
BALANCING GREEN GROWTH AND GROUND REALITIES: POLICY GAPS IN LAND ACQUISITION AND ENVIRONMENTAL CLEARANCE FOR INDIA'S RENEWABLE ENERGY TRANSITION

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Introduction

India has set ambitious renewable energy targets (500 GW by 2030) to reduce carbon emissions and meet growing demand. The sector has seen explosive growth – from 2.8 GW of solar in 2014 to about 97.9 GW in 2024, with wind capacity at 48.2 GW. This translates to roughly 45% of India's power capacity being non-fossil fuel based. However, this rapid expansion raises critical questions about land use and environmental oversight. Large-scale wind and solar farms require vast land tracts (around 4–5 acres per MW), and projects are often fast-tracked under exemptions. In practice, current policies largely favour rapid deployment: many renewables are *exempt* from standard land, water or environmental regulations, on the rationale that they “do not cause pollution or ecological impact”. Experts warn that this topdown, industry-led approach risks sidelining ecological and social concerns. This paper examines India's land acquisition and environmental clearance regimes as they apply to renewable energy, identifying key gaps and conflicts. It considers all major renewable types (solar, wind, hydro, biomass, etc.) and includes state perspectives from Karnataka and Delhi, highlighting recent developments and cases.

Renewable Energy Landscape in India

India's installed renewable capacity reached about **209.44 GW** by end-2024. Major sources include:

- **Solar Power:** ~97.9 GW installed (up from 73.3 GW in 2023). Utility-scale parks and rooftop PV dominate. Large solar parks (e.g. Kurnool UMPP in Andhra Pradesh) occupy thousands of acres; for example, achieving 1 MW often requires about 4–5

acres.

- **Wind Energy:** ~48.2 GW installed, mostly onshore wind farms in states like Tamil Nadu, Gujarat and Rajasthan. Wind projects spread turbines over rural and semi-arid areas. While each turbine has a small footprint, the **landscapes** they occupy can be extensive (e.g. large wind-rich ridges).
- **Hydropower:** ~46.5 GW (large hydro) plus ~5.1 GW small hydro. Small hydro projects (<25 MW each) are numerous in hilly regions; large dams (e.g. Tehri Dam) exist as well. Hydro projects involve reservoir inundation or river diversion.
- **Biomass & Waste-to-Energy:** ~11.35 GW biomass (including 2.25 GW from bagasse cogeneration), plus municipal waste-to-energy plants (typically 5–30 MW each). These use agricultural residues, urban waste or industrial byproducts. They have smaller land footprints but raise air/water pollution concerns.
- **Others:** Minor shares from geothermal (pilot projects) and offshore wind (nascent).

Each category has specific land and environmental implications. For example, solar parks convert land (often farmland or wasteland) into panel fields; wind projects intersect with bird habitats; small hydros impact rivers. The table below summarizes key characteristics:

- **Solar PV:** High land demand; largely exempt from formal EIA. Local issues include land use change (often from agriculture), dust/water use (panel cleaning) and end-of-life waste (PV panels).
- **Wind:** Moderate land per MW; turbines on wild or agricultural lands. Officially exempt from EIA unless in sensitive areas. Key concerns are avian and bat collisions (raptors, bustards) and ecological disturbance.
- **Hydropower:** Dams flood valleys; large hydro (>25 MW) requires EIA, small hydro often exempt. Impacts include deforestation, river flow alteration and social displacement.
- **Biomass/WtE:** Low land needs (uses existing facilities); regulated under air/water pollution norms. Clearance required under Air/Water Acts; often no major land

conflicts.

Despite low emissions, renewable projects still exert pressure on **land, water and biodiversity**. For instance, a 2021 IEEFA study estimates solar and wind might occupy ~95,000 km² by 2050 – roughly the size of Bihar. Studies show 74% of India’s solar farms sit on land previously used for farming or natural habitat. With these stakes, the adequacy of land acquisition laws and clearance rules is critical.

Land Acquisition: Framework and Gaps

India’s primary land law for infrastructure is the **Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013** (LARR Act). This Act generally mandates: consent from 70–80% of affected farmers (for public–private projects), Social Impact Assessment (SIA), and payment of compensation plus resettlement assistance. However, for many renewable projects, this framework is bypassed or evaded.

- **State Exemptions and Alternatives:** Recognizing that LARR’s lengthy procedures could delay renewable goals, many states have devised alternate routes. The Centre itself *allowed* states to use “alternative mechanisms” for land acquisition in renewable energy, sidestepping full LARR procedures. For example, Karnataka’s Solar Policy empowers district collectors to *reclassify* agricultural land for solar use. Under the Karnataka Land Reforms (Amendment) Act, 2015, any agricultural landholder may divert land to solar power, with conversion permission automatically granted. In practice, this lets project authorities lease or allot farm plots without typical rezoning hurdles.
- **Leasing vs Purchase Models:** In lieu of formal acquisition, developers access land via varied models. A survey of projects found common approaches:
- **Leasing government land:** States often identify waste or fallow public land for solar/wind parks. The Solar Park Scheme encourages using “government waste/non-agricultural land”. Large parks like Bhadla (Rajasthan) use leased state land, avoiding resettlement. Advantages are low cost (nominal rents) and no farmer displacement, though such land is limited and may have access challenges.

- **Leasing private land:** Many policies incentivize voluntary lease agreements with farmers. Developers pay annual rents (often ~₹20,000–30,000/acre) instead of buying land outright. This model has been adopted in Karnataka, Maharashtra, Tamil Nadu and even Delhi. Its advantage is speed and simpler paperwork (avoid LARR), but deals are opaque and farmers have reported poor terms (e.g. fixed low rent, no SIA). For instance, in Karnataka's Pavagada Solar Park, officials went door-to-door securing 25-year land leases at ₹21,000/acre-year, sidestepping LARR. Critics note that farmers were not informed about end-of-lease protocols, effectively blocking their legal protections.
- **Purchasing private land:** Direct land purchase from owners at market rates is common. This yields clear titles (lenders prefer it). It creates a long-term asset, but substantially raises project costs and may provoke local resistance if sellers feel pressured. Here too, LARR's rigid conditions generally do not apply since land is not "acquired" by government decree.
- **Land pooling and SPVs:** Some states (e.g. Maharashtra) use landpooling – aggregating small parcels into larger contiguous sites. Others create Special Purpose Vehicles (SPVs) or land banks (e.g. NREDCAP in Andhra) to assemble land ahead of projects. These SPVs may hire consultants for SIAs, but legally they often *do not* follow LARR procedures like public hearings.

The table below (from a Shakti report) summarizes leasing vs purchase:

- **Leasing Revenue (Govt) Land:** Low rent, uses wasteland, no resettlement required. *Challenges:* Limited availability outside a few states; may still affect communal grazing or forest rights.
- **Purchasing Private Land:** Provides clear title and asset for developers. *Challenges:* High land costs and long negotiation times; sidesteps the checks (SIA, consent) intended by law.
- **Key Gaps:** These land strategies reveal major policy gaps. By leasing (not acquiring) land, developers often **avoid LARR safeguards** entirely. At Pavagada, the government admitted LARR wasn't followed because land was only *leased*. As a result, farmers did not benefit from SIA or full compensation. Similarly, classification of many project sites

as “wasteland” masks livelihoods – Fatehgarh Solar Park (Rajasthan) faced a court stay when villagers demonstrated that so-called waste lands were community grazing grounds. In effect, the exemption of renewables from strict LARR process has tilted power towards developers. The **shortfall** is that *in practice* land is often obtained without comprehensive social impact studies or fair consent, undermining ecological and social justice.

Environmental Clearance Regime and Gaps

India’s Environment Impact Assessment (EIA) rules are set by the 2006 Notification under the Environment (Protection) Act. Critically, this notification **omits** many renewable projects from clearance requirements. For example:

- **Solar PV and Parks:** MoEFCC clarifications (2011, 2017) explicitly state that solar PV plants, solar thermal plants and solar parks *do not require EIA clearance* under the 2006 Notification. Developers instead must follow general norms (water, air pollution standards), but there is no formal EIA, scoping, or public hearing process.
- **Onshore Wind:** Similar to solar, wind farms are **not listed** in Schedule I of the 2006 EIA Notification. Official guidelines note that wind power projects are “not land-intensive” and have “little environmental impact,” so no EIA is mandated. (Clearance is only triggered if a project involves forest clearance or lies in a notified eco-sensitive zone.)
- **Small Hydro:** Policy exempts small hydro projects (<25 MW) from mandatory EIA. They require only basic screening. Large dams (>25 MW) do need clearance, but thousands of mini hydels bypass detailed review.
- **Bioenergy:** Projects like biomass boilers or biogas plants generally require standard Air and Water Act consents, but typically not separate EIA clearance unless capacity or location criteria are met.
- **Waste-to-Energy:** WtE (incineration) projects fall under hazardous activity rules and usually require an EIA plus public hearing. For example, Delhi’s upcoming 30 MW WtE plant underwent a public EIA process via the DPCC.

In summary, *most renewable projects today avoid full EIA*. Government policy has favoured this: Mongabay reports that “renewable energy is exempt from certain land, water or mineral use regulations that India has,” and from environmental clearances, on the basis that renewables “do not cause any pollution or ecological impact”.

- **Key Gaps:** This regulatory laxity creates blind spots. With no mandatory EIA or public hearing for large solar/wind farms, **biodiversity and local impacts can go unassessed**. Notable issues include:
 - **Wildlife and Habitat:** Turbines and solar farms can fragment habitats. For instance, Karnataka studies found that bird species richness and abundance are significantly lower within wind farms than in nearby control areas. Raptors (kites, eagles) face high collision risk. The critically endangered Great Indian Bustard has been mortally affected by turbines in Gujarat/Rajasthan. Yet India lacks clear guidelines for siting renewables outside sensitive zones. There is *no mandated biodiversity impact assessment* for these projects.
 - **Water Resources:** Large solar parks use water for panel cleaning. A TERI/NITI study warned states like Himachal about “excess water usage” for solar cleaning. Yet this is managed through voluntary advisories, not through EIA mandates.
 - **Pollution Controls:** WtE and biomass plants emit pollutants; they are regulated under air/water acts. However, local communities have questioned whether WtE incinerators actually meet environmental standards. Without rigorous EIA, public scepticism can grow.
 - **Land and Social Impacts:** In the absence of EIA’s Social Impact Assessment, projects may overlook community usage of land. For example, many solar parks were sited on agricultural or commons land, depriving villagers of grazing without formal SIA.

Experts argue that **renewable growth needs better regulation**: as land and water demands rise, “the sector is exempt from certain regulations... but experts have been pointing out the necessity of regulations for renewable energy”. In sum, the environmental clearance framework contains a clear gap: it was written with fossil/industrial projects in mind, and has not been updated to ensure sustainability of fast-growing renewables.

Renewable Energy by Type – Land and Clearance Issues

- **Solar Projects:** Utility-scale solar parks must secure land, often in desert or farmland regions. Large parks (e.g. Bhadla, Pavagada) bundle multiple projects together. Because no EIA is required, solar developers need only follow basic pollution norms. This speeds deployment but can overlook local concerns. For instance, Karnataka's Pavagada park (2 GW) was built on rich agricultural land leased from farmers; no formal social impact study was done. Groundwater use for cleaning, loss of crop land and future panel disposal are not subject to mandatory environmental review. National policy even subsidizes capital goods and exempts solar glass from taxes, showing priority on growth. The result is that solar projects proceed with minimal ecological checks.
- **Wind Projects:** Wind farms sit on thousands of hectares, but turbines touch only a fraction. No EIA means new wind parks avoid a detailed review unless they involve forests. Thus, many windmills have gone up near wildlife areas. In 2010, the Mumbai High Court banned new windmills inside the Koyna Wildlife Sanctuary, noting earlier ones violated forest law. More recently, Gujarat and Rajasthan bustard habitats have been hotspots of conflict, culminating in Supreme Court cases. Despite these cases, India has **no standard EIA requirement** for wind turbines, nor clear setback rules. A 2022 study in Karnataka found that even relatively small wind facilities reduce local raptor populations, underscoring what EIA could have caught. In summary, wind projects largely self-certify "low impact", an assumption challenged by onground biodiversity losses.
- **Hydropower Projects:** Large hydro (dams >25 MW) require full EIA and public hearings, as well as forest clearance for any submerged forest land. In contrast, *small hydro* (<25 MW) is exempt. Thousands of mini-hydel projects (including check dams and run-of-river plants) thus go up with minimal oversight. While smaller in scale, cumulatively they alter river flows and affect communities. The exemption creates a policy gap: smaller projects can slip through without strategic watershed planning. Environmental NGOs have noted that formal assessment of cumulative impacts of many mini-dams is sorely lacking.
- **Biomass & Waste Projects:** Bioenergy plants (e.g. rice husk or sugarcane bagasse

boilers) require fuel sources but little land; their regulation focuses on emissions. These projects must obtain *Consent to Operate* under the Air and Water Acts, which involves emissions standards but usually no EIA. Waste-to-energy plants are classified under hazardous activity rules; they **do require** public EIA. For example, Delhi's new 30 MW WtE plant at Bawana underwent a DPCC-led public hearing before MoEFCC clearance. In practice, though WtE is renewable in spirit, critics claim existing WtE plants "do not follow norms and pollute". Thus, while emission controls exist, the scrutiny and social dialogue often are less than ideal.

In each case, the **environmental clearance gap** is clear: projects that still have significant land or ecological footprints are not mandatorily evaluated as rigorously as coal plants or highways.

Karnataka: State Spotlight

Karnataka is a leading renewable state (ranks 3rd in solar, 1st in wind), making it an important case study. Its policies illustrate both innovation and oversight gaps. Under the **Karnataka Land Reforms (Amendment) Act 2015**, any holder of agricultural land can convert it for solar power generation – and such conversion is automatically deemed approved. District Commissioners were empowered to approve large solar park schemes, effectively fast-tracking land use change. In practice, this legal ease contributed to the Pavagada Solar Park: the government simply took 25-year leases from farmers at fixed rates, declaring it a lease (not an "acquisition") to circumvent the LARR Act. Local activists have since complained that this left them underinformed and under-compensated, with no assurances about what happens at lease end. Meanwhile, Karnataka's electricity department has aggressively bid out parks, but it does not require EIA for these solar installations.

Wind power in Karnataka also faced scrutiny. A 2022 study in the state found that blackbucks, chinkaras and raptors avoid sites with many turbines. Karnataka's Southern Western Ghats host important wildlife, yet turbine siting decisions proceed with no mandatory fauna surveys. As noted by researchers, "there's no documentation on whether long-established wind turbines can wipe out a species, and no government guidelines on how to mitigate it". In short, Karnataka's experience shows that even with proactive incentives (large parks, hybrid auctions, grid connectivity), the state's framework *prioritizes buildout over ecology*. The social and wildlife costs have been addressed only retroactively (through courts or studies), not pre-emptively through law.

Delhi: State Spotlight

By contrast, the NCT of Delhi presents a different picture. With virtually no open land, Delhi's green strategy emphasizes rooftop and urban solar. The new Delhi Solar Energy Policy (2023) aims to triple solar capacity to 4,500 MW by 2027, largely through rooftop and third-party sales. This approach sidesteps the typical land acquisition dilemma entirely: instead of leasing fields, the city incentivizes condos and offices to install panels. As such, "land acquisition" is hardly an issue for Delhi's renewables – projects use existing infrastructure.

Environmental clearance in Delhi still follows standard law. Large projects (e.g. waste to-energy plants) require DPCC/MoEFCC approval. For example, the proposed 30 MW Bawana WtE plant (15 acres) underwent a full public EIA process, mirroring what a conventional industrial project would face. The DPCC invited public comments and held hearings before forwarding the EIA to MoEFCC. This contrasts with the blanket exemptions elsewhere: in Delhi, even so-called "environment friendly" projects aren't automatically exempt. Nonetheless, public opposition remains, with activists arguing that Delhi's WtE model "pollute[s] the air and soil" and may be unsustainable.

Rooftop projects in Delhi trigger essentially no regulatory hurdles beyond netmetering rules; there is no question of forest clearance or land use. This has spurred a boom in installations (about 1,500 MW total, 180 MW from rooftop so far). However, Delhi's model also highlights a gap: the city heavily relies on third-party off-site large solar to meet its RPOs (e.g. sourcing from out-of-state solar farms). These contracts may not factor local social-environmental costs. In sum, Delhi sidesteps land issues by design, but it still faces the national legal framework: large projects must clear the usual checks, which contrasts with renewable projects in other states.

Policy Gaps and Recommendations

In summary, India's renewable transition exposes the following policy gaps:

- **Lack of Integrated Land Policy:** The LARR Act is not designed for rapid renewable rollout, yet there is no alternative statutory scheme ensuring fair process. States use ad-hoc measures (leasing, reclassification) that lack transparency. A cohesive framework is needed to balance farmers' rights and renewable needs – for example, mandatory

SIAs and minimum compensation for any land diverted to energy, even if “leased”.

- **Exemption from EIA:** Solar PV and wind projects largely bypass EIA and public hearings. This regulatory gap means cumulative environmental impacts are ignored. Requiring at least a scaled-down EIA (or SIA) for large renewable parks could capture issues like biodiversity loss or water use.
- **Biodiversity Safeguards:** There are no clear guidelines on siting renewables relative to wildlife. The conflicts over bustards and sanctuary windmills show this omission. Conservation law demands forest or wildlife clearance *if* projects overlap protected areas, but in practice many projects skirt these lines. New rules could set minimum distances from critical habitats and require bird/bat monitoring (as in some Western countries).
- **State Capacity and Oversight:** Many issues surface in land-poor or wildlife rich states. Karnataka’s experience (leasing farmland without consent, wildlife impacts) calls for stronger oversight by state land and environment departments. Delhi’s case shows that even exempt projects are often treated like industries, but the thrust is on rooftops. States should integrate land-use planning with renewable goals, mapping sensitive areas and community lands before auctions.

India’s current approach – aggressively promoting renewables while loosening standard land and environment rules – has helped install over 200 GW of clean energy. But this has come at a cost: local communities contest land transfers, and conservationists warn of unseen ecosystem damage. If renewables are to truly be sustainable, policy must close these gaps. Strengthening the land acquisition framework (e.g. defining renewable parks as public purpose with safeguards), and recalibrating the EIA regime to include high-impact renewable projects, would help ensure the energy transition does not “favour industry over ecology” unchecked.