.53	45.49	12.24%
NUCLEAR	4.78	6.78	41.84%
WIND	21.04	34.30	63.02%
SOLAR	2.63	23.02	775.0%
SMALL HYDRO	3.80	4.49	18.15%
BIOPOWER	7.5	8.84	17.86%
TOTAL	248.55	344.79	38.72%

1.2

Renewable Energy Growth Story

Renewable energy's share in India's overall energy mix has increased from 14% in 2014 to 20.2% in 2018

1.2.1 Energy mix in policy

Renewable energy's share in India's overall energy mix has increased from 14% in 2014 to 20.2% in 2018. Installed renewables capacity has increased by 102%⁷ to a current total of 69 GW. This comprises:

- * 49.5% wind energy (34.05 GW)
- * 31% solar energy (21.65 GW)
- * 13% biomass based power (8.8 GW)
- * 6.5% small hydro (4.48 GW)

In the same period, coal based thermal power has added only 35% new capacity. Coal based power still dominates India's energy mix as of today. However, its share in new plants has declined dramatically. This trend is expected to persist for another 5 years as coal continues to face multiple challenges:

- * Increased conflicts for natural resources
- * Escalating costs
- * High air and water pollution impacts
- * Sharp drops in RE prices, particularly solar photovoltaic (PV)

India Energy Security Scenarios (IESS) projections of Niti Aayog⁸ and Istituto Affari Internazionali's "India's Institutional Governance and the Energy Transition"⁹ predict that the bulk of new generation capacity will be renewable. Solar energy will form a lion's share of this, dominating all new capacity addition. After a slowdown period, wind energy is also set to make strides, particularly by unlocking offshore potential.

TABLE 2 | Current installed RE capacity in 7 key states (in GW)¹⁰

RAJASTHAN CURRENT INSTALLED RE CAPACITY							
SOLAR	WIND	BIOMASS	SMALL HYDRO	TOTAL INSTALLED RE CAPACITY	TOTAL INSTALLED CAPACITY	% SHARE OF RE	% INCREASE IN RE INSTALLATION IN THE LAST 4 YEARS
2.31	4.28	0.12	0.024	6.8	21.05	32.30%	93%

GUJARAT CURRENT INSTALLED RE CAPACITY							
SOLAR	WIND	BIOMASS	SMALL HYDRO	TOTAL INSTALLED RE CAPACITY	TOTAL INSTALLED CAPACITY	% SHARE OF RE	% INCREASE IN RE INSTALLATION IN THE LAST 4 YEARS
1.35	5.54	0.065	0.017	7.37	30.87	23.87%	66%

MAHARASHTRA | CURRENT INSTALLED RE CAPACITY

SOLAR	WIND	BIOMASS	SMALL HYDRO	TOTAL INSTALLED RE CAPACITY	TOTAL INSTALLED CAPACITY	% SHARE OF RE	% INCREASE IN RE INSTALLATION IN THE LAST 4 YEARS
0.77	4.78	2.08	0.35	8.76	43.25	20.25%	67%

ANDHRA PRADESH | CURRENT INSTALLED RE CAPACITY

SOLAR	WIND	BIOMASS	SMALL HYDRO	TOTAL INSTALLED RE CAPACITY	TOTAL INSTALLED CAPACITY	% SHARE OF RE	% INCREASE IN RE INSTALLATION IN THE LAST 4 YEARS
2.16	3.83	0.44	0.16	7.08	23.41	30.24%	650% with Telangana

TELANGANA | CURRENT INSTALLED RE CAPACITY

SOLAR	WIND	BIOMASS	SMALL HYDRO	TOTAL INSTALLED RE CAPACITY	TOTAL INSTALLED CAPACITY	% SHARE OF RE	% INCREASE IN RE INSTALLATION IN THE LAST 4 YEARS
2.99	0.10	0.16	0.091	3.76	15.2	24.73%	650% with Andhra

KARNATAKA | CURRENT INSTALLED RE CAPACITY

SOLAR	WIND	BIOMASS	SMALL HYDRO	TOTAL INSTALLED RE CAPACITY	TOTAL INSTALLED CAPACITY	% SHARE OF RE	% INCREASE IN RE INSTALLATION IN THE LAST 4 YEARS
1.80	3.79	1.60	1.23	12.75	27.01	47.20%	131%

TAMIL NADU | CURRENT INSTALLED RE CAPACITY

SOLAR	WIND	BIOMASS	SMALL HYDRO	TOTAL INSTALLED RE CAPACITY	TOTAL INSTALLED CAPACITY	% SHARE OF RE	% INCREASE IN RE INSTALLATION IN THE LAST 4 YEARS
1.82	7.97	0.90	0.12	11.52	30.25	38.08%	36%

TOTAL | CURRENT INSTALLED RE CAPACITY

SOLAR	WIND	BIOMASS	SMALL HYDRO	TOTAL INSTALLED RE CAPACITY	TOTAL INSTALLED CAPACITY	% SHARE OF RE	% INCREASE IN RE INSTALLATION IN THE LAST 4 YEARS
13.22	30.3	5.36	2.145	58.04	191.04	30.38%	

1.2.2 RE shortfalls

Despite its impressive growth to 21.65 GW, solar's share in the energy mix stands at a little over 6%. 80% of the National Solar Mission (NSM) target for 2022 remains to be achieved. However, solar projects driven by the Solar Energy Corporation of India (SECI), that are utility scale, ground-mounted and grid-connected, have been well-funded and appear to be on course to meet their target of 60 GW.

A recent CRISIL report¹¹ suggests that India may fall short of achieving its 100 GW solar target by 25%, primarily because rooftop solar has not taken off as well as is necessary. This shortfall has been attributed to higher cost of generation, limited off-take options, and lack of cheap financing. State solar projects have also failed to take off within stipulated time frames.

1.3

About Study

1.3.1 Need for study

India's energy transition from fossil fuels to renewable energy is critical to tackling the climate crisis. However, the environmental and social implications of India's massive RE expansion plans have not been studied well. RE comes with a "green" and "sustainable" tag. While there is no doubt that RE is greener and more sustainable than fossil fuel based electricity, the impacts of large-scale RE projects are not well-documented. This report attempts to address this gap and studies the regulation of RE in more detail.



We examine and review existing policies, regulatory structures and instruments to promote, develop, monitor and regulate RE, at the central and state levels. Our goal is to determine whether strong safeguards exist to prevent environmental or social damage large-scale RE projects may cause. Such a study can help identify drawbacks and shortcomings in the existing framework. It can initiate a discussion on preventive and remedial measures to ensure that RE projects don't create and/or perpetuate the same environmental and social issues as large-scale conventional energy projects.

We studied the support for RE expansion in these seven states. We visited two large-scale RE projects in different states

1.3.2 Study methodology

Seven states account for more than 80% (50.88 GW) of total installed RE capacity in the country: Rajasthan, Gujarat, Maharashtra, Andhra Pradesh, Telangana, Karnataka, and Tamil Nadu. These states have good solar irradiation and/or high wind speeds, making them ideal for solar and wind energy installations.

- * These seven states account for 47% of the country's overall electricity demand.
- * 55% of the country's installed electricity capacity from all sources, conventional and renewable, is situated in these seven states.
- * Karnataka has the highest installed capacity of RE power in the country, followed by Tamil Nadu and Maharashtra.
- * Telangana now has the largest installed capacity of solar power in the country.

We studied the support for RE expansion in these seven states. We examined their policies and regulations to understand the state level regulatory frameworks being put in place to support the national regulatory framework.

We visited two large-scale RE projects in different states. On site, we surveyed the local environmental and social impacts of these projects.

1.3.3 Criteria for case selection

We chose to visit the Andhra Lake Wind Farm in Maharashtra and the Pavagada Solar Park in Karnataka. Salient features of these projects are as follows.



Andhra Lake Wind Farm, Maharashtra

- * It is located in one of the country's most eco-sensitive zones, the Western Ghats.
- * The project has been strongly opposed by the local community.
- * Due to its adverse effects on biodiversity and forest rights, this project has been referred to in the report of the Western Ghats Ecology Panel chaired by Madhav Gadgil, submitted to the Ministry of Environment, Forest and Climate Change (MoEFCC).

Pavagada Solar Park, Karnataka

- * This was India's largest utility scale solar project in 2018, and has the potential to reveal the maximum number and widest range of challenges.
- * Securing land is one of the most common hurdles for big infrastructure projects. The project uses an innovative solution for this.



2.0

POLICIES, GUIDELINES, & REGULATORY PROVISIONS

2.1

Central Government Policies

The new target sets India on course to become one of the largest green energy producers in the world, surpassing several developed countries

India has upscaled its renewable energy ambition massively, and targets achieving them in a relatively short timespan. This ambition is supported by several mission programmes and policy frameworks. These are listed in this section, along with other regulatory provisions and guidelines that govern the renewables sector at central and state levels. State-level RE policies of seven key states are also discussed here. The preambles of RE policies of all seven states are analysed to assess the environmental, climate and energy related priorities of these policies.

2.1.1 National Solar Mission

The Indian government's National Action Plan on Climate Change includes several key initiatives towards environmentally sustainable energy security. Among these is the flagship programme, the **National Solar Mission (NSM)**, with a mission to establish India as a global leader in solar energy. It proposes to do this by creating policy conditions for large scale diffusion of solar power across the country as quickly as possible.

Launched in 2012 as Jawaharlal Nehru National Solar Mission (JNNSM), it originally targeted achieving utility-scale, grid-connected solar deployment of 20 GW by 2022. In May 2014, this target was revised to 100 GW, comprising 40 GW of rooftop solar and 60 GW of large- and medium-scale grid-connected projects. The new target sets India on course to become one of the largest green energy producers in the world, surpassing several developed countries¹².

The Indian government recognised the importance of solar energy as far back as 2006, demonstrated by the launch of the rural electrification programme¹³. Nevertheless, the mainstreaming of solar energy into large-scale electricity generation and distribution only began with the NSM. In 2011, the Solar Energy Corporation of India (SECI) was formed with a mandate to oversee the implementation and achievement of targets set in the NSM¹⁴.

The total investment for setting up 100 GW is estimated to be around ₹6,00,000 crore. In the first phase, the Government of India (GoI) has given a capital subsidy of ₹15,050 crore for rooftop solar projects in cities and towns, for Viability Gap Funding (VGF) based projects to be developed through SECI, and to support decentralised generation through small solar projects. Another ₹90,000 crore is to be invested in bundling schemes. A bundling mechanism is one in which a 'bundle' of relatively expensive solar power and cheaper power is sold to the DISCOM at weighted average price. The cheaper power comes from the unallocated quota of the Ministry of Power, generated at NTPC Limited's coal based stations. Further investment is expected from large Public Sector Undertakings (PSU) and Independent Power Producers (IPP). In addition to the NSM, most state governments have also formulated state-specific solar policies to promote solar capacity addition. As a result of strong support policies, solar capacity has grown 700% from 2.6 GW to 21.65 GW in the last four years.

“With a current installed capacity of 34 GW, wind forms the largest portion of the country’s RE mix, standing at 49.5% of the total”

2.1.2 National Offshore Wind Energy Policy

India’s wind energy target of 60 GW is slated to be achieved by 2022. With a current installed capacity of 34 GW, wind forms the largest portion of the country’s RE mix, standing at 49.5% of the total. Over the last four years, installed capacity has grown 38%. India is the world’s fourth largest producer of wind energy.

However, the wind energy sector had begun to experience a slowdown over the last few years. Key reasons for this were the removal of supportive fiscal incentives such as accelerated depreciation for wind farm investments, and the absence of supportive regulations, policies and programmes, such as NSM for solar.

To correct this, the Indian government approved the **National Offshore Wind Energy Policy**¹⁵ in September 2015. The aim of this policy is to promote offshore wind farms in India by ensuring injection of massive investment flow, both domestic and foreign, into the wind energy sector. Investments had begun to plateau over the five years prior to the introduction of the policy.

Although the policy doesn’t name specific targets, India intends to join the world’s top offshore wind power producing countries: the United Kingdom, Germany, Belgium, Denmark, The Netherlands, Sweden, and China, which have a total installed capacity of 8.7 GW.

The policy also aims to promote spatial planning for offshore wind turbines and the management of maritime RE resources in the country’s Exclusive Economic Zones (EEZ) through suitable incentives. An EEZ is the marine area between 12 and 200 nautical miles from the coast. As per international law, India holds the right to construct structures such as wind farm installations in its EEZs.

The Ministry for New and Renewable Energy (MNRE) is the nodal ministry for the execution of this policy. It is tasked with ensuring overall monitoring of offshore wind development in the country. To this end, it needs to:

- * Work with other ministries/departments
- * Issue guidelines/directives for the development of offshore wind energy
- * Oversee the working of the nodal agency and support it
- * Facilitate international cooperation
- * See to tariff setting and regulatory issues

The National Institute for Wind Energy (NIWE), headquartered in Chennai, is the nodal agency for this Policy. It is responsible for:

- * Facilitating international competitive bidding for offshore wind projects
- * Easing clearances from concerned ministries and departments for these projects
- * Demarcating offshore wind energy blocks

2.1.3 Renewable Energy Regulatory Framework¹⁶

The Electricity Act 2003, widely considered a cornerstone of power sector reform in India, was the first to set up electricity regulatory commissions at the centre and state levels¹⁷.

The State Electricity Regulatory Commissions (SERCs) thus set up need to ensure the development of grid-connected or grid-interactive RE in their respective states. The Act empowers SERCs to promote RE by:

- * Determining tariff
- * Specifying Renewable Purchase Obligation (RPO)
- * Facilitating grid connectivity
- * Promoting market development¹⁸

Sources of RE are not evenly spread across different parts of the country. Some states produce well in excess of the RPO set for their for their state, while other states do not have the RE potential to meet the RPO targets set for them.

To address this mismatch, the Central Electricity Regulatory Commission (CERC) created a market-based instrument called Renewable Energy Certificates (REC). RECs are transferable and saleable credit certificates set up through the CERC (Terms and Conditions for Recognition and Issuance of Renewable Energy Certificate for Renewable Energy Generation) Regulations 2010, also called REC Regulation 2010¹⁹.

RPO is a legal instrument created under Section 66 of the Act. It requires electricity distribution companies in states and union territories (UT), captive power consumers, and bulk consumers of 1 MW and above, to either buy electricity generated by specified 'green' sources, or buy RECs in lieu of that from the market. The regulatory framework for RE is evolving. All major states, CERC, and CEA regularly declare, revise, and modify RE policy, RPOs, Feed-in Tariffs (FiTs), REC mechanisms, grid connectivity and forecasting provisions, etc.

2.1.4 National Tariff Policy

The National Tariff Policy (NTP), governed by the Electricity Act 2003, guides the setting of power rates, signing of power purchase agreements (PPAs), and the sale and purchase of coal and power (conventional and renewable). In 2016, the NTP was amended²⁰ to help increase uptake of RE, source power through competitive bidding, and achieve the objectives of the Ujwal DISCOM Assurance Yojana (UDAY). Some salient features and objectives of the NTP are as follows:

- * **Revised RPO targets:** State DISCOMs had a poor record of meeting state-specific RPO targets set for them. The NTP set a uniform RPO of 18% for all state governments to comply with by 2022. The RPO, which is proportional to



the total units of electricity supplied by a DISCOM, was further broken down as 8% solar RPO and 10% non-solar RPO. This was done to encourage the development of upto 175 GW of RE capacity nationally. It was also aimed to spread the uptake of RE uniformly across states, in proportion to the state's electricity demand. The NTP specifies that the solar RPO component does not apply to pumped storage power sourced from hydro power plants.

- * **RGOs:** The NTP introduced Renewable Generation Obligations (RGOs) for new coal/lignite based thermal plants. These new plants will need to establish or procure a certain percentage of RE to meet their RPO. The modalities of RPO and RGO are to be determined by the state electricity regulator.
- * **24*7 electricity for all by 2022:** State governments and regulators were tasked with devising a power supply trajectory to achieve this. Power is to be provided to remote unconnected villages through micro grids. Micro grids will be allowed to feed electricity into the main grid as and when the grid connection reaches them.
- * **Increased efficiency, cheaper power:** RE plants were allowed to increase power production on the same project site to 100% capacity. This enables optimal utilisation of land and other resources, and eliminates the need to obtain new land and attendant clearances. It increases the financial viability of projects, attracting and promoting private investment.
- * **Encouraging inter-state transmission:** Inter-state transmission charges and losses due to injection of solar and wind power have been waived.



2.2

Legal Obligations

2.2.1 Environmental Clearance

The **Environmental Impact Assessment (EIA) Notification 2006²¹**, notified under the **Environment (Protection) Rules 1986**, requires projects across sectors to get an EIA done. This is a prerequisite to getting an environmental clearance (EC). Based on potential effects on the area, human health, natural and man-made resources, the notification broadly divides projects into the following categories:

A

Category

Projects with potentially significant impact must carry out an EIA and a public hearing to get an EC from the MoEFCC.

B

Category

Projects with potentially less significant impact are evaluated and cleared by state level authorities: the State Environment Impact Assessment Authority (SEIAA) and State Expert Appraisal Committee (SEAC).

C

Category

Projects expected to have negligible negative effects on the environment need not carry out an EIA. Solar and wind power projects of all sizes are classified in this category and are exempt from seeking an EC. Schedule I of the notification enumerates the types of projects and activities that need prior EC, and neither solar nor wind power projects are listed in it.



Both wind and solar projects must get a No Objection Certificate and a Consent to Establish from the State Pollution Control Board of their respective states

So far, it has been assumed that solar and wind power projects have negligible carbon footprints and negative effects on the environment. In comparison to conventional power plants, this is true. However, improper project implementation can significantly affect local ecology.

In several countries, an EIA is required for large-scale RE projects. Wind projects must carry out EIAs in the US, UK, Ireland, Denmark, Netherlands, Germany, Spain, and China. According to a report²² by the Centre for Science and Environment (CSE), wind projects in India funded by international institutions like the Asian Development Bank (ADB) or the World Bank carry out an EIA. An example is the ADB-funded Tata Power 50.4 MW wind farm in Dhule, Maharashtra.

Both wind and solar projects must get a No Objection Certificate (NoC) and a Consent to Establish (CtE) from the State Pollution Control Board (SPCB) of their respective states under the **Air (Prevention and Control of Pollution) Act 1981**²³ and **Water (Prevention and Control of Pollution) Act 1974**²⁴.

Wind and solar projects also need to be cleared by the Central Ground Water Board (CGWB) or the state Water Resource Department (WRD) or both for use of ground-water and surface water. In water-stressed zones, the CtE may stipulate that water be brought from outside.

There have been some instances of confusion about the EC exemption for wind and solar projects at the SPCB level. In some states, solar thermal power projects were asked for an EC. Concentrated Solar Plants (CSP), also known as solar thermal power plants, like all thermal electric plants, require water for cooling. Water use depends on plant design, plant location, and type of cooling system installed. CSP plants that use wet-recirculating technology with cooling towers draw between 2200 and 2500 litres of water per megawatt-hour of electricity produced. Dry-cooling technology can reduce water use by approximately 90%. A solar thermal power plant requires an area of about 2.0 to 2.5 hectares of land per MW capacity depending on its configuration. The MNRE asked the MoEFCC to exempt CSPs, which clarified that solar thermal power plants are not covered by the EIA Notification 2006 and are not required to obtain an EC²⁵.

2.2.2 Land acquisition

The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act 2013 (also known as the **Land Acquisition Act 2013**)²⁶ was passed to ensure a “human, participative, informed and transparent process for land acquisition for industrialisation, development of essential infrastructural facilities and urbanisation with the least disturbance to the owners of the land and other affected families and provide just and fair compensation to affected families whose land has been acquired.” To achieve this goal, land has

“The relevant government needs to ensure that a social impact assessment report and a social impact management plan are prepared”

to be acquired in active consultation with local self-governance institutions and gram sabhas. The Act replaced the Land Acquisition Act 1894, a nearly 120-year-old law enacted during British rule.

The Land Acquisition Act 2013 applies to large-scale RE projects, including wind and solar. When a private company needs to acquire land to set up solar or wind farms, it needs to negotiate fair compensation as per the Act. This is where the state government comes into the picture. In its section on “preliminary investigation for determination of social impact and public purpose”, the Act requires the relevant government to consider the likely impact on livelihoods of affected families, public and community properties, sources of water for cattle, community ponds, grazing grounds, burial grounds, land for traditional tribal institutions, cremation grounds etc. The relevant government needs to ensure that a social impact assessment (SIA) report and a social impact management plan are prepared. These must be made available in the local language to the affected panchayats, municipalities and municipal corporations for the community to access.

If the land is not acquired by the government, the developer can buy it directly. In this case, the compensation is decided between the buyer and seller. Project developers need approval from the local revenue authority (Collector/Sub-Divisional Officer/Tehsildar) to use the purchased land for commercial purposes.

2.2.3 Coastal Regulation Zone Clearance

In 1991, the then Ministry of Environment and Forests (MoEF) issued the Coastal Regulation Zone (CRZ) Notification²⁷. The Notification was guided by the principles of conservation of fragile coastal ecosystems and biological resources, and protection of livelihoods of fishermen and rights of coastal communities. It has since undergone many amendments. It applies to both wind and solar power projects. The new draft CRZ Notification 2018 issued by the central government in April 2018 is available in the public domain for comments and feedback²⁸. It allows non-conventional power projects, such as solar and wind, to be set up in some types of CRZs subject to prior approval. The approval will be awarded by the MoEFCC on the recommendation of the concerned Coastal Zone Management Authority (CZMA).

These projects will be permitted in two types of CRZ areas:

- * **CRZ-I B:** CRZ-I areas are the most environmentally critical areas on land and in water along the coast. They are further divided into two subcategories: CRZ-I A and CRZ-I B. CRZ-I B is the intertidal zone, i.e., the area between Low Tide Line and High Tide Line.
- * **CRZ-IV:** This constitutes water area.

2.2.4 Forest Land Diversion

The **Forest (Conservation) Act 1980**³⁰ (FCA) restricts and regulates the de-reservation of forests or use of forest land for non-forest purposes without prior approval from the central government. It lays down prerequisites for the diversion of forest land for non-forest purposes. A few noteworthy implications are as follows.

- * **Project type:** Solar power projects are extremely unlikely to be situated in forested regions due to technological hurdles. Wind power projects, particularly large-scale ones, frequently require diversion of forest lands, since suitable sites for wind power generation often fall within (hilly) natural forest regions.
- * **Proposal type:** As per Rule 6 of the Forest (Conservation) Rules 2003, any project which requires use of forest land for non-forest purposes needs to create a proposal using the appropriate form (appended to the rules). Form A is for proposals seeking first time approval, and Form B is for proposals seeking renewal of leases previously approved by the central government.
- * **Land area:** For projects that need 5–40 hectares, a State Advisory Group (SAG) makes recommendations to the regional office of the MoEFCC. For projects that need more than 40 hectares, a Forest Advisory Committee (FAC) at the central level gives its recommendations to the central office of the MoEFCC.
- * **Forest type:** The MoEFCC clears diversions of reserved forest land. Clearance for revenue land or protected forests is awarded by the forest department of the state where the project is proposed to be set up. Some states provide single window clearance systems and/or obtain clearance from the relevant authorities on behalf of project developers.
- * **Afforestation:** As compensation for diverted forest land, developers must pay for purchase of land for afforestation. Afforestation must be done on an equivalent area of non-forest land or over degraded forest twice the area being diverted, if non-forest land is not available. This land has to be located as close as possible to the site of diversion, and has to be transferred to the state forest department with sufficient funds for compensatory afforestation. The diverted land is then declared reserved forest.
- * **Net Present Value:** Directed by the Supreme Court in 2002, a Central Empowered Committee (CEC) set up by the MoEFCC laid down the procedure for the use of monies received from project developers for compensatory afforestation. This is supposed to compensate for the loss of tangible and intangible benefits from forest land diverted for non-forest use through recovery of Net Present Value (NPV) of the diverted forests. Project developers must pay the NPV for the land diverted. A three-member expert committee

chaired by Prof. Kanchan Chopra was constituted to determine the basis on which this NPV could be fixed, which projects could be exempted from paying, and a number of other issues. The Indian Wind Power Turbine Manufacturers Association (IWPTMA) made its case for exemption before this committee. The committee recommended a 90% exemption on payment of NPV for wind power companies. In its opinion, most of the diverted forest land could continue to be used for forestry related purposes. The CEC disagreed and recommended a 50% exemption, which the Supreme Court accepted³¹.

Between 2014 and 2018, forest land was diverted for power projects as follows³²:

- * 612.51 hectares of forest land was diverted for wind power projects.
- * 27 wind projects sought, and were awarded, approval for diversion for forest land: 11 in Madhya Pradesh, 8 in Karnataka, 4 in Gujarat, 2 in Andhra Pradesh, and 1 each in Uttar Pradesh and Uttarakhand.
- * 375.33 hectares of forest land was proposed to be diverted for 128 small hydro power projects.
- * 7248.462 hectares of forest land was approved for diversion for coal mining and coal based power projects.
- * No forest land was proposed to be diverted for solar projects in any state or UT.

2.2.5 Forest rights

Diversion of forest land for RE projects also needs compliance with the **Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act 2006** (FRA). Rules notified under the FCA require the District Collector to settle rights under FRA, get consent from the gram sabha(s) as required, and send the report to the Conservator of Forests within a specified time that depends on the area being diverted.

2.2.6 Wildlife protection

The **Wildlife Protection Act 1971** prohibits setting up of industrial and commercial projects in or near protected areas, such as national parks, sanctuaries, conservation reserves, and community reserves. Only government projects deemed to be in the public interest are considered for approval. Permission for such projects can only be granted by a high powered committee constituted by the MoEFCC. This applies to solar and wind projects as well.



2.2.7 Hazardous waste

Solar panels contain hazardous chemicals such as cadmium, hexavalent chromium, and lead. These can leach from damaged panels or panels discarded during decommissioning. To mitigate the threat this poses to the environment, proper monitoring and specialised disposal are needed.

Used oils from moving parts of wind turbines also require proper disposal.

The Hazardous and Other Waste (Management and Transboundary Movement) Rules 2016 apply to large-scale solar and wind power projects

The **Hazardous and Other Waste (Management and Transboundary Movement) Rules 2016** apply to large-scale solar and wind power projects.

Proponents of these projects must obtain clearance from the concerned SPCB or Union Territory Pollution Control Committee (UTPCC). However, these rules do not delineate how panels, cells, and modules are to be disposed. They also do not specify who is responsible for disposal.

The **Battery (Management and Handling) Rules 2001** under the Environment (Protection) Act apply to both solar and wind power projects if batteries are used for storage of power. Project developers have to set up a system for proper disposal of batteries.

Solar panels are also deemed a form of toxic, hazardous e-waste, and should therefore fall within the purview of the **E-Waste Management Rules 2016**. Recently, the MNRE released a blueprint for the utilisation, manufacture, disposal, and import of solar modules and glass containing antimony. This was in response to directions issued by the National Green Tribunal (NGT) citing severe adverse impacts of improper disposal of solar PV panels. NGT directed the Central Pollution Control Board (CPCB) to amend the E-Waste Rules 2016 and bring antimony within the scope of Rule 16 pertaining to hazardous substances.

TABLE 3 | Regulatory mapping of central government laws and rules on RE

CLEARANCE		WIND POWER		SOLAR POWER	
TYPE	REGULATION	CLEARANCE	INSTITUTION	CLEARANCE	INSTITUTION
Environmental clearance	EIA Notification 2006	EC exempt	N.A.	EC exempt	N.A.
Air pollution	Air (Prevention and Control of Pollution) Act 1981	CtE, CtO for quarry mining, stone crushing, hot mix plant for access road construction	SPCB	CtE, CtO for quarry mining, stone crushing, hot mix plant for access road construction	SPCB
Water pollution	Water (Prevention and Control of Pollution) Act 1979	Consent for sewage/effluent discharge on land or in water bodies	SPCB	Consent for sewage/effluent discharge on land or in water bodies	SPCB
Water use	Water (Prevention and Control of Pollution) Act 1979	CtE, CtO Payment of water cess for use >10 KLD	SPCB	CtE, CtO Payment of water cess for use > 10 KLD	SPCB
Groundwater	EPA 1986	NOC required if project uses groundwater	<50m3/day: Dist. Magistrate/ Commissioner 50–500m3/day: state groundwater authority/ SNA >500m3/day: CGWB	NOC required whether or not project uses groundwater	<50m3/day: Dist. Magistrate/ Commissioner 50–500m3/day: state groundwater authority/ SNA >500m3/day: CGWB
Surface water	EPA 1986	Approval to draw water from state WRD/special river basin management authorities	State WRD, gram panchayat	Approval to draw water from state WRD/special river basin management authorities	State WRD, gram panchayat
Land acquisition	Land Acquisition Act 2013, state rules	SIA, consent of landowners, R&R plan (unless excepted by state laws)	Relevant state departments, revenue department, District Collector	SIA, Consent of landowners (unless excepted by state laws)	Relevant state departments, revenue department, District Collector
CRZ clearance	CRZ Notification 2011/Draft CRZ Notification 2018	CRZ clearance (permitted in CRZ IV only)	MoEFCC, state CZMA	CRZ clearance (permitted in CRZ IV only)	MoEFCC
Forest land diversion	Forest (Conservation) Act 1980	Prior approval by MoEFCC, final approval by state government	5–40HA: SAC recommends to regional MoEFCC office >40HA: FAC recommends to central MoEFCC office No projects near protected areas, biosphere receivers, sanctuaries	NOC required whether or not project uses groundwater	5–40HA: SAC recommends to regional MoEFCC office >40HA: FAC recommends to central MoEFCC office

CLEARANCE		WIND POWER		SOLAR POWER	
TYPE	REGULATION	CLEARANCE	INSTITUTION	CLEARANCE	INSTITUTION
Hazardous waste	Hazardous and Other Waste (Management and Transboundary Movement) Rules 2016	Consent required if operations involve hazardous waste, e.g., used oils from turbines	SPCB	Consent required if operations involve hazardous waste, eg end-of-life solar panels containing scheduled hazardous chemicals	SPCB, at time of dismantling
	Battery (Management and Handling) Rules 2001	NA	NA	Consent for battery disposal and recycling	SPCB

2.3

State Government Policies

80% of India's large-scale RE capacity is installed in seven states, which includes solar, wind, small hydro, and biomass based energy. Between them, these seven states account for 92% of the country's total installed wind energy capacity and 77% of the country's total installed solar energy capacity. We examined the RE policies of these seven states.

- * **Rajasthan:** Rajasthan Solar Energy Policy 2014³³ and Policy for Promoting Generation of Electricity from Wind 2012³⁴.
- * **Gujarat:** Gujarat Solar Power Policy 2015³⁵ and Gujarat Wind Power Policy 2016³⁶.
- * **Maharashtra:** Comprehensive Policy for Grid-connected Power Projects based on New and Renewable (Non-conventional) Energy Sources 2015³⁷.
- * **Andhra Pradesh:** Andhra Pradesh Solar Power Policy 2015³⁸ and Andhra Pradesh Wind Power Policy 2015³⁹.
- * **Telangana:** Telangana Solar Power Policy 2015⁴⁰ and Telangana Wind Power Policy 2016⁴¹.
- * **Karnataka:** Karnataka Solar Policy 2014–2021⁴² and Karnataka Renewable Energy Policy 2014–2020⁴³.
- * **Tamil Nadu:** Tamil Nadu Solar Energy Policy 2012⁴⁴.

This section describes the policy and regulatory support mechanisms for large-scale solar and wind projects in these states. In particular, we examine whether socio-economic, environmental, transparency and accountability tradeoffs are being made to promote solar and wind. We also explore if common social and

environmental safeguards applicable to other industrial and commercial projects apply to large-scale RE projects, and whether there are any additional safeguards.

2.3.1 Project approvals

All state RE policies assign project approval related responsibilities to their respective State Nodal Agency (SNA). These include:

- * Facilitating the registration of the project and its developers
- * Overall project development
- * Tendering and bidding
- * Providing single window clearance

SNAs are tasked with promotion and development of renewables in their states. Rajasthan, Telangana, Karnataka, and Tamil Nadu augment the services offered by their SNAs with separate institutional arrangements for project approval. This simplifies cumbersome inter-departmental approval mechanisms and helps implement RE policies more effectively.

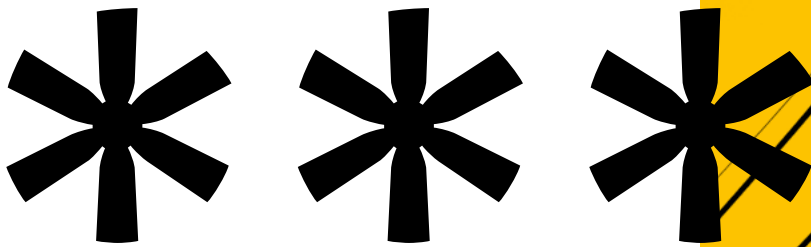
Rajasthan has two separate committees for screening and approval of projects. The State Level Screening Committee (SLSC) is headed by the Principal Secretary/Secretary, Energy. It approves, in-principle, solar power projects which are either being set up under the REC mechanism, or for captive use, or for open access solar plants outside Rajasthan. It does the same for wind projects which directly sell generated electricity to state DISCOMs. The State Level Empowered Committee (SLEC), headed by the Chief Secretary, grants final approval to solar projects of capacity greater than 10 MW, and to wind projects cleared by SLSC.

In Rajasthan, solar power projects set up under NSM are considered to be approved in-principle if PPAs are signed with NTPC Vidyut Vitaran Nigam (NVVN) or MNRE or SECI. If NSM solar projects sell their electricity directly to DISCOMs, they need not obtain in-principle approval. Instead, the project is awarded through a competitive bidding process carried out by Rajasthan Renewable Energy Company Limited (RRECL), the SNA. RRECL also approves projects not covered by SLSC and SLEC and not exempt from approval requirements.

“Rajasthan, Telangana, Karnataka, and Tamil Nadu augment the services offered by their SNAs with separate institutional arrangements for project approval”

Telangana's separate institutional arrangements for project approval and clearance are further separated into wind and solar projects. The Solar Policy Cell offers a single-window clearance mechanism for speedy approval for solar power projects for a fee of ₹10,000 per MW. The Wind Policy Cell offers single window clearance for wind projects in the state, charging ₹25,000 per MW for the service.

Karnataka has a separate institutional arrangement for project approval only for solar projects of 50 MW or higher capacity. This committee is headed by the Additional Chief Secretary and comprises Secretaries from the Energy, Finance, Revenue, Irrigation, and Forest Departments along with Managing Directors of Karnataka Power Transmission Company Limited (KPTCL), the SNA Karnataka Renewable Energy Development Limited (KREDL), and state electricity supply companies (ESCOs). Wind power projects require more scrutiny as compared to solar projects due to their site specificity and frequent location in forest land.



Tamil Nadu has an Empowered Committee headed by the state Energy Minister, comprising the Chief Secretary, the Finance Secretary, the Energy Secretary, and the Chief Managing Director (CMD) of the state transmission company. The CMD of the SNA, Tamil Nadu Energy Development Agency (TEDA), serves as member secretary. It clears and approves solar power projects of all capacities in the state. TEDA provides single window clearance for solar power projects.

In Gujarat, Maharashtra, and Andhra Pradesh, SNAs are authorised to approve projects. This includes:

- * Registration of projects under the relevant solar, wind, or RE policy
- * Facilitation of inter-departmental approval and clearances
- * Accreditation and approval of projects with central agencies for RECs

2.3.2 Project monitoring

Rajasthan, Maharashtra, Andhra Pradesh, and Telangana have laid out project monitoring mechanisms. Rajasthan's SNA monitors solar power projects only. In Maharashtra, a committee chaired by the Chief Secretary carries out mid-term review of policy and modifies targets accordingly.

In Andhra Pradesh and Telangana, high powered committees led by the respective state Energy Secretaries have been set up to separately monitor projects approved under the states' solar and wind policies. These committees have representatives from their respective SNAs, their DISCOMs, and state generating companies and transmission companies. Two representatives from the renewables industry bring in perspectives and concerns of project implementers into consideration.

Gujarat, Karnataka, and Tamil Nadu do not mention project monitoring mechanisms, even as responsibilities of their SNAs, in their state solar and wind energy policies.

TABLE 4 | State-wise project approval and monitoring agencies

STATE	STATE NODAL AGENCY		OTHER INSTITUTIONAL ARRANGEMENTS	
	NAME OF AGENCY	POWERS AND FUNCTIONS	NAME OF AGENCY	POWERS AND FUNCTIONS
Rajasthan	Rajasthan Renewable Energy Company Limited (RRECL)	» Project registration » Facilitation of inter-department clearances » Approval of projects not covered by SLSC/ SLEC	» State Level Screening Committee (SLSC) » State Level Empowered Committee (SLEC)	» In-principle approval of projects » Final approval
Gujarat	Gujarat Energy Development Agency (GEDA)	» Project registration » Facilitation of inter-department clearances » REC accreditation with central agency	» None	» N.A.
Maharashtra	Maharashtra Energy Development Agency (MEDA)	» Facilitation of RE projects	» None	» N.A.
Andhra Pradesh	Non-conventional Energy Development Corporation of Andhra Pradesh Limited (NREDCAP)	» Project approval	» None	» N.A.

STATE	STATE NODAL AGENCY		OTHER INSTITUTIONAL ARRANGEMENTS	
	NAME OF AGENCY	POWERS AND FUNCTIONS	NAME OF AGENCY	POWERS AND FUNCTIONS
Telangana	Telangana State Renewable Energy Development Corporation Limited (TSREDCO)	» Registration and facilitation of solar projects	» Solar Policy Cell » Wind Policy Cell » Gram panchayat	» Single window clearance, solar » Single window clearance, wind » Clearance for borewell digging and groundwater use
Karnataka	Karnataka Renewable Energy Development Limited (KREDL)	» Approval of solar projects < 50 MW » Approval and monitoring of wind projects	» High Level Project Approval Committee	» Approval and monitoring of solar projects > 50 MW
Tamil Nadu	Tamil Nadu Energy Development Agency (TEDA)	» Single window clearance for solar projects	» Empowered Committee	» Final approval and clearance of projects

2.3.3 Environmental clearance

Rajasthan categorises all types of solar power projects as ‘green’, and exempts them from getting ECs. Wind power projects are explicitly exempted as well.

Telangana’s solar policy explicitly requires solar PV and solar thermal projects to get an environmental clearance from the Telangana State Pollution Control Board (TSPCB). This has caused some confusion, because ECs are generally awarded by the MoEFCC. Even though the environmental impact of wind power plants is greater than that of solar power plants, the former are exempt from getting an EC from the TSPCB.

Karnataka’s wind energy policy requires wind power projects to get ECs, while exempting solar power projects. Maharashtra and Andhra Pradesh categorically exempt solar and wind power projects from obtaining ECs. Gujarat and Tamil Nadu’s state policies are silent on this.

“Most state governments preferentially provide government land for wind power projects; these projects are site specific”

2.3.4 Land acquisition

As a norm, state governments do not acquire land for private RE projects, either via their state RE policies or industrial promotion mechanisms. The Land Acquisition Act 2013 dissuades state governments from acquiring land on behalf of private investors, companies, or project developers. State governments only acquire or assist with acquisition of land in two situations:

- * For projects deemed to be in ‘public interest’, such as roads, highways, railway tracks, dams, ports, etc.
- * For projects part of a central or state government development programme which is to be implemented by central or state agencies for public good and not for commercial interest.

State governments do, however, provide support for land acquisition by private developers. Such support can be of several kinds:

- * Providing easy or automatic conversion of non-commercial/non-industrial land to commercial/industrial land
- * Making approval procedures at local bodies easy
- * Creating private land banks
- * Permitting leasing of land, etc.

State governments also offer government land for private RE projects. Most state governments preferentially provide government land for wind power projects since these projects are site specific.

A state-wise overview of land related policies follows.

Rajasthan

Rajasthan promotes a land leasing model to encourage farmers to set up small solar plants on their own farms

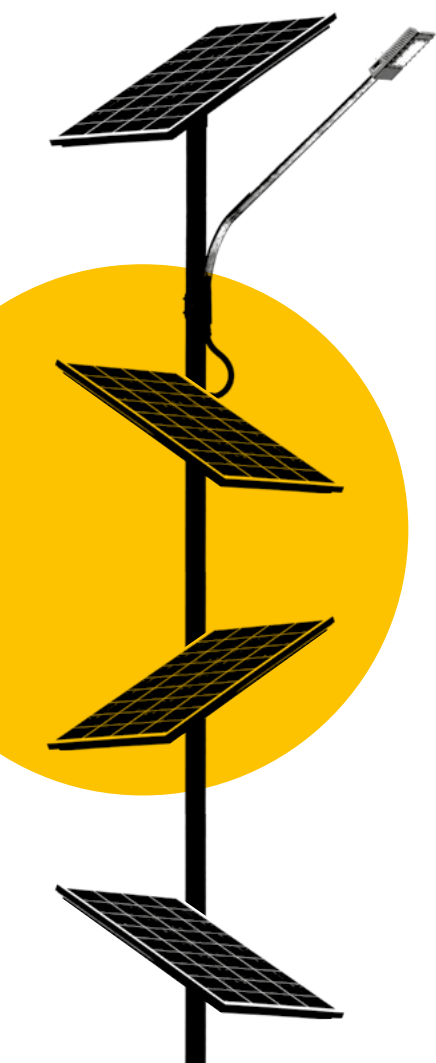
The Rajasthan Land Revenue (Allotment of Land for Setting up of Power Plant based on Renewable Energy Sources) Rules 2007 govern allotment of land for RE projects. Government land can be allotted to developers for solar power projects (including solar parks) and wind power projects on RRECL's recommendation. Land allotted for solar or wind parks can be further sub-leased to the power producer by the District Collector on RRECL's recommendation. For wind projects, this can be done before or after the commissioning of Wind Turbine Generators (WTG). If land is sub-leased after WTGs have been commissioned, stamp duty is levied on land cost only. A land ceiling based on the technology used applies to solar and wind power projects in the state. The maximum land allowed to various technologies is as follows.

- * **Solar, crystalline:** 2.5 hectares of land per MW (6 acres per MW)
- * **Solar, thin-film:** 3.5 hectares per MW (8.6 acres per MW)
- * **Wind:** 5 hectares per MW (12.3 acres per MW)

Project developers submit a cash security deposit of ₹1,00,000/MW by demand draft in favour of RRECL, Jaipur. RRECL then recommends a land allotment to the concerned District Collector. The security deposit is refunded on successful completion of the project, and forfeited if the allotment of land is cancelled.

Wind power projects get a preference over solar power and other industrial projects. They get government land at a concessional rate of 10% of the District Level Committee (DLC) rate (agricultural land) as per the rules. Project developers are also allowed to purchase private land from private owners for wind power plants in excess of the ceiling prescribed in the Ceiling Act 1973. This is a very significant incentive unique to Rajasthan. The state requires conversion of private land to industrial use land for wind power plants before work starts. The conversion charges are 10% of those levied for industrial purposes. However, the state's solar policy is silent on this aspect for solar power projects. Other states studied in this report do not specify land conversion procedures for acquired private land.

Rajasthan also promotes a land leasing model to encourage farmers to set up small solar plants on their own farms. To enable this, the state government has amended the Rajasthan Tenancy Act 1955 and the Rajasthan Land Revenue Act 1956. Based on this land leasing solar farming model, the GoI announced a pan-Indian solar power scheme called Kisan Urja Suraksha evam Uttan Mahabhiyan (KUSUM) in the 2018 budget. KUSUM was approved for launch in February 2019.



Gujarat

The Gujarat Energy Development Agency (GEDA) leases land to wind power plant developers after approval from a coordination committee headed by the state Additional Chief Secretary. The state's solar policy is silent on allotment of government land for solar energy projects. However, the solar sector is accorded industry status, and is eligible for land allotment from government land pools on the recommendation of the state Industries Department.

Gujarat Industrial Development Corporation (GIDC) can acquire private land in addition to and near existing industrial estates in order to promote new industrial estates. It is presumed that these additionally acquired lands will be preferentially allotted to large-scale solar and wind power projects because of proximity to power consumers. This also enables existing industries to procure green power to meet their RPO targets. These lands can also be given to existing industries for captive RE power plants.

Gujarat's Industrial Policy 2015⁴⁵ instructs the state government to identify vacant government land in industrial areas/zones that can be used to create land banks for industry. The policy proposes advance valuations of such parcels of government land, which can later be allotted to investors on the Industries Department's recommendation. Policy documents propose simplified processes for conversion to non-agricultural land, change in tenure etc.

Maharashtra

Maharashtra provides government land on priority to the RE sector to promote RE in the state. The state's RE policy recognises solar and wind power projects as industrial units under the state's Industries Department.

Considering Maharashtra's land acquisition challenges, the state's RE policy has suggested that solar power projects be set up on land available with various government departments, including land that is located near and over canals and owned/maintained by the Water Resources Department. It has also proposed locating solar projects on land available for public transport, and in industrial areas, warehouses and townships, etc.

The state targets setting up of 7500 MW of solar power capacity by 2022. 2500 MW of the total solar power target is to be developed by Maharashtra State Power Generation Company Limited (MAHAGENCO) through the Public Private Partnership (PPP) model to meet its RGO. To meet 10% of this target, MAHAGENCO will enter into agreements with the WRD or other relevant local bodies to set up solar power projects along canals, lakes, and water bodies.

District Collectors are authorised to grant available government ‘wasteland’ on leasehold basis. For grid-connected solar projects up to 2 MW capacity, they can allocate up to 4 hectares of land after scrutinising the request. Such land can be given on lease without an auction, at 50% concessional rate, as per the Maharashtra Land Revenue Code and the Disposal of Government Land Rules 1971. This is done on a case-to-case basis and comes with specific terms and conditions. Such land can also be leased for manufacture of solar modules, equipment, and allied machinery.

Agricultural land acquired for solar or wind projects is given deemed conversion status. The policy specifies no fees or procedures for getting deemed conversion status. Maharashtra offers a land leasing model that allows private landowners to rent/lease their land for solar power projects.

Andhra Pradesh

“Andhra Pradesh provides available revenue land for wind projects in areas with high potential for wind power on the recommendation of its SNA”

Andhra Pradesh provides available revenue land for wind projects in areas with high potential for wind power on the recommendation of its SNA, Non-conventional Energy Development Corporation of Andhra Pradesh Limited (NREDCAP). Allotment is on a first-come-first-served basis.

The state assures forest land for wind power projects when high wind potential areas are available, subject to clearance. Project developers need to apply to the state Forest Department through the NREDCAP. The forest department can allot land as per its own guidelines/regulations.

Priority land allotment on long-term leases boosts wind turbine and solar equipment manufacturing in the state.

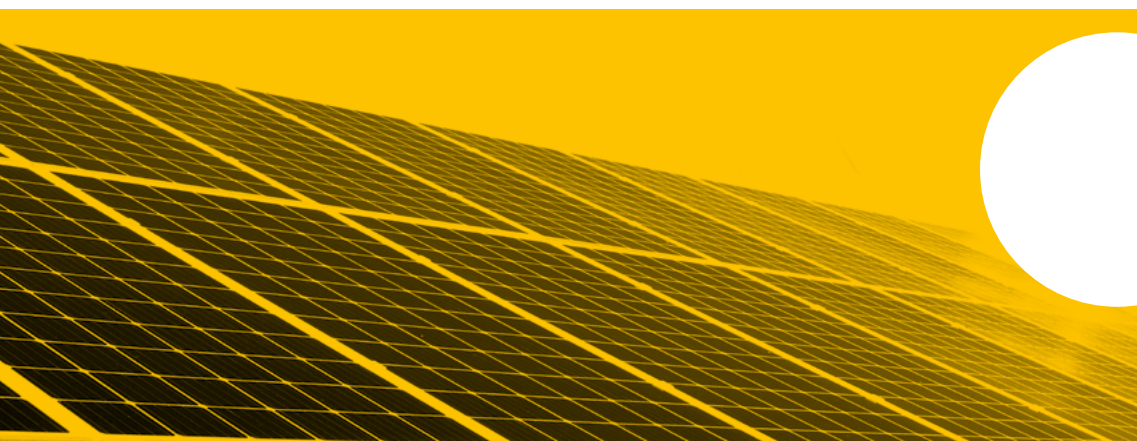
Solar and wind power projects enjoy industry status and attendant incentives in the state. For example, Andhra Pradesh’s Industrial Development Policy 2015–2020⁴⁶ gives a 25% subsidy on total fixed capital investment to solar and wind energy projects, with a ceiling of ₹50 crore. This subsidy excludes expenses for cost of land, land development, preliminary and pre-operative expenses, and consultancy fees.

As per the state’s Industrial Development Policy, a consolidated land bank of ~3 lakh acres has been set up, with a plan to expand upto 10 lakh acres. There is a well-laid framework to allot these lands to industries on 99-year leases. As industries, solar power projects get preferential land allotment from this land bank. Another benefit is easy conversion of agricultural land into non-agricultural land.

Telangana

Telangana is the only state of the seven studied that does not encourage wind power projects to be set up on government land. The state government provides government land on lease only for wind power projects implemented by state or central PSUs or government-majority stakeholding joint ventures. Wind power projects set up on government revenue or fresh land must sell electricity only within the state and not export it out of the state.

Agricultural land acquired for solar projects by private project developers are considered deemed converted into non-agricultural land with just the payment of a stipulated fee. This bypasses a process that should ideally protect farmers' interests, to the benefit of solar power developers.



“Telangana recognises solar and wind power projects as industries to ensure the protection of labour interests, rather than to give incentives and subsidies to these sectors”

Solar and wind power projects in the state are exempt from the Land Ceiling Act. Land required for the stated capacity is computed as follows.

- * **Solar:** 5 acres per MW or less
- * **Wind:** Assessment by Telangana State Renewable Energy Development Corporation Limited (TSREDCO), the SNA

The exemption applies only to the amount of land computed as above. Projects also need to be approved by the relevant gram panchayats, where they are required to pay a development fee of ₹25,000/acre. This includes approval for use of groundwater.

Telangana recognises solar and wind power projects as industries to ensure the protection of labour interests, rather than to give incentives and subsidies to these sectors. Both solar and wind power projects in Telangana must register under the Factories Act.



Karnataka

In Karnataka, government land that belongs to the Revenue, Forest, and Irrigation departments can be leased for wind power projects for 30 years, with a 5-year extension. For forest land, the forest department needs to issue a facilitation letter as per MoEFCC guidelines.

Karnataka's solar policy also proposes to create private land banks owned by individual farmers/groups of farmers/farmer associations for the development of solar projects

Solar power projects can be set up on agricultural land without formal approval for conversion to non-agricultural land, on payment of stipulated fees. This does away with the need for a deemed conversion status altogether. The state government amended Section 95 of the Land Reform Act to make this possible. It also amended Section 109 of the Act to enable time-bound permission and approval for purchase of agricultural land for solar power projects.

Karnataka offers a land leasing model as well. The state's solar policy encourages farmers to set up solar power projects of 1 MW to 3 MW on their own farmland and sell power to the relevant DISCOM. Power generation through this farmland model is limited to 300 MW on first-come-first-served basis.

Karnataka's solar policy also proposes to create private land banks owned by individual farmers/groups of farmers/farmer associations for the development of solar projects. These are to be allotted on long-term leases up to 30 years, subject to renewal, at a lease rate fixed by the state government in coordination with the state revenue department.

Tamil Nadu

Tamil Nadu's solar policy and Industrial Policy 2014⁴⁷ provide for allotting land for solar manufacturing parks where solar manufacturing industries are promoted. The state envisages development of the entire chain of solar equipment manufacturing, including wafers, cells and modules, and Balance of System equipment. There is, however, no provision for allotting government land for solar or wind power generation projects.

The state policies of Rajasthan, Gujarat, Maharashtra, Karnataka, and Tamil Nadu have no special provisions to obtain clearances for use of forest land for RE projects

2.3.5 Forest clearance

The state policies of Rajasthan, Gujarat, Maharashtra, Karnataka, and Tamil Nadu have no special provisions to obtain clearances for use of forest land for RE projects.

Rajasthan's state policy categorically disallows wind energy projects near protected areas, national parks, and sanctuaries. Project developers need to seek forest clearances. In Gujarat, large-scale RE projects are predominantly large wind farms. Like all other industries, they need to follow a formal approval process as per the Forest (Conservation) Amendment Rules 2014⁴⁸.

Andhra Pradesh and Telangana offer forest clearances as part of a single window clearance mechanism for large-scale wind power projects. It is the SNA's task to get forest clearances on behalf of projects developers. This facility is not available to any other industries in the two states, indicating special encouragement to large-scale RE. In Karnataka, large-scale RE projects need a facilitation letter from the forest department as per the MoEFCC's guidelines.

2.3.6 Water use approval

Only Rajasthan and Telangana's RE policies specify approval mechanisms for water usage. In Rajasthan, the state Water Resource Department (WRD) can approve diversion of water for solar thermal power plants from the Indira Gandhi Nahar Project (IGNP) canal or the nearest water source. The project developer makes a water requirement request to RRECL. RRECL must perform a thorough scrutiny and assessment of the request, and then forward it to the state WRD. If the canal or other water bodies need to be modified to supply water to the project, project developers must bear the costs. Solar thermal power projects are water-intensive. In an arid, water-starved region like Rajasthan, such approval systems help project developers immensely.

In Telangana, the local gram panchayat must approve use of groundwater and permit digging of borewells for solar power projects. Wind power plants have low water requirements, and no such provisions are made for them.

TABLE 5 | Regulatory mapping of state policies on RE

RAJASTHAN	
Project Approval SNA: No Institutional arrangement (INSTT.) + SNA: Yes	Project Monitoring SNA: Yes INSTT. + SNA: N.A.
Land Acquisition Support from state government: Yes, for leasing to private developers Government land allotted: Yes, sub-leasing by developers allowed	Environmental Clearance Yes for solar, no for wind
Forest Clearance Yes, no wind projects near protected areas	Water Use Approval Yes for solar thermal
GUJARAT	
Project Approval SNA: Yes INSTT. + SNA: N.A.	Project Monitoring SNA: N.A. INSTT. + SNA: N.A.
Land Acquisition Support from state government: No Government land allotted: Yes	Environmental Clearance N.A.
Forest Clearance Yes	Water Use Approval N.A.
MAHARASHTRA	
Project Approval SNA: Yes INSTT. + SNA: N.A.	Project Monitoring SNA: Yes INSTT. + SNA: Yes, for policy monitoring
Land Acquisition Support from state government: No Government land allotted: Yes, on priority	Environmental Clearance No
Forest Clearance No	Water Use Approval N.A.
ANDHRA PRADESH	
Project Approval SNA: Yes INSTT. + SNA: N.A.	Project Monitoring SNA: No INSTT. + SNA: Yes
Land Acquisition Support from state government: No Government land allotted: Yes	Environmental Clearance No
Forest Clearance Yes for solar, single window at SNA, N.A. for wind	Water Use Approval N.A.

TELANGANA	
Project Approval SNA: No INSTT. + SNA: Yes	Project Monitoring SNA: Yes INSTT. + SNA: Yes
Land Acquisition Support from state government: No, facilitation only Government land allotted: No, government land for government RE projects only	Environmental Clearance Yes for solar, no for wind
Forest Clearance Yes for wind, single-window at SNA, N.A. for solar	Water Use Approval Yes for solar, by gram panchayat
KARNATAKA	
Project Approval SNA: Yes for wind INSTT. + SNA: Yes for solar	Project Monitoring SNA: N.A. INSTT. + SNA: N.A.
Land Acquisition Support from state government: Yes, for lease Government land allotted: Yes, on lease	Environmental Clearance No for solar, N.A. for wind
Forest Clearance Yes	Water Use Approval N.A.
TAMIL NADU	
Project Approval SNA: No INSTT. + SNA: Yes	Project Monitoring SNA: N.A. INSTT. + SNA: N.A.
Land Acquisition Support from state government: N.A. Government land allotted: N.A.	Environmental Clearance N.A.
Forest Clearance Yes	Water Use Approval N.A.

Yes: Information available in relevant state policy

No, project approval and monitoring: Responsibility not assigned to SNA, no institutional arrangement available

No, land: State government does not acquire/support acquisition of land/government land not provided

No, clearances: Clearance not required/project exempted from clearance

N.A.: Information not available



3.0

SOCIAL AND ENVIRONMENTAL ISSUES

The deployment of RE technologies on scale has begun to reveal environmental/social issues they create

RE projects have a lower carbon and environmental footprint than conventional energy projects. They do not emit planet-warming gases, toxic fumes, or particulate matter during electricity generation. Both solar and wind technologies rely on renewable, non-depleting resources like sunlight and wind, not finite mined fuel. However, deployment of these technologies on scale has begun to reveal environmental and social issues they create, some of which are the same as any large project: land acquisition, water use, forest diversion, etc. Others are unique to these particular technologies, for example, decommissioning of plants in a safe manner. Both technologies are at relatively nascent stages as compared to traditional power generation technologies. Therefore, there is scope to anticipate and resolve critical challenges early on, and to avoid pitfalls.

3.1

Land Diversion

Land is the most critical requirement for large-scale solar and wind power projects. It is also the biggest and most frequent bottleneck in the deployment of these technologies in the country. Both technologies are land intensive and can only be set up in areas with very specific geographical characteristics.

Solar plants require ~5–8 acres of land per MW, which includes space for a power generation system, an evacuation line, and other subsidiary activities. The amount of land required is linked to the type of solar technology used (thin-film or crystalline). Small solar projects of 20–25 MW need 100–200 acres of land, while larger projects like solar parks of 100 to 300 MW need 500 to 2400 acres. With arable land availability per person a low 0.29 acres⁴⁹ and an average population density of 382 persons per sq.km⁵⁰, large-scale land procurement is a difficult challenge to surmount.

A large percentage of India's population depends on land for its livelihood. These livelihoods range from farming, fishing, grazing, and collection of forest produce, to artisanal occupations like pottery or weaving. The Census of India 2011⁵¹ reports that 263 million people, including farmers and farm labourers, are directly dependent on the land for their lives and livelihoods. Another 300 million people earn their livelihood indirectly from farm land as part of supportive or ancillary activities. These total up to nearly half the country's population.

The Land Acquisition Act 2013 stipulates that the compensation for acquisition of private land for projects of national or social interest be four times the market value of the land. However, even this compensation value is frequently considered lower than the assumed opportunity cost of the land. This leads to prolonged conflicts and complex (and possibly forced) acquisition processes.

Barren land is considered most suitable for solar projects due to its low capacity to grow food. Such land is generally located in arid regions with scanty rainfall, creating a potential for conflict over scarce water resources.

Barren land suitable for solar projects is generally located in arid regions with scanty rainfall, creating a potential for conflict over scarce water resources

Roughly 90 million hectares (~30%) of the country's total land is classified as 'waste land'⁵². Much of the land classified as waste land comprises grassland, open degraded forest, marshy land, flood plains, terai land or hill tops. Though officially deemed non-productive, these lands provide critical ecosystem services and are crucial for people's lives and livelihoods. Consequently, it is difficult to locate barren land that can be easily acquired for solar parks. This frequently leads to scavenging of productive farm land for solar projects, which has its own attendant social and environmental issues.

Wind power technology is also land intensive. As compared with solar, the choice of land for wind power installations is far more restricted. Commercial large-scale wind power projects require regions with 3 m/s cut-in wind speed (wind speed at which the motor can start) and 8–12 m/s wind speed for optimum power generation. This restricts wind power projects to either coastal areas (frequently in CRZs), deserts (possibly sensitive ecosystems), or high hilly terrain (generally forested areas), where the turbine gets unhindered wind speed. As a result, wind projects are concentrated in eight states in southern and western India.

3.2

Water Extraction

Solar parks consume large quantities of freshwater for cleaning their photovoltaic panels. A 2018 article published by Down To Earth⁵³ cites a Council on Energy, Environment and Water (CEEW) estimate of water required to clean solar panels in India as around 7000–20000 litres/MW/wash. The bulk of solar installations in India are located in arid or semi-arid zones, where an average of two washes per month are needed. The government's ground-mounted solar PV target is 60 GW. Putting all these factors together, the projected freshwater needs amount to 1–3 billion litres every month. This is significantly lower than the average of 4m³/hour/MWh used by coal power plants in India. However, ground-mounted solar PV deployments in the water-stressed zones of the Western Thar Desert, Kutch, Ladakh, Marathwada, Vidharbha, Hyderabad-Karnataka, and the interiors of Telangana, pose serious ecological challenges for these regions.

Automating panel maintenance makes more efficient use of water, but is likely to lead to loss of jobs among semi-skilled and unskilled workers.



4.0

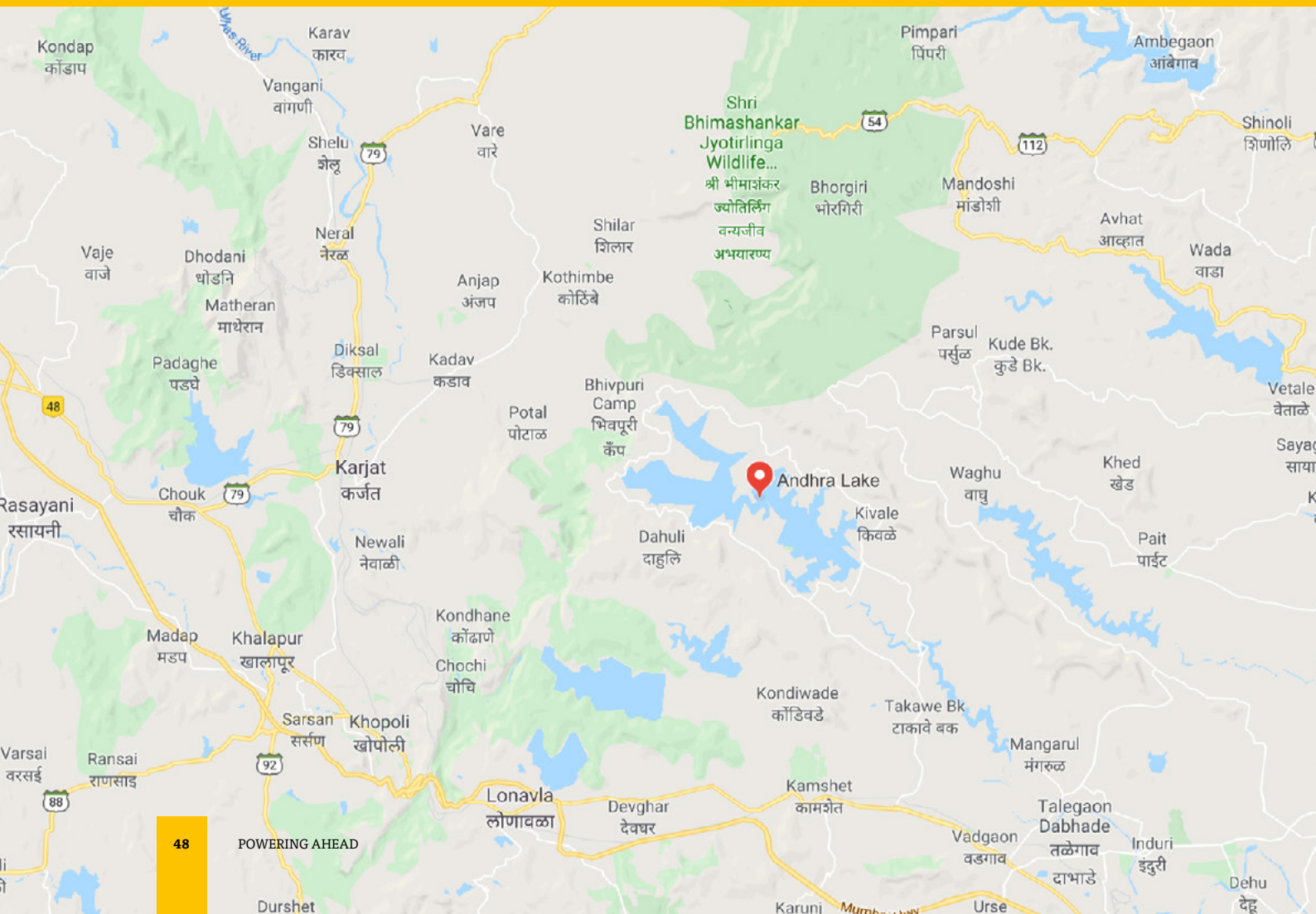
CASE STUDIES

4.1 Andhra Lake Wind Farm, Maharashtra

The BWS forests are a high ecological value region in the northern reaches of semi-evergreen and seasonal cloud forests that are home to endangered flora/fauna

CLP India Private Limited⁵³ has developed a wind power project close to Andhra Lake in Maharashtra. Andhra Lake is an earthfill dam on the Andhra river near Mawal in Pune district along the perimeter of Bhimashankar Wildlife Sanctuary (BWS).

The BWS forests are a high ecological value region in the northern reaches of semi-evergreen and seasonal cloud forests that are home to endangered flora and fauna. According to the Census report 2006, endangered mammals, reptiles, birds, and other animals live in the area. Notable among these are the endangered Giant Squirrel, and the leopard, which is endemic to the BWS. The region is also home to deer, panthers, nilgai, peacocks, porcupine, and numerous other animal species. The region is rich in medicinal plants. The forest department, with the help of the Foundation for Revitalisation of Local Health Traditions, has set up a Medicinal Plants Conservation Area (MPCA) in Kharpud village.



4.1.1 Project background

The project, set up at a cost of ₹850 crore⁵⁵, is spread over 14 villages of the Khed and Mawal talukas, covering 194.66 hectares of reserve forest land. 142 wind turbines (134 on forest land and 8 on non-forest land) were to be erected.

To be implemented in two phases, the Andhra Lake Wind Farm project will have a total installed capacity of 113.6 MW. The first phase has seen the installation of 70 WTGs, forming an installed capacity of 56 MW⁵⁶. The E-53 WTGs installed in the project have been supplied by Wind World (India) Limited (WWIL), formerly Enercon (India) Limited. WWIL is also the operations and maintenance contractor for the project.

The first wind energy generator (WEG) under this project was commissioned on August 19, 2011 and has been operational since then, except for regular shutdowns as per Operations & Maintenance (O&M) requirements. The expected operational lifetime of the project is 20 years.

The power generated by the project is fed into the Maharashtra State Electrical Distribution Company Limited (MSEDCL) grid.

This project was registered under the United Nations Framework Convention on Climate Change Clean Development Mechanism (UNFCCC CDM) project, with effect from August 10, 2012. The electricity generated from the project is meant to replace the electricity generated from thermal power stations in the regional grid, and reduce greenhouse gas (GHG) emissions.

“These approvals were challenged by a local group, the Paschim Ghat Bachao Samiti

4.1.2 Project approval

Kalpavriksh, an organisation working for the implementation of the FRA, summarises key developments in the approval and clearance of this project in a letter⁵⁷ to the Principal Chief Conservator of Forests, Maharashtra. It says that the project got an environmental clearance from the MoEFCC based on a November 7, 2009 letter from the Chief Conservator of Forests (CCF), Pune. Diversion of forest land for the project was approved by the MoEFCC on December 10, 2009.

These approvals were challenged by a local group, the Paschim Ghat Bachao Samiti (PGBS). PGBS filed a public interest litigation (PIL) in the Bombay High Court. Pramod Bankhele, the coordinator of PGBS, alleged irregularities in the clearance of 194.7 hectares of protected forests. He testified that a significant part of the project area lies within a 10 kilometre radius of the ecologically sensitive BWS: the project is located close to Kharpud village, which is around 3.5 kilometre from the boundary of the sanctuary. The project lies in an extension of the southern corridor of the sanctuary, in a buffer zone designated for the protection of biodiversity.

The petitioner alleged that the forest clearance was granted in violation of the Wildlife Conservation Strategy 2002⁵⁸ (WCS) adopted by the National Board for Wildlife (NBWL). The WCS stipulates that land falling within a 10 kilometre radius of deemed National Wildlife Sanctuaries and National Parks should be notified as eco-fragile zones under section 3(V) of the Environment (Protection) Act. The NBWL adopted this strategy to provide an effective boundary for conservation of sanctuaries and parks, while accounting for the well understood fact that biodiversity cannot be conserved solely and neatly within the confines of “Protected Areas”; it is critical to ensure the ecological sanctity of neighbouring areas as well. This has been reinforced by the Guidelines for Declaration of Eco-Sensitive Zones around National Parks and Wildlife Sanctuaries⁵⁹ issued by the MoEFCC in February 2011.

Bankhele also alleged that the project was approved based on factual claims that were contested. In response to the PIL, the court ordered a halt to tree felling on December 16, 2010.

4.1.3 Impact assessment

Dattatreya Bhale Rao was Forest Range Officer of Khed taluka when the project was approved. According to the aforementioned letter from Kalpavriksh, in his report titled “Inspection Report on the Natural Status of the Original Fauna and Flora protected Forest Land 87.57 ha in the Junnar Forest Division”, Rao wrote:

- * The forest proposed to be diverted consists of rich biodiversity, is located adjacent to the sanctuary, and contributes enormously to the protection and conservation of the local ecology.
- * Although the actual windmill construction is limited to 87.577 hectares of forest land in Khed, the impact of allied activities like construction of the access road will cover around 3541.84 hectares of biodiversity rich forests.
- * Cutting down these forests could lead to changes in rainfall patterns in the region.
- * High quality medicinal plants inside the forest would be destroyed.

Rao told the Asar team that his site visit report was ignored and he was sidelined by his superiors in the forest department and higher authorities. He continues to stand by his report. He alleged the following.

- * He was pressured to alter his report by then Divisional Forest Officer (DFO) Subhash Shelke and then Member of Legislative Assembly (MLA) Dilip Moite.

- * No gram sabha meetings about granting permission for the diversion of forests to the company had ever taken place⁶⁰.
- * The letters in which the gram sabha, on behalf of the villagers, granted permission to the company to divert forest land and set up its project, were of doubtful authenticity.
- * His attempts to verify these letters failed when Moite, with Shelke's support, threatened and pressured him to desist. The next DFO, Ajit Bhosle, also categorically refused him permission to authenticate the letters.
- * All references to and copies of his report were removed from the administrative system.

According to him, the letter from the CCF, based on which clearance was granted, continued to misrepresent facts.

- * It claimed the soil depth on the slopes of the hills was too low to support any vegetation.
- * It also said that the area did not have any significant wildlife, and no threatened or endangered species had been reported from the area.

Kalpavriksh's letter suggests this is contrary to the forest department Census report 2006, which mentions the presence of Giant Squirrels in the forests of Kharpud and the presence of thick vegetation on the region's slopes.

Although the actual windmill construction is limited to 87.577 hectares of forest land in Khed, the impact of allied activities like construction of the access road will cover around 3541.84 hectares of biodiversity rich forests

4.1.4 Environmental impact

In 2011, the Andhra Lake Wind Farms project was studied by the Western Ghats Ecology Expert Panel (WGEEP) constituted by the MoEFCC. This 14-member panel chaired by ecologist Prof. Madhav Gadgil was asked to study the Western Ghats. The Ghats are considered to be one of the eight hottest biodiversity hotspots in the world: an ecologically sensitive area with high-statured, rich tropical rainforests. The need for this study arose because the Ghats' delicate ecosystem had been disturbed and measures to conserve it and use its resources sustainably were required. In section 12.1 of its report⁶¹ submitted to the GoI, it made the following observations on the impact of the wind project on the Bhimashankar Wildlife Sanctuary:

Mahabaleshwar-Panchgani ESA, constituted prior to the IBWL resolution of 2002 calling for the 10 kilometre ESAs around PAs, serves to protect a significant belt of evergreen forest of the Western Ghats, near the origin of Krishna river and its major tributary, Koyna. The northward extension of this evergreen forest belt constitutes the Bhimashankar Wildlife Sanctuary, an ancient, extensive Sacred Grove on the hill from which the Bhima river, another major tributary of the Krishna, originates. No action whatsoever has been taken since 2002 to establish an ESA around this PA, despite the following communication from PPCF(WL), Maharashtra dated 19/8/04 to CCF(WL), Nagpur, Nashik, Mumbai and CF(project Tiger), Amaravati: "Central Government had asked for proposals regarding the constitution of ESZs over an area of 10 kilometre surrounding all PAs in connection with a resolution of the IBWL in 2002. The follow up should have been concluded by 2004. However, no action has been taken so far. Hence, in response to the direction of Nagpur High Court, all Wildlife Wardens in charge of Protected Areas are asked to constitute a committee involving forest officials as well as NGOs and Hon. Wildlife Wardens to decide on the necessity of declaration of ESZs around PAs. Even if it is considered unnecessary to constitute any ESZ, full rationale for why this is considered appropriate should be provided." The report was to be submitted by 30/10/04. Subsequently a Wind Mill project by the company ENERCON has come up in this area. This project has proved to be controversial, with pending Court cases. As a result WGEEP was asked to specially look into the matter by the Honourable Minister for Environment and Forests at the WGEEP meeting in his chambers on 24 March 2011. WGEEP therefore attempted to obtain information in this connection from the following officials of Maharashtra Forest Department: PCCF (General), PCCF (WL), CF(T), Pune, CF(WL), Pune. Beginning 7 April 2011, they were all requested in writing to provide all pertinent background documents and maps relating to ENERCON project, and the proposal to constitute an ESZ around Bhimashankar Wildlife Sanctuary.

“The Ghats’ delicate ecosystem had been disturbed and measures to conserve it and use its resources sustainably were required”

The Forest Department subsequently facilitated WGEEP field visits to this area by Madhav Gadgil on 14 April, 2011 and by Renee Borges on 19 May, 2011.

Pertinent documents were requested during these field visits also. No documents relating to Bhimashankar Wildlife Sanctuary have been provided to Madhav Gadgil at any stage till date despite repeated reminders, and on 2 June 2011 Shri Sinha CF(T), Pune personally told Madhav Gadgil that no papers relating to this matter are traceable in any office of the Maharashtra Forest Department. However, Renee Borges was handed a file with correspondence that has been exchanged on the ENERCON project and also the legal proceedings vis-a-vis the case filed by Shri Kale. In addition, substantial material was accessed under RTI by an activist, Shri D.K. Kale, a resident of Chas village close to project area, and this was made available to WGEEP. Evidently, this project should not have been cleared at all without completing the constitution of the Ecologically Sensitive Zone, as also implementation of Forests Rights Act (FRA).

It is clear from field inspection, as well as from Google Earth images, that the hills where wind mills have come up are tracts of high rainfall and biodiversity-rich evergreen forest, contiguous with that in the Bhimashankar WLS, and home to Maharashtra’s state animal, the Malabar Giant Squirrel *Ratufa indica*. In fact, RB noticed nests of the Giant Squirrel in the project area. The local Range Forest Officer had also clearly recorded these facts and recommended that the wind mill project should not be sanctioned. He was overruled by his superior officers who have cleared the project by patently misrepresenting the facts on ground.

Apart from substantial forest destruction (including Forest Department estimates of about 28,000 trees being cut) via wide roads cutting huge swathes through Reserve Forest, the wind mill project has triggered large scale erosion and landslides through poor construction of roads with steep gradients, and all this rubble is ending up on fertile farmland and in reservoirs of tributaries of the Krishna.

The Forest Department is colluding with wind mill project operators in also illegally denying citizens access to these hills. Boards and check-posts have been put up by the company, falsely claiming to be authorised by the Forest Department. There are many traditional forest dwellers on these hills. Not only are their rights under the Forest Rights Act not being recognised, they are being illegally restrained in their movements on hills they have inhabited for centuries.

“Suddenly we found truckloads of timber being taken away from the forest by people who were not forest department officials”

4.1.5 Land acquisition

According to Vijay Medge and Vansath Dhandre of Kude Budruk village, the company did not consult the village or tell anybody about the upcoming project. They found out about it only when company officials started cutting down trees in the forest. They said, “Suddenly we found truckloads of timber being taken away from the forest by people who were not forest department officials. We then got to know that the company officials were cutting trees and transporting timber. We stopped them and asked for permission letters, but they couldn’t provide any. That is when we stopped their construction work for about eight days. Our entire village depends on the forests for firewood and it also served as pasture land.”

Dhondu Gopala Shingadi of Satkarwadi village told us that no land from their village had been taken to build the access road for the wind farm. However, transmission lines run through the farmland in their village. He said that transmission towers were set up on their agricultural land after a one-time payment of ₹3,000, and no payments were made after that.

4.1.6 Forest rights

Forest clearance for the project was obtained for a total reserve forest area of 194.66 hectares, encompassing 14 villages of Khed and Mawal talukas in its bounds. An MoEFCC circular dated July 30, 2009⁶² requires that processes for granting of community and individual forest rights as per the FRA be completed before considering applications for forest clearance. Community members interviewed by Asar did not know of any such processes initiated in their area.

The company submitted resolutions from the Forest Rights Committees (FRCs) of 14 villages stating that they had no objection to the project coming up in their forests. However, community members in all the villages we visited said that the NOCs were obtained fraudulently. The FRA does not give FRCs any legal right to accept or reject a proposed project. The MoEFCC circular mentioned earlier gives this right to the gram sabha of the concerned panchayat, where it has to be passed with a 50% quorum.

Kharpud and Kude Budruk villages deny giving any such permission. Kude Budruk has filed a complaint with the Pune District Collector stating that the NOC was bogus, and that the company obtained the resolutions by bribing the sarpanch and gram sevak. The Collector has ordered an enquiry into the matter.

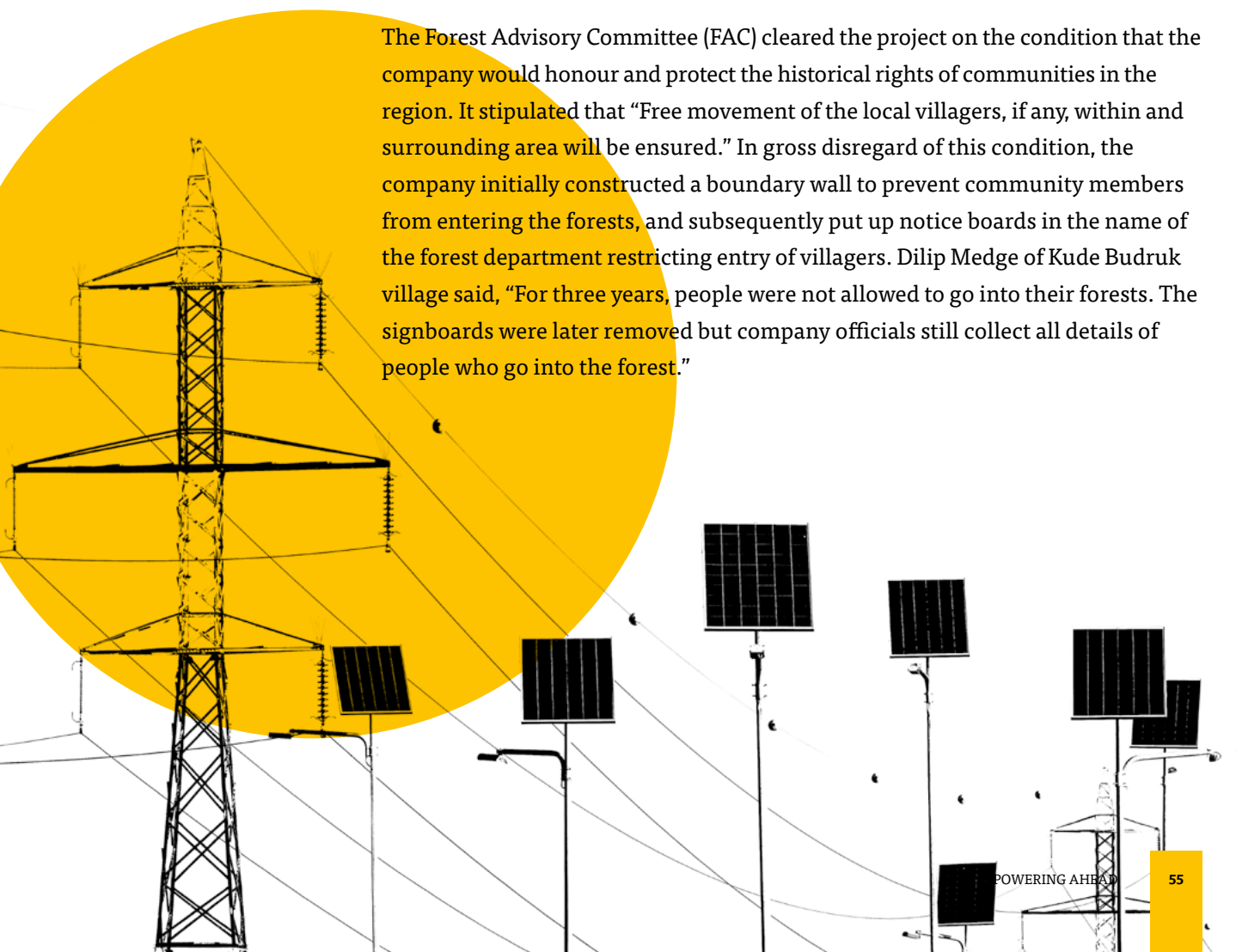
Satkarwadi village is 6 kilometre from the windmills by the access road. It has around 122 households and a population of 700. The villagers call the forest Shingeshwar Dangar after their deity Shingeshwar, who they believe lives in the forests. The villagers confirmed that neither the company nor the local administration held any meetings in the village or informed them about the proposed

wind project. The villagers alleged that local politicians were involved in pushing the project through while keeping the community in the dark. They insisted that all the NOCs were negotiated and granted at the panchayat level and that there was a lot of money and corruption involved.

Suresh Kalu Budhe, former sarpanch of Satkarwadi village, gave an NOC on behalf of the village panchayat. He claimed that he was coerced to do so, even though no gram sabha was held in the village to discuss diversion of forest land for non-forest use, as required by the FRA. He said, “The officials told me that all the panchayats in the region have given permission, hence you also have to give the NOC, you are the only village left. Even if you do not give it we will anyway take it from the Tehsil.”

Padarwadi village is 4–5 kilometre from the windmills. It has 50 households and 250 people. The village has some houses built under the Awas Yojana and a functioning Anganwadi. The panchayat has installed three solar lights in the village. The village is connected to the grid but only has three to four hours of electricity during the night. The entire population of Padarwadi is tribal. They did not know of their individual and community rights under the Forest Rights Act 2006. Even though most families had land holdings, they did not seek recognition of their rights. Pradeep Chavan of Kalpavriksh said that the Act has not been implemented in any of the villages in the region.

The Forest Advisory Committee (FAC) cleared the project on the condition that the company would honour and protect the historical rights of communities in the region. It stipulated that “Free movement of the local villagers, if any, within and surrounding area will be ensured.” In gross disregard of this condition, the company initially constructed a boundary wall to prevent community members from entering the forests, and subsequently put up notice boards in the name of the forest department restricting entry of villagers. Dilip Medge of Kude Budruk village said, “For three years, people were not allowed to go into their forests. The signboards were later removed but company officials still collect all details of people who go into the forest.”



4.1.7 Effects on livelihoods

Many communities affected by the project depend on the forests for their livelihoods. Manda Vishu Thubal is the president of a women's Self-Help Group (SHG) in Kharpud village. She belongs to an adivasi community that makes a living from the forests. The SHG collects shikakai, hirda, jamun, thorna, ambedi fruit, wild vegetables, firewood, bamboo, etc., from the forest. She told us that the community makes bamboo baskets and sells them through the SHG.

Many locals said that they rarely go into the forests any more because of the company's presence there.

“Many locals said that they rarely go into the forests any more because of the company's presence there”

Another local, Dunda Padar told us, “When the ‘pavan chakki’ came nobody asked us and we did not know about it. We were told that it is coming under a government scheme and youth in the village will get jobs. I worked for two years as a watchman with the company during the construction phase. Around 50–55 people from the village were temporarily hired by them to cut trees as well as for loading and unloading.” He also said that mud from excavation for the access road washed into their farms, destroying their rice crops. They were not compensated for those losses.

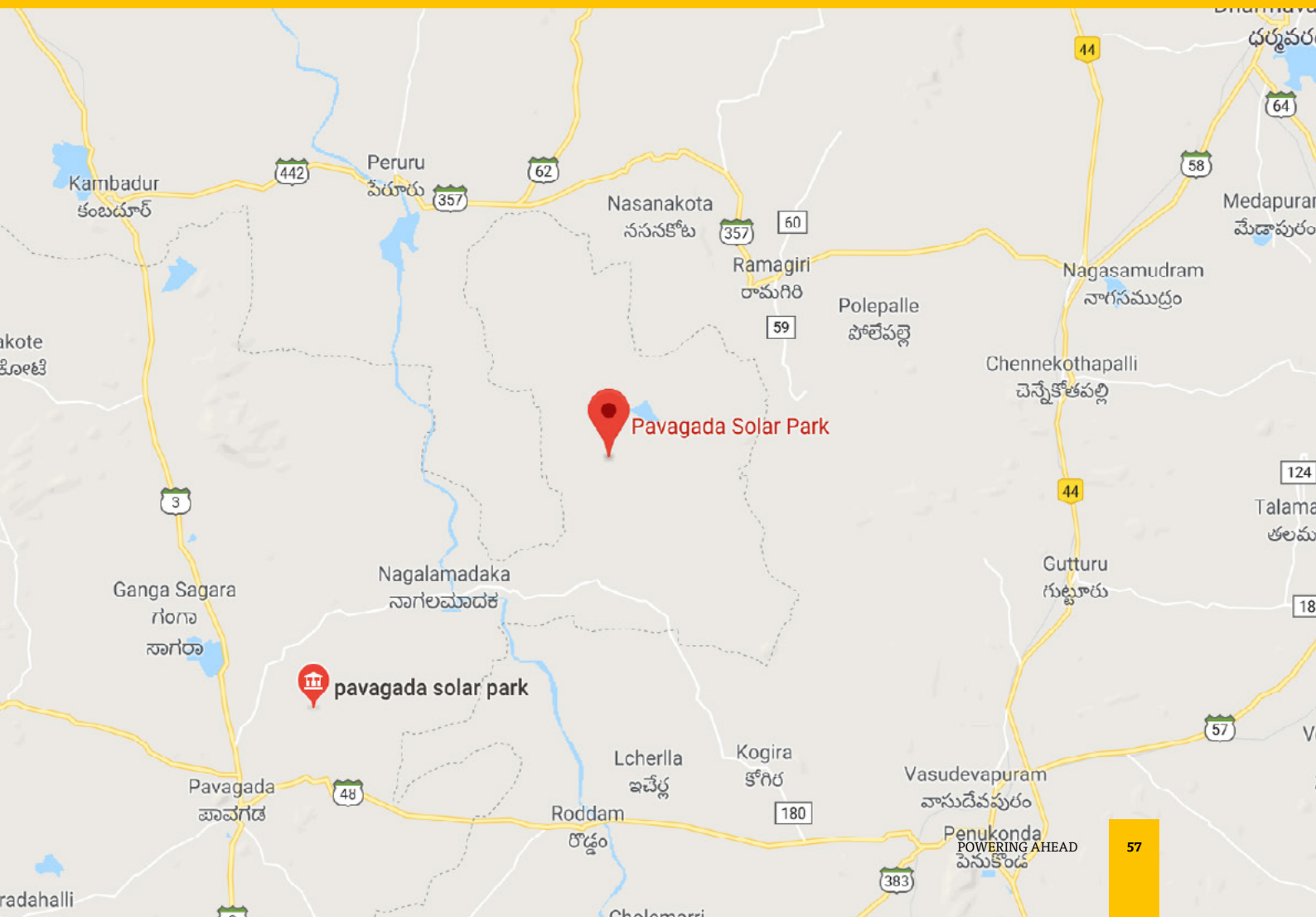
Residents of Satkarwadi and Padarwadi villages used to take their cattle into the forest for grazing. There was a common cattle shed on top of a hillock. Villagers said they were forced to bring their cattle down when the company took over the land, and that the company told them the windmills were bad for the cattle.

4.2 Pavagada Solar Park, Karnataka

Pavagada taluka is located in Tumkur district of Karnataka. It has a population of 2,45,194⁶³. It is situated in a hot, semi-arid region on top of an elevated plateau. The vegetation in the region is largely shrubby, thorny, and stunted. With chronic deficient rainfall, the government of Karnataka has declared the region drought-hit 54 times in the last 60 years. The water in the region has a very high fluoride content.

Pavagada was listed amongst the most “backward” talukas in Karnataka in a report⁶⁴ produced in 2002 by a High Power Committee on Redressal of Regional Imbalances set up by the state government.

Pavagada has ample solar radiation and is now the site of one of the largest solar parks in the world⁶⁵.



4.2.1 Project background

Pavagada Solar Park is spread over an area of approximately 13,000 acres and covers 5 villages: Balasamudram, Kyataganacharlu, Rayacharlu, Thirumani, and Vallur. When completed, it will have a total installed capacity of 2000 MW. Currently, 600 MW is commissioned as part of Phase 1.

The project was conceptualised by Karnataka Solar Power Development Corporation Limited (KSPDCL), a joint venture company of KREDL and SECI. KSPDCL was set up in March 2015 to implement solar power projects across Karnataka⁶⁶. This project is experimenting with a new model of leasing land from farmers at a monthly rental of ₹21,000/acre/year with a 5% increment every 2 years.

The solar park is divided into 40 segments of 50 MW each. The allocations were made as follows:

- * 600 MW to NTPC Limited under JNNISM
- * 200 MW to SECI under Viability Gap Funding (VGF)
- * 1200 MW to KREDL

Out of 2000 MW, 600 MW has been commissioned by 6 developers who were given tenders by NTPC to install solar generating capacity.

- * M/s. Arrow Infrastructure Limited (50 MW)
- * M/s. Parampujya Solar Energy Private Limited (150 MW), a subsidiary of Adani Green Energy
- * M/s. Fortum FinnSurya Energy Private Limited (100 MW)
- * M/s. ACME Rewari Solar Power Private Limited & M/s. ACME Kurukshetra Solar Energy Private Limited (100 MW)
- * M/s. ReNew Wind Energy (TN2) Private Limited (50 MW)
- * M/s. Tata Power Renewable Energy Limited (150 MW)

NTPC entered into Power Sale Agreements with the DISCOMs of Karnataka⁶⁷. SoftBank Energy won an auction by SECI to install a further 200 MW. Tenders for the remaining 1200 MW have been awarded to the following.

- * M/s. ReNew Solar Energy Private Limited (300 MW)
- * M/s. Avaada Solar Energy Limited (150 MW)
- * M/s. Azure Power Earth Private Limited (100 MW)
- * M/s. Fortum FinnSurya Energy Private Limited (250 MW)
- * M/s. Tata Power Renewable Energy Limited (250 MW)
- * M/s. Giriraj Renewables Private Limited (150 MW)

In January 2018, NTPC, which was initially going to auction and tender 750 MW from the KREDL share, pulled out of the project citing inability to supply power at the agreed cost. NTPC was supposed to purchase 600 MW of power from six developers at ₹4.80 per unit and supply to the state ESCOMs at a bundled tariff of ₹3.30 per unit⁶⁸.

4.2.2 Project approval

On October 29, 2015, the State High Level Clearance Committee approved the project in principle⁶⁹ on the understanding that an investment of ₹14,800 crore would be made, generating employment for about 8,000 people. It conditionally sanctioned the following infrastructure assistance, incentives and concessions.

The State High Level Clearance Committee approved the project in principle on the understanding that an investment of ₹14,800 crore would be made, generating employment for about 8,000 people

- * **Land:** ~11,000 acres of land was identified in the aforementioned five villages of Pavagada, including 254 acres of government land. 40 acres of this government land was to be allotted to Power Grid Corporation of India and the remaining was to be in the possession of KSPDCL. The rest was private land the company intended to rent on a yearly lease for 30 years.
- * **Water:** 1110 kilogram litres per day (KLPD) from digging borewells in accordance with applicable rules.
- * **Power:** Necessary power was to be obtained from Bangalore Electricity Supply Company Limited (BESCOM).

Some of the key terms and conditions for this sanction were as follows.

- * KSPDCL had to comply with the provisions of the Karnataka Industrial Policy 2014-19⁷⁰. One of these was the submission of a Human Resources Development plan for the project to the Commissioner of Industrial Development and Director of Industries and Commerce for monitoring. KSPDCL had to train local people and prioritise residents of the five villages for employment in the project.
- * KSPDCL was required to adopt rainwater harvesting and other water conservation methods, and to develop and maintain the water bodies in the project area.
- * KSPDCL, along with solar developers, was required to develop social infrastructure in the vicinity of the proposed location and comply with the stipulations of Company Act 2013.

On December 14, 2015, Karnataka's forest department issued an NOC to the effect that no 'reserved' or 'semi-reserved' forest fell in the area earmarked for the Pavagada Solar Park⁷¹.

The semi-arid conditions, deficient rainfall, ample solar radiation, and frequent low crop yield or failed cultivation made the area attractive for setting up a solar park

4.2.3 Impact assessment

PricewaterhouseCoopers (PwC) prepared a detailed project report for the solar park in December 2015⁷². It evaluated the following criteria for picking the site for the project: meteorology (microclimate data and solar irradiation), land (land type and topography, land use, ownership patterns, environmental and wildlife aspects, etc.), infrastructure (connectivity, accessibility, grid infrastructure, water availability, etc.).

The semi-arid conditions, deficient rainfall, ample solar radiation, and frequent low crop yield or failed cultivation made the area attractive for setting up a solar park.

Interestingly, while the report suggested a price of ₹23,100/acre for an annual lease with 5% escalation on base year, the rate finally offered to the villagers was ₹21,000/acre/year.

Knight Frank (India) Private Limited carried out a social impact assessment⁷³ (SIA) and an environmental impact assessment (EIA)⁷⁴ in the preliminary stages of the project. It scoped the area of the park allocated to NTPC for developing 600 MW. Two villages, Rayacharlu (1277 acres) and Thirumani (1822 acres), came in the ambit of the SIA. A total of 707 land parcels come under the purview of NTPC blocks, and 50% of the 537 land owners were categorised as small and marginal farmers (those who own less than 2 hectares). These small and marginal farmers owned 15% of the land.

4.2.4 Land acquisition

Instead of buying land for the solar park, KSPDCL has adopted a new model of leasing land from farmers, who remain its owners. Leases have been signed with individual farmers for a 28-year period and a starting annual payment of ₹21,000/acre to the land owner, with a 5% increase every 2 years. This model has successfully offset some of the challenges governments face when acquiring land for large projects. In principle, the model appears to have benefitted both parties: farmers have retained ownership of their land and will have a continuous and increasing source of income throughout the lease period, while the solar park proponent has avoided the invariable hurdles and delays normally associated with land purchase.

Approximately 80% of the area of the 5 villages was formerly used for agriculture. Land was purchased at the rate of ~₹6.5 lakh/acre for building support infrastructure like roads, substation, transmission lines and towers, etc.

KSPDCL also obtained all required government approvals for solar power generation, created infrastructure for internal evacuation, layout roads, street lights, water, and for evacuating power generated from solar power developers (SPD). It

“Locals told the Asar team that 2000 people attended this meeting, but they did not get sufficient opportunity to ask questions, seek clarifications or to properly negotiate the starting lease amount”

then awarded contracts to SPDs through auctions⁷⁵.

KSPDCL held meetings in Thirumani to inform local communities about the project. Locals were told the total area to be leased, terms and conditions of lease agreements, and benefits to the community.

Locals told the Asar team that 2000 people attended this meeting, but they did not get sufficient opportunity to ask questions, seek clarifications, or to properly negotiate the starting lease amount. Many felt they had been pressured into accepting the ₹21,000/acre/year when they would have liked to negotiate a higher price.

Some people told us that they had been receiving rent for their land with no hassles over the past three years. The villages were visited by the Chief Minister, the Energy Minister, the local MLA, and the Collector. Villagers felt the likelihood of getting their land back at the end of the 28-year lease period was low, citing the money spent on supporting infrastructure as a reason for the solar park to continue. They view this as an opportunity to renegotiate their contracts on better terms.

4.2.5 Effects on livelihoods

Pavagada's economy is primarily agrarian. Crops are cultivated almost entirely in dryland rainfed conditions without irrigation. The principal crop grown in the region is groundnut, which is grown for just one season in a year. Parcels of land with reasonable amounts of groundwater, which are small in number, are used for the cultivation of other crops including fruits, vegetables, ragi, bajra, and sunflower.

Migrant labour is employed almost exclusively for the small number of jobs available in operating the plants, and negligible job benefits accrue to the local population

As per local testimony, 10% of the population in the affected villages have land holdings exceeding 10 acres, while more than 80% of the landholders own less than 5 acres each. In general, people with larger holdings have given the bulk of their land to the solar park but have retained some land for agriculture, particularly irrigated land. Previously, most people earned between ₹15,000 and ₹25,000/acre/year, depending on the rain. So an assured yearly compensation of ₹21,000/acre with a built-in annual increase of 5% is viewed as a decent deal, though people feel they could have been given a better starting price for their land.

Villagers previously employed in farming activities now have no occupation at all. This hasn't led to any problems in the short time since work on the project started. However, in the longer term, having a large number of people with little or no occupation may lead to discontentment.

Compensation money has been used to spruce up houses, and buy cars, motorbikes, tractors, dumpers, tippers and other heavy duty machinery. The machinery is sometimes let out for development of infrastructure in the park. We noticed many newly constructed houses in the villages we visited.

Each solar park employs about 20 to 30 people. At a very preliminary stage of the project, some locals were given odd jobs at construction sites to entice others to give up their land. Now, however, migrant labour is employed almost exclusively for the small number of jobs available in operating the plants, and negligible job benefits accrue to the local population. There is resentment amongst locals at being excluded entirely from working at the plants. They have even expressed a willingness to take on unpaid internships to train for employment at the plants, but these requests have been ignored. When locals try to approach the companies directly for jobs, the companies use local police to intimidate them until they back off. Attempts to speak to officials at KSPDCL have been unfruitful.

4.2.6 Environmental impact

Companies with a PPA with NTPC are said to have signed clauses that prohibit the use of local groundwater in their plants, specially for cleaning of solar panels and potable water use. A Right to Information (RTI) application has been filed with NTPC to verify whether this is indeed true. It also remains to be verified whether NTPC is still involved or has pulled out of the project, and if the new PPAs also stipulate this clause.

It is not clear if any of the water-related terms and conditions stipulated in the in-principle approval are being fulfilled. The locals didn't mention any of the measures listed down for KSPDCL as having been implemented. If water conservation measures are not implemented, this could pose a serious threat to

water availability in the future. An operator at ReNew said water for bimonthly cleaning of solar PVs is always brought from outside in tankers.

50-year-old farmer Oblesha pointed out that some of the leased plots have borewells; it is not clear if the companies use these borewells to extract water. He also told us that some locals sell water to the solar plants at ₹250/tanker.

4.2.7 Current status

From our conversations with locals, we learned that many of the benefits promised to the community by KSPDCL were not included in the contracts. These promises have largely been reneged on but are difficult to pursue because they were not recorded in a formal legal document. Promised benefits that have not materialised include the following.

- * **Power for the villages from whom land was leased:** most households have negligible access to power.
- * **Jobs for lessors:** approximately 10,000 jobs were promised to locals, but almost no local has got a job with companies that have been awarded land by KSPDCL.
- * Infrastructure for the local population:
 - » A new diploma college
 - » A 50-bed hospital
 - » 10% greenery in the area
 - » Reverse osmosis plants to provide locals with clean water at very reasonable rates, as the local water has very high fluoride content. One plant has been set up by ReNew but is insufficient to meet the needs of the villagers.
 - » Cement concrete roads have so far only been built in areas used by the companies for their work. Many internal village roads were damaged during the construction of the plants due to movement of heavy equipment. They continue to be in terrible condition⁷⁶.
 - » Improvements to the local temple.
- * Villagers are unsure if the 6% of profit to be used for Corporate Social Responsibility (CSR) initiatives for local development has been used, and if so, how.

These promises have largely been reneged on but are difficult to pursue because they were not recorded in a formal legal document

Muthyalappa, a security guard at a ReNew power plant, told us about labour issues, such as being made to do 12-hour shifts while being paid for only 8 hours. He said this practice was prevalent.

On the other hand, community members told us of the following benefits that have been delivered.

- * Adani has sanctioned the building of toilets in the primary school.
- * Fortum has provided sports equipment worth ₹20,000 to the primary school at Thirumani.
- * ReNew has started a digital literacy programme for 30 young people.

One local said the ambulance service started by ReNew was very useful, especially because of the large number of snake bite cases in the area after dark.





5.0

RECOMMENDATIONS AND CONCLUSION

Based on our examination of the relevant policies and findings from visits to project sites, we recommend the following for large-scale renewable energy projects in India.

1

Mandatory EIAs and SIAs

Impact assessments are not limited to carbon emissions and hazardous effluent discharge. They also assess a project's impact on natural resources in its vicinity and on those dependent on these resources. They gauge a project's effects on human lives as well as wildlife. These effects are quite visible, and in many cases, irreversible. Unless they are assessed, it is difficult to say that large-scale RE projects have no or negligible environmental impact on local resources. Moreover, residents of areas where large-scale RE projects are proposed and/or set up should have ways to register their opinion on projects which can affect their lives. Projects can then be modified according to their feedback, along with serving public interest or national interest more generally. Therefore, it is important for large-scale RE projects, including solar and wind, to carry out EIAs and SIAs, just like any other infrastructure or conventional power project.

2

No exemption from environmental clearances

Apart from the aforementioned concerns, large-scale RE projects can also produce hazardous waste as outlined in section 2.2.7 of this report. It is critical that large-scale RE projects not be exempted from obtaining an EC, which should include the management and proper disposal of hazardous waste.

3

Compulsory water use approval

Large projects normally need an EC from the MoEFCC. This EC is contingent on prior approvals for water use from the relevant authority: the Central Ground Water Board (CGWB) or the State Water Resource Department or both. Solar and wind projects are exempt from getting ECs. So, if the state policy does not specify the need for approval for water use, project developers can bypass this. Most state policies are ambiguous on approvals for use of surface and groundwater, while projects developed by SECI are required to get these.

Water scarcity is increasing in many parts of the country. Competition for access to water between residential use, agriculture, industry, and the power sector is accelerating. There is a dire need for state RE policies and central government policies to mandate approval for water use for large-scale RE projects, even if these projects do not use significant amounts of water. These approvals should include clear plans to harvest and recycle water in plant O&M. For surface water use, the state WRD should be the competent authority. For groundwater, it should be the CGWB.

4

Impact mitigation plans

Project proponents should be required to assess the effects of their project and create a time-bound mitigation plan that can be monitored for each impact. Conditions on which projects are cleared often stay on paper as a formality only, remaining unfulfilled on the ground. Agreed on mitigation measures ought to be implemented and monitored for progress. Project proponents should face penalties or disincentives if they do not implement mitigation measures.

5

No-go zones

Large-scale RE projects have severe adverse effects on the environment and resources in eco-sensitive zones like forests and CRZs. Infrastructure projects, even those with small footprints, can have devastating impacts on the delicate ecology of these areas and irreversibly damage local ecological resources. Such areas should be designated no-go zones for industrial or developmental activity, including large-scale RE projects.

6

Water assessment in water-stressed regions

Many large-scale RE projects, particularly large solar projects, have been set up or proposed in water-stressed, rainfed regions like western Rajasthan, western Gujarat, Vidarbha in Maharashtra, and north-eastern Karnataka (Hyderabad-Karnataka). A large number of solar parks and solar farms put considerable stress on the already reduced groundwater reserves of these regions. To avoid total depletion of a region's groundwater, a regional assessment of available water resources must be done. This should cover mapping of surface and groundwater availability, its longevity, competition for access, and utilisation plans including reuse and recycling of water. Until such an assessment is done, approval of new large-scale infrastructure projects, including RE, should be put on hold. New projects should be approved only after factoring in availability of surface and groundwater.

7

Public consultations

Though there are legal provisions to ensure public participation in projects under the Land Acquisition Act 2013, the Forest Rights Act 2006 and others, these are not always applied. All stakeholders, including the local, state and central authorities, as well as the communities living in the region, should be consulted. Their concerns and suggestions should be taken on board right from the beginning of a project. Public consultations should carry on during project implementation, and genuine efforts should be made to resolve points of disagreement. Public consent should be an integral part of clearance procedures.

8

Proper implementation of resettlement and rehabilitation (R&R) plans:

Policies for resettling and rehabilitating displaced people are in place in every state. Project proponents should have well-laid R&R plans in accordance with these policies, which they must implement properly. Governing agencies need to monitor implementation of these plans and other promises made by project proponents in agreements. Innovative measures like leasing of land and annual rental schemes seem to have benefitted project-affected communities, but community interests must not be put beneath industry interests.

9

Adequate compensation for affected livelihoods

In talking to members of project-affected communities, it became clear that even when people are not displaced for RE projects, their livelihoods are frequently affected. When the project site falls partly or fully within forests on which these communities depend, they lose their access to forest produce and other forest dependent livelihoods. In such cases, it is important to compensate the communities adequately.

10

Public debate on revenue sharing in land leasing models

One measure being adopted to address scarcity of land for solar power projects is land leasing. Several states, like Gujarat, Maharashtra, Karnataka, and Punjab are exploring this model, which has also found a place in the central government's recently approved KUSUM scheme. This scheme provides for use of farm land for solar power projects upto 2 MW along with solarisation of irrigation pumps (both private and government), and feeding of additional power generated through pumps into a centralised grid. The scheme has a significant financial outlay. However, this model is heavily tilted in favour of solar power developers and has few benefits for farmers/landowners. Landless farm labourers who are heavily dependent on these lands do not benefit at all. Landless farm labourers who lose their livelihoods should also be considered when land lease models are developed. We highly recommend further public debate on these options to help resolve known issues and improve leasing models.

11

Evaluation of impact on food security

When proposing solar parks in areas where dryland agriculture is prevalent, the following factors should be taken into account.

- * Is the dryland specific food crop being replaced by the solar park of high nutritional value?
- * Will its shortage in the country result in an expensive import bill for the country's exchequer and/or adversely affect food security?
- * Is the ecological damage merely being passed on from India to other countries?
- * Will farmers' incomes be hit?

In conclusion, large-scale RE is expected to bring several important benefits to the country, and address global and national development and environmental challenges. It promises to address the country's electricity needs, create local job opportunities, decarbonise India's power sector at a time when the climate crisis is already peaking, and bring down overall GHG emissions. It is important that these projects actually achieve these objectives, and not go the way of conventional power projects in matters of land, social and environmental conflict. This report is an effort to initiate a public conversation on this important issue.

6.0

LIST OF ABBREVIATIONS

ADB	Asian Development Bank
BESCOM	Bangalore Electricity Supply Company Limited
BWS	Bhimashankar Wildlife Sanctuary
CC Road	Cement Concrete Road
CCF	Chief Conservator of Forests
CEA	Central Electricity Authority
CEC	Central Empowered Committee
CEEW	Council on Energy, Environment and Water
CERC	Central Electricity Regulatory Commission
CF	Conservator of Forests
CGWB	Central Ground Water Board
CMD	Chief Managing Director
CPCB	Central Pollution Control Board
CRZ	Coastal Regulation Zone
CSE	Centre for Science and Environment
CSP	Concentrated Solar Plant
CSR	Corporate Social Responsibility
CtE	Consent to Establish
CtO	Consent to Operate
CUF	Capacity Utilisation Factor
CZMA	Coastal Zone Management Authority
DFO	Divisional Forest Officer
DISCOM	Distribution Company
DLC	District Level Committee
EC	Environmental Clearance
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
EPA	Environment Protection Act 1986
EPS	Electric Power Survey
ESA	Ecologically Sensitive Area
ESCOM	Electricity Supply Company
ESZ	Eco-Sensitive Zone
EV	Electric Vehicle
FAC	Forest Advisory Committee
FCA	Forest (Conservation) Act 1980
FiT	Feed-in Tariff
FRA	Forest Rights Act, refers to the Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act 2006
FRC	Forest Rights Committee
GEDA	Gujarat Energy Development Agency
GHG	Greenhouse Gas
GIDC	Gujarat Industrial Development Corporation
GoI	Government of India
GW	Gigawatt

ha	hectares
IESS	India Energy Security Scenarios
IGNP	Indira Gandhi Nahar Project
IPP	Independent Power Producer
ISA	International Solar Alliance
IWPTMA	Indian Wind Power Turbine Manufacturers Association
KLPD	kilogram litres per day
KPTCL	Karnataka Power Transmission Company Limited
KREDL	Karnataka Renewable Energy Development Limited
KSPDCL	Karnataka Solar Power Development Corporation Limited
KUSUM	Kisan Urja Suraksha evam Uttan Mahabhiyan
MAHAGENCO	Maharashtra State Power Generation Company Limited
MEDA	Maharashtra Energy Development Agency
MLA	Member of Legislative Assembly
MNRE	Ministry for New and Renewable Energy
MoEFCC	Ministry of Environment, Forest and Climate Change, formerly Ministry of Environment and Forests (MoEF)
MPCA	Medicinal Plants Conservation Area
MSEDCL	Maharashtra State Electrical Distribution Company Limited
MW	Megawatt
NBWL	National Board for Wildlife, formerly Indian Board for Wildlife (IBWL)
NEP	National Electricity Plan
NGT	National Green Tribunal
NIWE	National Institute for Wind Energy
NOC	No Objection Certificate
NPV	Net Present Value
NREDCAP	Non-conventional Energy Development Corporation of Andhra Pradesh Limited
NSM	National Solar Mission, formerly Jawaharlal Nehru National Solar Mission (JNNSM)
NTP	National Tariff Policy
NVVN	NTPC Vidyut Vitaran Nigam
O&M	Operations & Maintenance
PA	Protected Area
PCCF	Principal Chief Conservator of Forests
PGBS	Paschim Ghat Bachao Samiti
PIL	Public Interest Litigation
PLF	Plant Load Factor
PPA	Power Purchase Agreement
PPP	Public Private Partnership
PSU	Public Sector Undertaking
PV	Photovoltaic
PwC	PricewaterhouseCoopers
R&R	Resettlement & Rehabilitation
RE	Renewable Energy

REC	Renewable Energy Certificate
RGO	Renewable Generation Obligation
RPO	Renewable Purchase Obligation
RRECL	Rajasthan Renewable Energy Company Limited
RTI	Right to Information
SAG	State Advisory Group
SEAC	State Expert Appraisal Committee
SECI	Solar Energy Corporation of India
SEIAA	State Environment Impact Assessment Authority
SERC	State Electricity Regulatory Commission
SHG	Self-Help Group
SIA	Social Impact Assessment
SLEC	State Level Empowered Committee
SLSC	State Level Screening Committee
SNA	State Nodal Agency
SPCB	State Pollution Control Board
SPD	Solar Power Developer
TEDA	Tamil Nadu Energy Development Agency
TSPCB	Telangana State Pollution Control Board
TSREDCO	Telangana State Renewable Energy Development Corporation Limited
UDAY	Ujwal DISCOM Assurance Yojana
UNFCCC CDM	United Nations Framework Convention on Climate Change Clean Development Mechanism
UT	Union Territory
UTPCC	Union Territory Pollution Control Committee
VGf	Viability Gap Funding
WCS	Wildlife Conservation Strategy 2002
WEG	Wind Energy Generator
WGEEP	Western Ghats Ecology Expert Panel
WL	Wildlife
WRD	Water Resource Department
WTG	Wind Turbine Generator
WWIL	Wind World (India) Limited, formerly Enercon (India) Limited

7.0

ENDNOTES

- 1 *Sep-18 Executive Summary on Power Sector—Central Electricity Authority*
www.cea.nic.in/reports/monthly/executivesummary/2018/exe_summary-09.pdf
- 2 *India is now the world's third-largest electricity producer—Quartz India. 26 March 2018*
www.qz.com/india/1237203/india-is-now-the-worlds-third-largest-electricity-producer/
- 3 *National Electricity Plan—Central Electricity Authority*
www.cea.nic.in/reports/committee/nep/nep_jan_2018.pdf
- 4 *India's Institutional Governance and the Energy Transition. 5 December 2018*
www.iai.it/sites/default/files/iaip1819.pdf
- 5 *All India Installed Capacity (in MW) of Power Stations. 31 March 2014*
www.cea.nic.in/reports/monthly/installedcapacity/2014/installed_capacity-03.pdf
- 6 *Sep-18 Executive Summary on Power Sector—Central Electricity Authority*
30 September 2018
www.cea.nic.in/reports/monthly/executivesummary/2018/exe_summary-09.pdf
- 7 *All India Installed Capacity (in MW) of Power Stations. 31 May 2018*
www.cea.nic.in/reports/monthly/installedcapacity/2018/installed_capacity-05.pdf
- 8 *A Report on Energy Efficiency and Energy Mix in the Indian Energy System—Niti Aayog*
www.niti.gov.in/writereaddata/files/document_publication/Energy_Efficiency.pdf
- 9 *India's Institutional Governance and the Energy Transition. 5 December 2018*
www.iai.it/sites/default/files/iaip1819.pdf
- 10 *Jul-18 Executive Summary on Power Sector—Central Electricity Authority. 31 July 2018*
www.cea.nic.in/reports/monthly/executivesummary/2018/exe_summary-07.pdf
- 11 *India may not reach 100 GW solar power target by 2022: Crisil report.” 13 August 2018*
www.livemint.com/Industry/HEugjBRI2zsNDyVzB2E1kJ/India-may-not-reach-100GW-solar-power-target-by-2022-Crisil.html
- 12 *JNNSM Introduction—Solar Energy Corporation of India Limited*
www.seci.co.in/other_page.php?page=jnnsms_introduction
- 13 *Solar India Info | Indian Power Sector*
www.indianpowersector.com/home/renewable-energy/solar_new/solar-power/
- 14 *Introduction—Solar Energy Corporation of India Limited*
www.seci.co.in/other_page.php?mmid=18&page=about_us

- 15 *National Offshore Wind Energy Policy*—MNRE. 1 October 2015
www.mnre.gov.in/file-manager/UserFiles/National-Offshore-Wind-Energy-Policy.pdf
- 16 *Renewable Energy Regulatory Framework*—MNRE
www.mnre.gov.in/renewable-energy-regulatory-framework
- 17 *The Electricity Act, 2003*—Ministry of Law and Justice
www.powermin.nic.in/sites/default/files/uploads/The%20Electricity%20Act_2003.pdf
- 18 *The Electricity Act, 2003*—CERC. 2 June 2003
www.cercind.gov.in/Act-with-amendment.pdf
- 19 *Tariff Policy*—Ministry of Power. 28 January 2016
www.wberc.gov.in/sites/default/files/tariff-policy-28.01.2016.pdf
- 20 *Ibid*
- 21 *Environmental Impact Assessment Notification 2006*—Ministry of Environment and Forests
www.moef.gov.in/wp-content/uploads/2018/03/sol533.pdf
- 22 *EIA Guidelines Wind Power Report*—CSE.pdf—India Environment Portal. 20 July 2013
www.indiaenvironmentportal.org.in/files/file/EIA%20Guidelines%20Wind%20Power%20Report-CSE.pdf
- 23 *Air (Prevention and Control of Pollution) Act, 1981*
www.indiaenvironmentportal.org.in/files/file/air%20act%201981.pdf
- 24 *Water (Prevention and Control of Pollution) Act, 1974*
www.indiawaterportal.org/sites/indiawaterportal.org/files/e7402_1.pdf
- 25 *Environmental Clearance for setting up of Solar Thermal Power Plants under JNNSM, Ministry of Environment and Forests. June 2011*
www.moef.gov.in/wp-content/uploads/2018/04/JNNSM.pdf
- 26 *Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013*—Ministry of Law and Justice
www.dolr.gov.in/sites/default/files/Right%20to%20Fair%20Compensation%20and%20Transparency%20in%20Land%20Acquisition%2C%20Rehabilitation%20and%20Resettlement%20Act%2C%202013.pdf

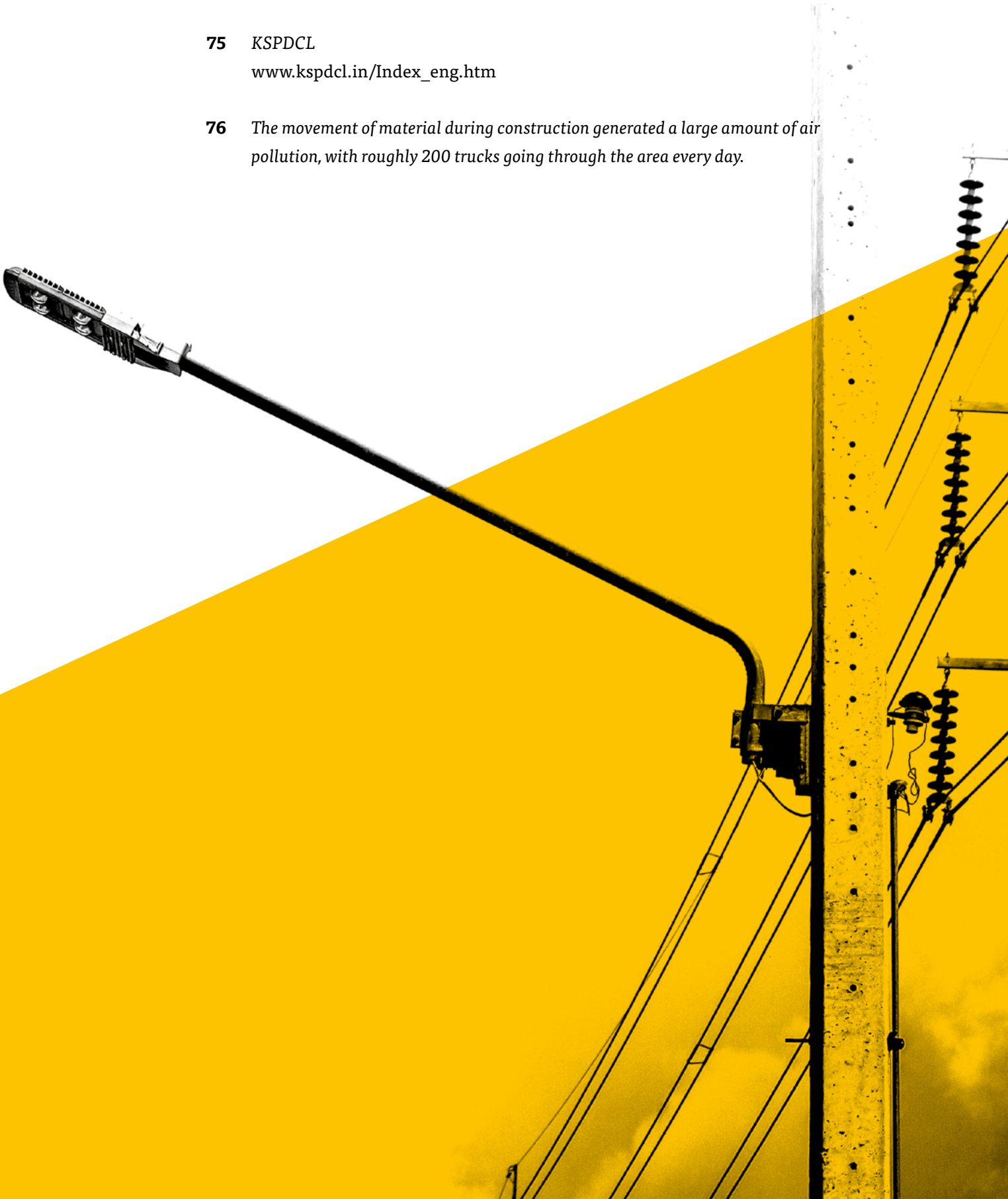
- 27** CRZ Notification, 1991.pdf—Environment Clearance
www.environmentclearance.nic.in/writereaddata/SCZMADocument/CRZ%20Notification,%201991.pdf
- 28** Draft Coastal Regulation Zone Notification, 2018—Ministry of Environment, Forests and Climate Change
www.indiaenvironmentportal.org.in/files/file/Draft%20Coastal%20Regulation%20Zone%20Notification,%202018.pdf
- 29** Ibid
- 30** Forest (Conservation) Act, 1980 with Amendments Made in 1988—MoEFCC
www.moef.gov.in/wp-content/uploads/2018/03/Forest.pdf
- 31** Guidelines for diversion of forest land for non-forestry purposes under Forest (Conservation) Act, 1980—Guidelines for collection of Net Present Value (NPV)—FC Division, MoEF
www.mpforest.gov.in/img/files/LM2_26-29S.pdf
- 32** Proposals received on or after 15 July 2014
www.forestsclearance.nic.in/Online_Status.aspx
- 33** Rajasthan Solar Energy Policy, 2014—MNRE
www.mnre.gov.in/file-manager/UserFiles/Grid-Connected-Solar-Rooftop-policy/Rajasthan-Solar-Energy-Policy-2014.pdf
- 34** Policy for Promoting Generation of Electricity from Wind, 2012—Government of Rajasthan
www.energy.rajasthan.gov.in/content/dam/raj/energy/common/Policy%20for%20promoting%20generation%20of%20electricity%20from%20Wind%20-2012.pdf
- 35** Gujarat Solar Power Policy 2015—GUVNL. 13 August 2015
www.gseb.com/DownloadFiles/File/GUVNL/Gujarat%20Solar%20Power%20Policy%202015.pdf
- 36** Gujarat Wind Power Policy 2016—Government of Gujarat
www.indiaenvironmentportal.org.in/files/file/Gujarat%20Wind%20Power%20Policy-2016.pdf
- 37** Comprehensive Policy for Grid-connected Power Projects based on New and Renewable (Non-conventional) Energy Sources 2015—Government of Maharashtra
www.mahaurja.com/meda/data/grid_wind_power/state_policy/Policy%202015_2.pdf


- 38** *Andhra Pradesh Solar Power Policy 2015—Government of Andhra Pradesh*
www.indiaenvironmentportal.org.in/files/file/Andhra_Pradesh_Solar_Policy_2015.pdf
- 39** *Andhra Pradesh Wind Power Policy 2015—Government of Andhra Pradesh*
www.indiaenvironmentportal.org.in/files/file/Andhra%20Pradesh%20Wind%20Power%20Policy,%202015.pdf
- 40** *Telangana Solar Power Policy 2015—MNRE*
www.mnre.gov.in/file-manager/UserFiles/Grid-Connected-Solar-Rooftop-policy/Telangana_Solar_Power_Policy_2015.pdf
- 41** *Telangana Wind Power Policy 2016—India Environment Portal*
www.indiaenvironmentportal.org.in/files/file/Telangana_Wind_Power_Policy_2016.pdf
- 42** *Karnataka Solar Policy 2014–21—Government of Karnataka. 22 May 2014*
www.kredlinfo.in/solargrid/Solar%20Policy%202014-2021.pdf
- 43** *Draft Karnataka Renewable Energy Policy 2014–2020—Government of Karnataka*
www.kredlinfo.in/Policy/RE%20Policy%202014-20.pdf
- 44** *Tamil Nadu Solar Energy Policy 2012—MNRE. 30 September 2012*
www.mnre.gov.in/file-manager/UserFiles/state-power-policies/Tamilnadu-Solar-Power-Policy.pdf
- 45** *Gujarat Industrial Policy 2015—Government of Gujarat*
www.ic.gujarat.gov.in/documents/commondoc/2019/INDUSTRIAL_POLICY_2015.pdf
- 46** *Industrial Development Policy 2015–2020—apiic*
www.apiic.in/wp-content/uploads/2015/05/Industrial-Devpt.-Policy.pdf
- 47** *Tamil Nadu Industrial Policy 2014—Government of Tamil Nadu*
www.ficci.in/SEdocument/20304/TN_Industrial_Policy_2014.pdf
- 48** *Forest (Conservation) Amendment Rules 2014—Ministry of Environment and Forests*
www.fed.gujarat.gov.in/writereaddata/images/pdf/fc-amendment-rule-2014.pdf
- 49** *India Arable Land Hectares Per Person—Trading Economics*
www.tradingeconomics.com/india/arable-land-hectares-per-person-wb-data.html
- 50** *Population Density (Per Sq. Kilometre.)—NITI Aayog. 21 January 2017*
www.niti.gov.in/content/population-density-sq-kilometre

- 51 *Executive Summary—Census of India*
www.censusindia.gov.in/2011census/PCA/PCA_Highlights/pca_highlights_file/India/4Executive_Summary.pdf
- 52 *Wastelands Atlas of India—Deptment of Land Resources, National Remote Sensing Centre. 2011*
www.dolr.gov.in/sites/default/files/Wastelands_Atlas_2011.pdf
- 53 *Automation in solar sector: when robots form the clean-up crew, 26 June 2018. Accessed 2 July 2019.*
www.downtoearth.org.in/news/energy/automation-in-solar-sector-when-robots-form-the-clean-up-crew-60978
- 54 *Wind Energy Projects—CLP India Private Limited*
www.clpindia.in/operations_wind.html
- 55 *Wind farm threat to forests—Down To Earth*
www.downtoearth.org.in/news/wind-farm-threat-to-forests-32970
- 56 *VCS Version 3. 6 October 2017*
www.vcsprojectdatabase.org/services/publicViewServices/downloadDocumentById/28710
- 57 *Permission granted to Andhra Wind Power Project Enercon-India, Maharashtra — Kalpavriksh*
www.kalpavriksh.org/wp-content/uploads/2018/07/Bhimashankar-windmills_letter-to-PCCF-Maharashtra.pdf
- 58 *Wildlife Conservation Strategy 2002—MoEF*
www.moef.gov.in/wp-content/uploads/2018/04/wildlife_conservation_strategy.pdf
- 59 *Guidelines for Declaration of Eco-Sensitive Zones around National Parks and Wildlife Sanctuaries—Ministry of Environment and Forests, 9 February 2009*
www.indiaenvironmentportal.org.in/files/GuidelinesforEco-SensitiveZone.pdf
- 60 *Gram sabhas are constitutionally and legally recognised village assemblies. Their approval is mandatory for several processes, such as diversion of forest land for non-forest use.*
- 61 *Report of the Western Ghats Ecology Expert Panel 2011*
www.indiaenvironmentportal.org.in/files/file/report%20of%20the%20western%20ghats%20ecology%20expert%20panel.pdf

- 62 *F. No. 11-9/1998-FC (pt) Government of India, Ministry of Environment and Forests.*
30 July 2009
www.sruti.org.in/sites/default/files/FRA%20and%20FCA%20circular%20by%20MoEF%2030.7.2009.pdf
- 63 *Census of India 2011*
www.censusindia.gov.in/pca/SearchDetails.aspx?Id=694817
- 64 *Critical analysis of Dr. D M Nanjundappa Committee Report and its Implementation*
www.cmdr.ac.in/editor_v51/assets/Mono-74.pdf
- 65 *Azure Power Secures \$58 Million for its 100 MW Solar Project at Pavagada—Mercom India.* 8 October 2018
www.mercomindia.com/azure-secures-58-million-100m-solar-pavagada/
- 66 *Karnataka Solar Power Development Corporation Limited—KSPDCL*
www.kspdcl.in/aboutus.aspx
- 67 *Proceedings of joint meeting for synchronisation of SPDs under JNNSM scheme.*
14 December 2017
www.kspdcl.in/sp_docs/Proceedings%20of%20joint%20meeting%20for%20synchronisation%20of%20SPDs%20under%20JNNSM%20Scheme.pdf
- 68 *NTPC pulls out of Pavagada solar power project—The Hindu.* 25 January 2018
www.thehindu.com/news/national/karnataka/ntpc-pulls-out-of-pavagada-solar-power-project/article22515610.ece
- 69 *In-principle approval to establish Pavagada Solar Park—GoK.* 29 October 2015
www.kspdcl.in/SP_DOCS/Notification/GoK%20order%20dated%2029-10-2015%20according%20in-principle%20approval%20to%20establish%202000MW%20Pavagada%20Solar%20Park.pdf
- 70 *Karnataka Industrial Policy 2014-2-19*
[www.itbt.karnataka.gov.in/Documents/karnataka-industrial-policy-2014%20\(1\).pdf](http://www.itbt.karnataka.gov.in/Documents/karnataka-industrial-policy-2014%20(1).pdf)
- 71 *Solar Park, Bhadla—kspdcl.* 13 January 2016
www.kspdcl.in/SP_DOCS/solarparks/PPT%20for%20NTPC%20pre%20bid%20meeting%20on%2013-01-2016.pdf
- 72 *Solar Park of 2000 MW Capacity in the State of Karnataka, India—CDKN*
www.cdkn.org/wp-content/uploads/2017/07/Up-Karnataka-Solar-park-DPR-1.pdf

- 73** *Social Management Plan—Solar PV Park—KSPDCL*
www.kspdcl.in/SP_DOCS/SMP%20Solar%20UMPP%20Pavagada.pdf
- 74** *Environmental Impact Assessment—Solar PV Park—KSPDCL. 11 February 2016*
www.kspdcl.in/sp_docs/Environment%20Assesment%20impact%20report%20Feb-16.pdf
- 75** KSPDCL
www.kspdcl.in/Index_eng.htm
- 76** *The movement of material during construction generated a large amount of air pollution, with roughly 200 trucks going through the area every day.*





“Powering Ahead:
An assessment of the socio-economic
and environmental impacts of large-scale
renewable energy projects and an examination
of the existing regulatory context”

—
Report by
Asar Social Impact Advisors Pvt. Ltd.
for **Heinrich Böll Stiftung**