

Social Sustainability of Large-Scale Solar Power Implementation in Bangladesh: A Case Study of Tetulia Solar Park of Panchagarh

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ABSTRACT

Owing to the rapidly-growing economy and faster development of Bangladesh, the government has put weight on guaranteeing a non-intermittent and quality flow of electricity - to guarantee sustainable economic development. The State has made strategies for private sector participation and releasing marginal areas for energy production to diversify the electricity supply. To utilize these policies, the government designs large-scale renewable energy projects. Even though these projects are seen to be environmentally sound, they can hamper a community's welfare if the result of the development is not reached the root level. Although solar energy is among the greenest forms of energy, not all societies can embrace it, as social, environmental and economic sustainability are the three factors that constitute total sustainability. This paper aims to qualitatively analyze the socio-economic prospects in the development of the large-scale solar park. It does a critical case study of a solar park of 10 megawatts (MW) capacity constructed on 40 acres of land in Tetulia of Panchagarh District. This structure began producing electricity in May 2019, which was added to the national grid. The research demonstrates how the advantages of renewable energy accumulate at the national and organizational level, and local communities face adverse effects. The paper recommends how social sustainability in such developments might be ensured in the future.

KEYWORDS: Solar Park, Clean Energy, Land Acquisition, Social Justice

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INTRODUCTION

Bangladesh has been recorded as one of the fastest-expanding economies in the world. This economic growth relies primarily on long-term energy security, but the amplifying of energy consumption between 2005 and 2016 has barred this progress (Power System Plan, 2016). Bangladesh's growing population accelerates this rising energy demand and exhausts the remaining energy sources. For prolonged and effective economic development and poverty reduction, an accessible and dependable energy source is considered a crucial necessity. Meeting these fundamental energy requirements is vital for Bangladesh to sustain sustained Gross Domestic Product (GDP) progress of 6 percent or higher through 2030 and beyond. The power-generation capacity of Bangladesh should be increased significantly and sustainably to meet the soaring energy demand and continue economic growth. This development should not have any adverse environmental externalities as Bangladesh is highly predisposed to climate change. Hence, sustainable renewable energy resources are the most plausible option.

To ensure economical and sustainable development, the government has pursued several projects to improve the uninterrupted supply of electricity. Government policy on the issue of secondary lands for energy production and the involvement of the private sector is meant to diversify the energy supply. The government has started a scheme to develop grid-tied solar energy generation facilities in non-agricultural regions to reduce the dependence on fossil fuels for electricity generation. These solar farms will generate electricity that will be commercially fed right into the grid. The total renewable energy facility across all categories is 890.88 megawatts (Renewable Energy Master Database). Solar park projects are the largest contributors to this total, with 656.89 MW.

Now is the time to understand how the project will affect the local community as the government works to expand the number of solar parks around the nation as a component of sustainable progress. Due to the widespread belief that large-scale renewable power projects are beneficial for the environment and society, Tetulia (Sympa) Solar Park was excluded from the need for an environmental shock evaluation and any formal evaluation of social implications. The Tetulia case, however, brings to light the possibility of apparent injustice in distributing the expenses and benefits of such "environmentally sound" initiatives. Such

injustice is unfair and undermines the social recognition of these development programs when it is taken seriously by the people impacted. It is a good moment, given that Tetulia Solar Park is just the beginning of a trend of large-scale renewable power projects in Bangladesh.

Rationale and Objectives:

Similar to policy expression, most academic research on Bangladesh's energy expansion aims at solar energy's promise to meet Bangladesh's energy needs in an affordable, clean and reliable manner. While the significant benefits are associated, there is a need for a critical study of the prospective environmental and social effects. This paper hence intends to fulfil the following objectives:

- To provide insight into the correlation between renewable energy expansion and its social perspective by increasing and studying socio-economic concerns in a large-scale solar energy project in Bangladesh through a pragmatic study.
- To understand if the solar plant implementation is socially sustainable and socio-cultural and agroecological challenges of this project in a developing nation like Bangladesh, where the population concentration is soaring, and land is exceptionally fertile and demandable.

LITERATURE REVIEW

Prospects of Solar Energy

In the context of Bangladesh, solar energy has an enormous potential of all the sustainable renewable energy sources (LIZA, AKTAR and ISLAM, 2020), which is situated ideally for exploiting sunlight (Nurunnabi, Roy and Mahmud, 2018). Solar energy is a potential choice for sustainable energy because it is non-polluting, limitless, and simple to expand. It is also adaptable and cheaper (Kumar et al., 2019). The COVID-19 economic shock reminds us that we need to care for and respect the environment more. Renewable energy is one way to do this (D'Adamo, Gastaldi and Morone, 2020). The enormous environmental costs and severe health risks associated with coal-based energy are well-known (Whiteside and Herndon, 2018). Additionally, nuclear power plants pose significant threats to stability, health, and safety (Hirose, 2012).

Energy Scenario of Bangladesh

Bangladesh generates power using a variety of energy sources. Figure 1 depicts the composition of the electrical generation. Heavy fuel oil (HFO) is made from the thick, tar-like substance left over after refining crude oil.

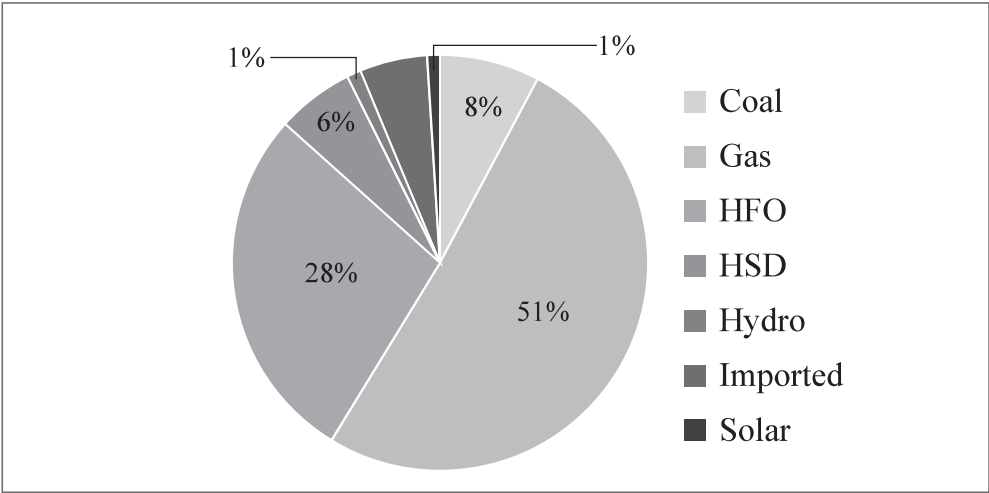


Figure 1: Energy Scenario of Bangladesh (Source: BPDB, 2022)

Renewable energy is produced from sunlight, rain, waves, wind, tides, and geothermal heat that naturally replenish over a human lifetime. Bangladesh generates considerable power from this supply. The only hydroelectric facility in the country is the Kaptai Hydroelectric Power Plant which produces 230 MW of electricity.

Electricity is produced by burning coal in coal-fired power plants. Coal, which is used chiefly in underdeveloped nations, produces 40% of the electricity used in the world.

In Bangladesh, gas is the primary energy source, and due to its wide availability across the nation, it makes up the majority. It has three main applications in Bangladesh's power plants: gas turbines, gas engines, and oil and gas-fired thermal. A significant portion of Bangladesh's total energy production comprises imported power.

Solar energy has the most potential of all renewable sources in Bangladesh. With an average of 5 kWh/m²/day, solar irradiation ranges from 3.81 kWh/m²/day to 6.43 kWh/m²/day. Figure 2 depicts the photovoltaic electricity potential.



Figure 2: *Solar Electricity Potential of Bangladesh*

Social Impact Study of Renewable Energy

Until recently, social science concerned with renewable energy sources had been inclined to concentrate on promoting economic development and reducing poverty (Chakrabarti and Chakrabarti, 2002). In the UK, numerous discussions have been over how to fairly distribute the damages and benefits of wind electricity development (van der Horst

andToke, 2010) and expanded to several European countries like Spain (Nadaï, 2007). The dissemination of economic gains (turnover and compensation), social gains (job opportunities, education, etc.), and energy gain, as well as problems like losing amenities, land, and livelihoods, are all contained by the justice prospects of these case study evaluations. It is commonly debated that the ecological and energy gains(Cass and Walker, 2009) accumulate predominantly at provincial, State and international levels, while it is observed that social and environmental influences occur mainly at the local stage where plans are accommodated (Mallon, 2012).

The assessment above also highlights the need for more research on the growth of renewable energy in poor economies (Yenneti and Day, 2015). Given the desire for the large-scale growth of renewable power in nations and expectations that renewable energy may support sustainable development, this is a significant gap. Due to the rapid growth of this industry as well as the distinct social and economic framework in which it is occurring, it is crucial to look at issues of injustice and justice in the development of the energy sector in the global South because the lessons learned from case studies in Europe may not be applicable there. By offering an academically informed study of energy sustainability in the context of Bangladesh's growth of renewable energy, this paper pursues to improve the area of energy justice.

METHODOLOGY

The Case Study:

Sympa 10.31 MWp Grid Tied Solar PV Project, located at Tetulia, Panchagarh, is one of the largest solar power plants in Bangladesh. This is constructed in a public-private partnership agreement, and the private developers start land acquisition and develop plots within them. After the implementation, companies sell the manufactured power to the government at a fixed rate.

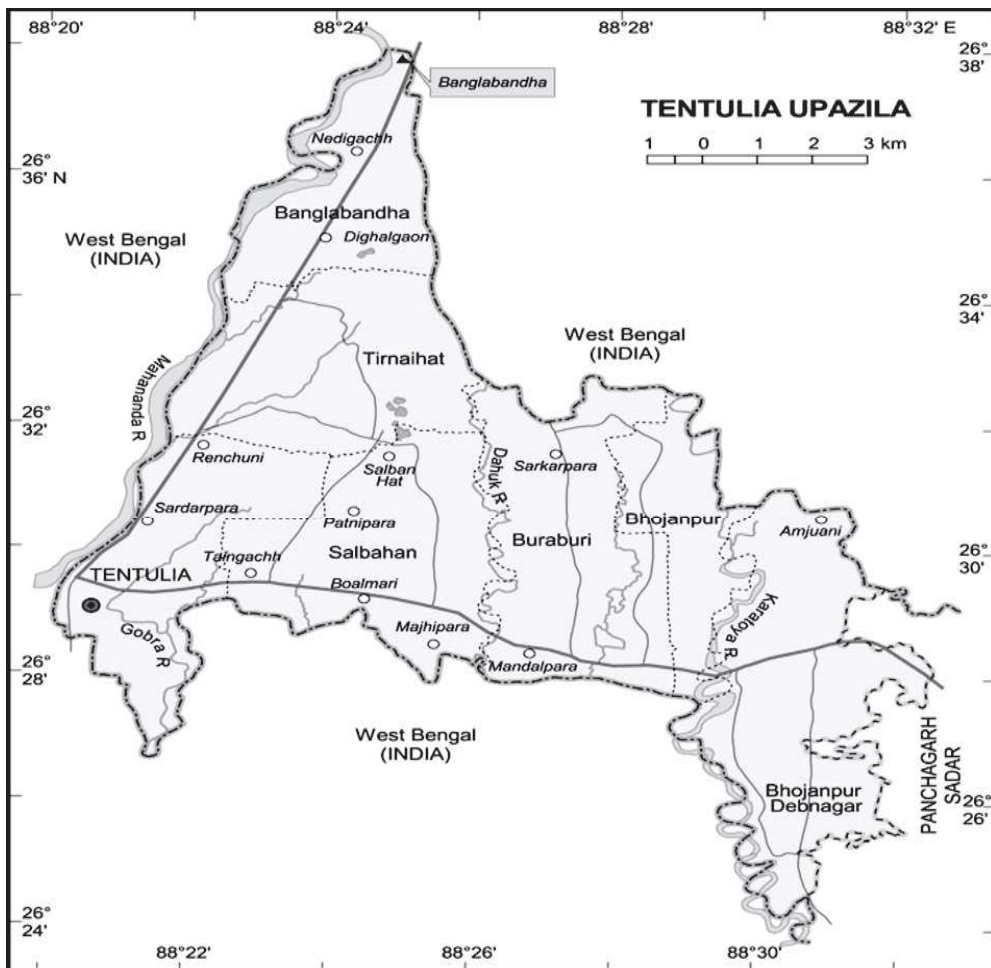


Figure 3: Location Map of Tetulia Solar Park

With an installed capacity of 10.31 MWp (by 2019), it is located towards the north of Panchagarh Zilla, not far from the border with India (figure 1). Majhirpara village, next to which the solar park was constructed, is a modest village. It has a population of about 1200. The majority of the people are Muslims. The majority of individuals work in agriculture and farming in general. Some of the community's younger members also have skilled and quasi-skilled jobs in commercial and public businesses in various state cities. There is also a Hindu community whose main sources of income are farming and other non-traditional jobs like running small businesses.

Table 3.1: *Specification of Sympa Solar Park, Panchagarh, Tetulia*

System Name	8 MW Solar Park by Parasol Energy Lt
Grid Status	On-Grid
Capacity	8.31 MWp
Completion Date	2019-05-13
Financing Org.	Independent Power Producer (Unsolicited) (IPP (Unsolicited))
Location	Shalbahan Union, Tetulia Upazilla, Panchagarh District, Rangpur Division, Bangladesh
Expected Energy Generation and CO2 Emission reduction during System Life	74 GWh, 82 k tCO ₂

Methods and Analysis

The research aims to investigate the same social and economic challenges in implementing large-scale solar energy expansion in Bangladesh. The 10 MW ‘Sympa solar park project was selected as a case study. The researcher conducted fieldwork between 5 June 2022 and 16 June 2022. The study used a qualitative approach to gather in-depth data on the informants' views, experiences, and daily realities. Qualitative work is more appropriate given that the area's literacy rate is lower than the national average. The interview protocols were created based on a review of the literature and early experiences at the case study location. Three primary sections made up the interview protocol. The first includes inquiries about the interviewee, such as specifics regarding his means of subsistence, place of job, etc. Their involvement with and knowledge of the construction of the solar park were discussed in the second section. The processes underlying the development process and its effects on the settlement are intended to be elicited in the third and most prominent portion. The interview procedure started with the villager interviews. A preliminary discussion with a ‘village elite’ helped to discover key representatives of distinct social groups. Then the interview of these groups is done by using focus group discussion. Focus Group Discussions (FGDs) have been performed with the villagers (farmers, beggars, local shopkeepers, distributors, rickshaw pullers, etc.).

Following the public interviews, some ‘expert group’ interviews (project makers and government) were conducted. The researcher has tried to get access to both the government and business interviewees. Then the data collected is analyzed to get information on the burdens and advantages of

the solar park in the community of Tetulia, as assembled from the local interviews, with further assessments brought from the specialist interviews. These data will be analyzed concerning employment, infrastructure, land acquisition, energy provision and economic advancement prospects of the community.

RESULTS

In this section, the information from the villager's interviews and additional viewpoints from the specialist's interviews are combined to discuss how the burdens and benefits of the solar park implementation were distributed among the community of Majhirpara. These concern the potential for local economic development, jobs, infrastructure, and energy supply.

Land Acquisition Processes

According to the interviews, the loss of access to land by landless villagers, small farmers, and agricultural labourers was the single most significant negative impact of solar park development felt by the residents of Majhirpara.

“... All the land of the solar park belonged to the villagers of Majhirpara, there were no government lands in here.”

(Village Respondent)



Figure 4.1: Sympa Solar Park, Tetulia, Panchagarh.

The interviews revealed that the company first approached some local noblemen who influenced the community. That person owned a significant share of land beside the road connecting Banglabandha to Panchagarh. They persuaded them to sell their plot at a lower price, promising to give their sons and daughters-in-law jobs. Following their footsteps, other villagers also sold their fertile agricultural land without hesitation.

We saw one of the respected villagers selling his land, which made us think the deal would be profitable. We sold our only piece of land without much thinking, and we have no land now and no means of livelihood.

(Village Respondent)

Unfortunately, some illiterate small farmers who owned small plots were forced to sell their land at low prices to intermediaries from other villagers. The mediators sold the land to the government at a considerably higher price since they were aware of the development through official and journalistic sources. This ended the small farmers' long-term and sustainable reliance on agricultural activities and left them with no alternative support beyond temporary labour jobs in the solar park (Section 4.2).

In our town, several residents had already sold off pieces of land and spent the proceeds. What happens to their lives moving forward?

(Village Respondent)

However, some others were more conscious of the implication of losing their land title and did not sell it; some exchanged their land with the ones who wanted to sell.

They might give whatever price for the land may be higher or lower, but what would money mean to us, for those who live only on farming? Money does not stay permanently, land stays, and the income on land is our survival.

(Village Respondent)

The interviews emphasized that many locals had a deep connection to their land and occasionally even worshipped it.

Employment Prospects

Employment prospects are to be anticipated from effective development. The respondents are also interested in discussing the subject, as good employment opportunity is a special issue in Tetulia. Even 5/6 years ago, many people in Pnachagarh and Tetulia were involved in the stone collection process. Stone could be found even 200 feet deep in the lands of Tetulia. Villagers used to dig fertile lands for stone and made huge holes. Many agricultural lands were spoiled in this process. However, the government and concerned administration have taken strict action against the stone collection process to prevent further land destruction. Now, most people are involved in tea gardening and the tea harvesting industry.

In Majhirpara village, most villagers are engaged in tea plantations, some on their land and others on a daily labour basis. A notable portion also works as an auto rickshaw puller. Nevertheless, according to the villagers, the solar park company did not provide any jobs to the people of this village or the adjacent villages.

The company promised but did not provide any jobs to local people, and all their employees are from outside Panchagarh.

(Village Respondent)

There are 1-2 people who work on the poultry farm inside the park, but these are mere odd jobs. When the solar park started construction, some educated villagers were given jobs. But they were dismissed soon after.

My brother got a job in the solar park, as promised to my father. He was a graduate. But after one year, he was dismissed from the job.

So, no means of employment was created for both qualified and unqualified local people.

Infrastructure Development

A large government-facilitated project always creates anticipation of improvement of local infrastructure. But the case of Sympa solar is quite the opposite. The company constructed the solar farm due to the N5

highway connecting Banglabandha port to Dhaka. The excellent condition of the highway and the possibility to provide power to the 8 km 33 KV evacuation line and 33 KV bay at the Tetulia NESCO substation. So, significant infrastructural development has yet to happen. Even the local administrative and agricultural offices have little idea about the situation of this project.

It is hard to keep a tab on the solar projects happening in Tetulia because there is frequent change in public administrative officers.

(Expert Respondent)

Access to Clean Energy

Access to uninterrupted, clean and low-cost energy is one of the prerequisites of renewable energy development (Cowell, Bristow and Munday, 2011). The villagers responded positively, as they are under 100% electrification due to the implementation of this type of project. Although they buy electricity from NESCO, they appreciate the lack of load shedding that used to trouble them throughout the year.

But one of the agricultural officers was reluctant to say that the energy is clean and renewable as it came at the cost of 40 acres of agricultural land.

The land used in the solar park was two-cropped land and very fertile; you can understand this by seeing the adjunct plots. Although the government policy is to construct solar parks on barren lands, the regulation is clearly violated here. They did not even seek NOC from the agricultural department for this project.

(Expert Respondent)

Local Economic Development Opportunities

The data collected from the local villagers and public representatives indicate no significant opportunities created by the solar park in the nearby villages as accepted by renewable energy projects (Brady and Monani, 2012).

People are mostly excluded from any economic gain earned from the solar plant. People live their daily lives in poverty, and outside workers snatch economic profits.

(Public representative respondent)

Some shops are constructed near the plant, but the revenue is quite insignificant to take into account.

DISCUSSION

The analysis of the Sympa solar park's economic and social costs and profits is recapitulated in Table 1. The locals, who lost access to farmland, and the landless agronomists, who also lost the land assets they depended on, turned out to be the biggest losers overall. Similarly, illiterate landowners coerced into selling their property before receiving news about the project's development also had their long-term livelihoods considerably crushed. During the construction phase, these classes could find employment at the solar site, but they were poorly paid and only on a provisional basis, putting their future vague. However, the village community as a whole generally did not benefit jointly in the ways that they ideally would from the significant development on their doorsteps, such as through improvements to their infrastructure, affordable electricity or the supply of services.

Due to lax regulation, the developers did not carry out their promises to provide long-term compensation and support for the community. As a result, these objectives did not materialize. The project's developers benefited from favourable feed-in tariffs, which provided quick income and a substantial refund on investment. The government also made significant profits through land contract payments to developers, private capital investments in infrastructure improvement, and a solidified position as a leader in economic development on a national and international scale.

Many residents of Majhirpara village already had quite uncertain or limited contact with resources to meet their basic needs. However, the expansion made some areas of the village worse due to land loss and livelihood scarcity. Suppose the village had received information about the development direction in a way that illiterate members of the community could access. In that case, some villagers might have made more money off of land sales.

Table 5.2: Distribution of Benefits and Burdens for Different Groups

Groups		Themes			
		Employment prospects	Green energy	Infrastructure growth	Economic prospects
Majhirpara village communities	Benefit	Transient low-salary construction labour jobs A modest number of unskilled temporary periodic salaried jobs	Non-intermittent energy supply Provision of solar streetlights	temporary medical services	Rental revenue for land lease
	Burdens	Small farmers with no long-term choices for a living due to the loss of acreage and the lack of long-term employment. Potential effect on local cultures by the outside labour force.	None	long-term basic or social or physical infrastructure development even after the solar park development	Only short-term economic gains to a few sections of the village
Business developers	Benefit	Improvement of the in-house technical workforce in solar energy Local and migratory workforce both as cheap labour e eventually profits in project development	Huge profits from FiTs Infrastructure Building up renewable equipment can flow in energy profile for smoothly further business development	Infrastructure development (such as internal roads, ambulances etc.) for the project site so that the resources and Building up renewable equipment can flow in energy profile for smoothly further	Alternative economic benefits from the sale of solar panels in the second-hand market after its life-period Experience that would allow the expected expansion of solar projects to other regions in the country
	Burdens	Project delay fines due to local conflicts and delays due to bringing in a migratory workforce.	None	None	None
Government	Benefit	Utilizing incoming labour to fill the skills	Improving the government's renewable	Huge revenues from collecting money for the	A different form of financial gain from the resale
	Burdens	Project delay fines due to local conflicts and delays due to bringing in a migratory workforce.	None	None	None

Groups		Themes			
		Employment prospects	Green energy	Infrastructure growth	Economic prospects
Government	Benefit	Utilizing incoming labour to fill the skills gap in the local labour force and expedite project completion	Improving the government's renewable energy base and establishing the nation's reputation as a climate-aware one	Huge revenues from collecting money for the infrastructure (such as roads, street lights, boundaries, etc.) Funding for the project's infrastructure development attracted additional industrial growth.	A different form of financial gain from the resale of solar panels after their useful lives Foreign direct investments and industrial growth in other state industries
	Burdens	loss of local communities' trust as a result of lax hiring policies.	None	Initial economic loss for the project's development-related investment in the shared infrastructure.	Due to the FiTs, which produced substantially more significant revenues for company developers than the capital expenditure in the individual projects, partial economic loss was experienced.

Therefore, the nation's economic development depends on impoverished farmers' loss of arable land, which has left them in dire straits. A boundary wall surrounds the parking area and prevents anyone from entering. The region has been divided by this border wall, which has ruined the harmony of the prior farming. Additionally, one of our responders claimed that a public road within the project area had been shut and restricted for locals. This road blockage significantly impacted their agroecological and economic existence.

CONCLUSION

Global political, economic, and social transformations now all share a unique trait: privatization. The government of Bangladesh has also turned over a larger portion of its material assets and duties to the private sector. In order to increase access to clean energy for sustainable development, the State has policies regarding private sector participation and the release of marginal lands for energy projects. However, the circumstance made some wonder whose development has been taken into account. Sustainable development is concerned with the social sustainability of marginalized, underprivileged people as well as economic and environmental

sustainability. Although this solar power facility would hasten the nation's economic expansion, it hasn't given the poor landless farmers any chances and has instead disrupted their social cohesion. It is crucial that consideration be given to the appropriateness of the additional solar energy parks that the government of Bangladesh proposes to develop. Do we need to continue using such expensive and land-intensive energy production techniques, or should we look for a more suitable replacement?

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CONFLICT OF INTEREST

There are no conflicts of interest.

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