INDIAN JOURNAL OF POWER & RIVER VALLEY DEVELOPMENT www.ijprvd.info

DISCUSSION-OPINION-EDITORIAL

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Grid solar installations can be anti-micro/macro biological environment, and what are the choices

Introduction

The generation of gigawatt upon gigawatt of solar power requires vast stretches of open lands caressed with year-round sunshine. In this respect, many countries including India are the rather lucky ones. Take India: over half of India's terrain is sunny and semi-arid, receiving 1,000 mm of rainfall or less every year. In other words, these lands are too dry to support forests of large trees that provide with a continuous canopy, similar to what we see in major rainfall forests. This is the opportunity side as touted by the engineers, politicians and the ministries. But they overlook the risk and threat side that even the arid soils have a biological ecosystem - the earth inherited for millions of years - that has a food chain that supports micro-biota of grass, insects and small animals that depend on them with a character of their own.

All lands have character

Many of the lands where the solar plants are coming up, are is made up of grass, herbs and shrubs. They are diverse, ranging from woodland savannas, scrublands and grasslands, to rocky outcrops, ravines and dunes. They are remarkable assemblage of animal species, many of which, such as the black buck and the critically endangered great Indian bustard, occur only in the Indian subcontinent. They also have a lot of ecological services. Research shows that under certain environmental conditions, these lands can sequester more carbon if trees were planted on them. They also support grazing-based livelihoods of millions of pastoralist and agro-pastoralist communities across the country. These low-density communities, with their rich cultures, have also had a long history of coexistence with these ecosystems and their unique wildlife.

Not just development but development with sensitivity

These areas continue to be misunderstood, misrepresented, and destroyed. Successive governments have carried forward a legacy-based thinking, terming them as 'wastelands' and sought to make them 'productive'; they have tried to 'develop' them, thereby incentivizing thee limination and permanent erasure. Unlike with forests, there are no conservation laws that protect against diversion of this potently biodiversity-rich areas, that responsibility of compensatory afforestation or sensitive development. And so, these landscapes have become among the easiest kinds of lands to despoil and destroy. Renewable energy technologies – wind and solar power, in particular – are heavily reliant on open spaces. So the development would strike on the defenseless. What better option for such 'development' than our arrogantly and insensitively termed 'wastelands'? "The unfortunate classification of our semi-arid and arid grassland-savanna ecosystems as wastelands has made them extremely vulnerable to co-option for a range of developmental projects, including large solar farms, which are projected as green and sustainable," says JayashreeRatnam, Director of the Wildlife Biology and Conservation Program at the National Centre for Biological Sciences, and a global authority on savanna ecosystems. "Such labels hide the significant loss of unique biodiversity, ecosystem services and ancient livelihoods that have sustained people in these landscapes for thousands of years. When these ecological and social costs are considered, it is unlikely that such benign labels will remain applicable."

Dialectics

People at large should understand that no benefits can come without costs, returned as reactionary response. But scrutiny often perplex the public, who support renewable energy unconditionally in the belief that they are 'green' technologies, and therefore always good. It bears repeating that it is not the technology of an energy option, but the scale and nature of its implementation that decides its ecological footprint. With plans to generate hundreds of gigawatts of power at the grid-scale, we end up with ecological and social footprints of energy production — even with wind and solar technologies — that are just as massive and devastating as any large hydroelectric dam or an opencast coal mine.

As both ecology and society are being overlooked by the zealous developers and development planners, murmurs of discontent have spiralled into overt conflicts and tensions. As one of India's most charismatic birds, the great Indian bustard,

(a) (b)

Fig.1: (a) Solar developers trip up over great Indian bustard habitat in Rajasthan – Courtesy: Saur Energy International, (b) The Great Indian Bustard on the decline, Courtesy: researchmatters.in/news/race-against-time-save-great-indian-bustards

is being displaced by these projects and killed in collisions with overhead power lines, the Supreme Court has had to intervene, much to the chagrin of governments and energy companies. Transmission lines are the greatest threat to the endangered great Indian bustard. In April,2021 the Supreme Court asked wind and solar companies to take their lines underground. Elsewhere, in Kutch for instance, communities displaced from their traditional grazing lands by renewable energy projects have been protesting these projects.

Roof-top alternative

As a form of natural justice, the users of electricity should take the burden of producing it. An alternative solution to grid-scale solar on such lands lies in the government's own policy on roof-top solar installations. People may not like it but incentives and shared benefits may pave the way for implementation; in fact they can be a win-win solution to the financially stressed families in the cities. Another way to obviate the challenges, is in implementing grid-scale solar on enough large-scale 'grey' areas – places that have already been built-up or designated for industrial purposes, now unused, derelict, or even in use – where largescale production of solar is possible. For example, the Maharashtra Industrial Development Corporation has a land bank of over 2.5 lakh acres. If even 20% of this area was used for solar power generation, it would generate nearly 16 gigawatt hour/year. Given that these industrial zones are major consumers of power, such localised generation and utilisation will cut transmission losses. Rooftops of public buildings can also offer a superb opportunity for solar installations, as has been done with railway stations in some cities.

Agrivoltaics

Another alternate scenario involves the use of agrivoltaics on degraded agricultural lands. Agri PV or Agrivoltaics consists on integrating PV modules above the crops in order to enhance climate resilience and allow sustainable food and energy production on one single piece of land. While in the past it was a question of either food or solar energy production on farmland, Agri PV can combine both successfully as well as achieving greater efficiencies on both activities. By working together on the same land, farmers and energy developers can realize benefits for all involved while preserving the agricultural character of the state's rural communities. It is not an all-or-nothing proposition

Deploying solar panels in a manner that allows for cultivation below them has dual benefits. The shade from the solar panels reduces evapo-transpiration and saves water, and the panels themselves benefit from increased efficiency due to the cooling effect from the plants growing below them. The Alliance for Reversal of Ecosystem Service Threats has identified 11 million hectares of degraded agricultural lands in the semi-arid and sub-humid regions of India. If such areas were used for agrivoltaics, it could potentially transform the rural economy of these regions.

Benefits of co-locating solar and crop or livestock farming

Benefits to solar developers include:

- Reduced installation costs – The use of previously tilled agriculture may prevent the need for expensive grading to flatten land to a usable level.
- Increase PV performance – Vegetation under modules can contribute to lower soil temperatures and increase solar performance.
- Accelerate the energy transition – by joining forces with the land managers and rural areas, more owners would probably be interested in using their lands for energy purposes too.

Fig.2: Agri-solar installations (courtesy: https://ratedpower.com/blog/benefits-agrivoltaics-examples/)

Fig.3: Elevated agrisolar applications (https://ratedpower.com/blog/benefits-agrivoltaics-examples/)

- Building closer links with the agricultural world – large-scale photovoltaic farms have created a lively controversy in the agricultural world and by adapting to the sector and favouring both activities, the solar industry would see a greater ratio of their project acceptance.
- Reduced upfront risk – Geotechnical risks can increase the cost of solar installation due to increased testing needs. Previously tilled agricultural land was identified as the "least risk option" during a series of surveys with solar installers.
- Reduced legal risk – By using previously disturbed land, solar installers can reduce the risk of up front litigation during the environmental review process.
- Marketing opportunity to a sustainability-minded audience.

Benefits to agricultural land managers include:

- Reduced electricity costs – developers and landowners may reach an agreement to allocate a percentage of the generated electricity to the land and/or town.
- Diversification of the revenue stream.
- Increased ability to install high-value, shade-resistant crops for new markets – The shading by the PV panels provides multiple additive and synergistic benefits, including reduced plant drought stress and more constant temperature as the panel will maintain the temperature higher at night and colder during the day.
- Potential to extend growing seasons.
- Ability to maintain crop production during solar generation.
- Allow for nutrient and land recharge of degraded lands.
- Potential for water use reduction.

While it is true that renewable energy projects are well-meaning and seek to reduce our reliance on an energy economy pivoted on fossil fuels, more attention needs to be paid to how and where these projects are established. Sadly, so far they have remained ill-conceived and poorly implemented efforts, paying little heed both to the ecological riches and diversity in "waste" lands, and to the human livelihood and cultures that these lands support.

Acknowledgements

1. https://www-thehindu-com.cdn.ampproject.org/c/s/www.thehindu.com/sci-tech/energy-and-environment/how-indias-unguided-quest-for-solar-energy-is-bringing-about-ecological-and-cultural-erasure/article38077440.ece/amp/
2. https://ratedpower.com/blog/benefits-agrivoltaics-examples/