Prospect of Pumped Storage Projects as Alternative Energy Storage

Introduction

With the world gradually transitioning to clean energy, several challenging questions emerge, such as – whether or not we have modern technologies at our disposal. If indigenisation of such technologies can reduce cost, what are the alternatives, and who bears the brunt of this transition? Whether this transition to a low-carbon growth trajectory translates into a more 'just economy' compared to the 'fossil fuel economy'[i] that it intends to replace, etc. The ongoing discourse around energy transition in India also accords importance to ensuring distributive justice to all stakeholders as one of its primary objectives.

In light of these pressing questions, this Discussion Paper attempts to look at the clean energy 'coin' by highlighting the Pumped Storage Hydropower (PSH) project(s) in the Purulia district of West Bengal – their prospect in energy transition and possible impact on the indigenous population of the region bearing the cost of these clean energy projects through the loss of their cultural property, identity, and traditional livelihoods. It aims to focus our attention on energy storage as an indispensable part of any stable energy portfolio and the potential inequities that may plague the 'clean energy movement' while choosing the best possible alternative in this regard.

This Discussion Paper tries to explain the concept of PSH and explores its benefits and drawbacks. The first four sections focus on the Purulia Pumped Storage Project (PPSP) in the Ajodhya hills, its tremendous impact on maintaining the grid stability, its influence on the surrounding flora and fauna, and consequently the lives as well as the livelihoods of the ethnic tribal population inhabiting that region. This Paper also highlights why there has been strong opposition to the proposed Turga, Kathlajal and Bandu pumped storage projects.

The fifth section of the Paper presents various narratives surrounding the PPSP. In contrast, the sixth section attempts to draw parallels between this case and other documented cases where indigenous tribal populations have met developmental measures with raised fists. The final section outlines how a developmental project like Pumped Storage, which has enormous potential to address crucial parameters

associated with the grid, can be aligned with the local context – people, environment, and livelihood.

Pumped Storage Hydropower (PSH) – Exaggerated or Understated?

Pumped storage hydropower (PSH) is a dynamic and commercially viable form of energy storage. It consists of two water reservoirs placed at two different elevations that generate power, as the water is released from one reservoir to the other, passing through a turbine. When energy demand is low, surplus energy is used to pump water to the upper reservoir (recharge), then released through turbines to the lower reservoir during peak demand or shortages (discharge). Thus, PSH is comparable to 'giant battery,' as it can store energy and then release it as and when needed.[ii] The fact that it can recycle the same quantity of water again and again for energy generation makes it suitable for places with scarce water resources. It can supplement the existing energy sources by ensuring a reliable supply all year round.

While PSH holds immense potential for energy storage, especially with its low-cost operational efficiency- its most significant drawbacks lie in the fact that there needs to be a significant elevation difference between the two reservoirs. Secondly, it requires more energy to pump the water back to the upper reservoir than it can generate, thus making it a net energy consumer.[iii] Additionally, these projects require massive investments in civil construction, which can take years to recover.

Apart from this, we must consider the environmental impacts of PSH. Construction of PSH often mandates damming a river to create a reservoir,[iv] thus disrupting its natural flow. This has negative consequences for the aquatic ecosystem and its terrestrial counterpart- owing to flooding of former drylands, bringing about visible changes in the landscape.

The following section will focus on India's first and most notable PSH project, the Purulia Pumped Storage Project (PPSP). It is nestled in the lap of the Ajodhya hills, on the Bamni river, and what impacts it has had on the ecological balance and lives of local communities in the region.

Initial Cross-currents of a Power Tussle in Purulia

In the Purulia district of West Bengal, the Ajodhya hills form the easternmost part of the Chotanagpur Plateau and are an extension of the Eastern Ghats belonging to a distinctive agro-climatic zone with its characteristic red and laterite soil.[v] These hills are home to approximately 25 lakh Santhals - an indigenous tribe who are the local inhabitants of this region, as per the 2011 census.[vi]

While the Ajodhya hills are renowned for their scenic beauty, in 2002, they were all over the news for the proposed Purulia Pumped Storage Project (PPSP), which was one of a kind back then. It was constructed on the Bamni river, downstream of Bareria village, near Bagmundi, jointly with the Japanese construction company Taisei Corporation. The project involved a massive investment of about ₹2475.86 crores, out of which Japan Bank invested ₹2272.41 crores for International Cooperation while the state government financed the rest.[vii]

It had an installed capacity of about 900MW and was inaugurated on April 06, 2008, by the then Chief Minister of West Bengal, Buddhadeb Bhattacharya. The project was primarily undertaken to cater to the growing energy demands of Arambagh in Bengal and Ranchi in Jharkhand.

Following the successful completion of the PPSP, the government announced the Turga Pumped Storage Project (TPSP). It was proposed on the river Turga, a tributary of the Subarnarekha River, that lies at about 2.5 to 3 km from the Bamni river. Apart from this, two more projects have also been declared at Kathlajal and Bandu. With the local tribal population still coping with the full extent of the destruction caused by the PPSP, these proposed projects faced severe resistance as they supposedly threatened to uproot them completely from the lands they had occupied for centuries.

When the PPSP was in its initial stages, the government promised to provide free electricity and employment to bring the indigenous residents onboard, especially those within a five-kilometer radius. According to the residents, it was a veiled move to ensure the project's continuity at the expense of the locals. They lacked the knowledge and the sight to predict the long-run impacts of this project on the delregion's delicate ecosystem

After completing this project, the government arguably failed to deliver on its promises. The indigenous residents suffered a double whammy caused by losing their livelihoods and cultural property. As the project had caused irreversible changes to the ecosystem, there was no way for them to fall back on their traditional livelihoods, which were entirely dependent on the surrounding forests cleared to make way for the PPSP.

The Positive Impact of PPSP

To understand the overall impact of a pumped storage project, we should first look at the tremendous potential it comes with. Pumped storage hydropower (PSH) can be of two types. First is the ‘open loop', which has an associated natural-water source (like rivers) for one or both the reservoirs. The second is a 'closed loop' (or off-river PHS), which does not have a connected natural-water source. The same water is cycled between two reservoirs to generate and pump energy, as per demands.

As mentioned before, PSH is comparable to a 'giant battery. Unlike battery storage technology, Pumped storage does not require expensive and rare metals like lithium, nickel, and cobalt, which rarely occur in India, or harmful metals like lead, potentially damaging the environment. PHS draws upon the potential energy of water as a storage medium and, based on the capacity of its reservoir, can generate energy for 6-10 hours without a break.

Additionally, these pump storages come with a life expectancy of about 50-100 years with a round trip efficiency of about 70-85 percent. PSH has site-specific and high capital costs and low operating and maintenance costs. The construction time usually is long, up to 10 years. PSH may use existing lakes as reservoirs, but artificial reservoirs are built in many cases.

First of all, while assessing the impact of PSH, we must acknowledge the unavailability of equivalent battery backup facilities in India. Developing the latter would require considerable investment in associated R&D activities and come with associated hazards like treatment of battery components, etc. Pumped storage plays a crucial role in maintaining grid stability at a very minimum cost and comparatively lower environmental damages.

Secondly, the PPSP received severe backlash from the locals, who held the project responsible for losing their cultural property and livelihood. One must admit this project also opened up new avenues of revenue generation and employment creation in eco-tourism, promoting Purulia and the Ajodhya hills as a travel destination for tourists. Allied sectors like transport and hospitality also prospered in this otherwise economically backward district of Bengal.

This subsequent sectoral growth led to the strengthening of rural roads and the region's health and educational infrastructure. Further to boost this growing tourism industry, the state government called for suitable training and capacity-building programmes to employ the region's local youth in upcoming projects. All these collectively created opportunities for community development in Purulia.

Bitter lessons from the PPSP

The construction of the PPSP necessitated the felling of approximately three and a half lakh trees and the diversion of nearly 159.59 ha of forest cover.[viii] This led to the displacement of the animals in those forests, some of which were critically endangered, such as pangolins, elephants, and leopards. While the PPSP stands on what used to be a

prime elephant habitat, which even saw seasonal migration of elephants from Jharkhand- these displaced mammals started invading human habitat and destroying crops. Such merciless killing of local fauna in the name of 'development' enraged the ethnic tribes who saw it as a threat to their habitat. With the Turga Project projected to cover approximately 292 ha of land, the area is highly vulnerable to soil erosion, landslides, and a host of natural disasters that can become more pronounced due to construction activities.

To offset this rampant deforestation and biodiversity loss, the government promised 'compensatory afforestation in parts of Purulia and Jalpaiguri in North Bengal. The objective was to compensate for the lost forest cover for the PPSP, but no implementable plan had been drawn up in this regard. Instead, the *Panchayat* had ordered the planting of eucalyptus trees in the Ajodhya hills. This move turned out to be counterproductive, as the adaptation of these trees was unconducive to that region, with the eucalyptus plants exhausting the almost depleted water and nutrient content in the soil of this region.

Additionally, the construction of multiple dams in a water-scarce area like the Ajodhya hills also exacerbates the region's already existing water shortage problem, with tribals struggling to procure water for daily requirements.

Another point is the loss of cultural property of the Santhals who have been living here for ages. The destruction of their sacred groves- Sutantandi, Sitakunda, and MarangBuru is a severe concern, threatening their culture.[ix] With the proposed pumped storage project at Turga, the sacred MarangBuru hill may end up potentially submerged.

While the PSPP has turned into a significant tourist attraction in recent times, the plastic waste generated from this threatens the ecological balance of this region. Also, these wastes are fatal to the nearby cattle, who are always at risk of consuming them. Also, with their lives inextricably linked to the forest- the tribal population residing in the Ajodhya hills are on the verge of becoming the most significant casualties of the PPSP. With their forests gone, their livelihoods destroyed, their lands submerged by the reservoir waters, and their culture on the brink of extinction- these people face the threat of ending up as 'development refugees,' forced to migrate to urban areas in search of work as migratory or casual labour.

The Other Side of the Story

While the preceding sections primarily present the challenges faced by the ethnic population inhabiting the Ajodhya hills, it would be wise to include the narratives of the remaining stakeholders in these projects and offer both sides of the story in an unbiased manner.

Senior officials of the West Bengal State Electricity Distribution Company Limited (WBSEDCL), the agency in charge of executing the proposed Turga project, recalled how the protests against the project completely blindsided them. The necessary plans had been drawn out, and all clearances were obtained from various concerned authorities. However, the High Court's decision on July 03, 2019, brought all these plans to a halt as it ruled in favour of the protesting tribal population.[x]

Coming to the allegations made by the tribals regarding promises of free electricity, guaranteed employment, and afforestation, the WBSEDCL officials rubbished them as mere rumors. They claimed that they were taking proper measures towards afforesting the areas around the PPSP. However, they had made no such promises guaranteeing jobs and energy- instead, they had planned and implemented some Corporate Social Responsibility (CSR) activities in these areas to ensure the welfare of the ethnic populations in the region.

Another parallel narrative from the government's side highlights how years of subsistence on government subsidies and support programmes had created a safe zone for the Santhals residing in Purulia, limiting their progress and making them hellbent on refusing to adapt to the changing times. The Santhals were much too happy with their primitive agrarian lifestyle, which was embedded deep into their socio-cultural fabric, and made tremendous efforts to avoid modernisation at all costs. Any attempts made by the government to upskill them and change their *status quo* were met with a lack of participation and even opposition.

Also, the Santhals barely took any initiative to effectively utilise the subsidised education and rations provided by the government to educate themselves or earn any vocational degree, instead of depending on government initiatives to uplift themselves as a community.

Drawing Parallels

The case of PPSP and the proposed TPSP is not unique. Instead, it is a recent addition in a long line of documented cases where the tribal

population of the region has raised their fists unitedly against clean energy projects owing to the severe damage that they would inflict on their surrounding ecosystems.

An example that can be cited in this context is that of the riparian states of the northeast, located in the Brahmaputra and Barak river basins and resisting the development of hydroelectric projects in the region. On the one hand, while these hydro energy projects can help ensure energy security in the relatively energy-poor northeast, they also pose a certain degree of threat to the water security in these regions. Apart from this, the construction of hydropower stations requires a lot of land in remote areas, often rural, acquired through deforestation and some by an appropriation from the local riverine communities. Much like in the case of TPSP, the local tribes in these areas are largely dependent on the forests in the riverine basins for their livelihoods and consider them their cultural assets.

However, besides these environmental and livelihood concerns, hydropower projects also raise geopolitical concerns,[xi] often resulting in trans boundary conflicts regarding the use of waters from shared rivers.

We can also cite the Tehri Dam in this context. Located in Uttarakhand, the Tehri Dam is a multipurpose hydroelectric project with reservoir storage spread over 45 sq. km to generate 1000 MW of power.[xii] It is the highest earth and rockfill dam in Asia and the fourth largest globally. However, despite all its potential, the dam is located on one of the world's most fragile and active earthquake zones- the geological boundary between the Indian and the Eurasian continental plates.[xiii]

The project started in the late 1970s amidst severe opposition from the local communities, and subsequently, construction work took place under police supervision as the protests had intensified. Eventually, realising the worst fears of the locals, the dam affected Tehri town and about 125 villages in proximity, submerging 37 of them. Approximately 85,000 people were relocated for this project resulting in a loss of their cultural identity, livelihood, and property -pushing them deeper into the poverty traps that the project was supposed to pull them out from.

Looking Ahead

The significance of projects like pumped storage facilities, especially in an Energy Transition context where equivalent battery backup technology remains farfetched, is undoubtedly immense. However, commissioning

such endeavors needs a detailed assessment of local socio-economic and environmental impacts and a carefully drafted implementation plan.

While the entire conflict between the government officials and the tribal population of Purulia, along with the other examples cited above, might compel us to think that indigenous people appear opposed to energy development on their lands - this could not be further from the truth. They want their opinions to be counted when decisions regarding regional development are made. However, they are interested in developing their lands respectful of their culture, traditions, lives and livelihoods.[xiv] Bridging the coordination, comprehension, and cooperation gap is required to ensure mutually beneficial development.

If a development project is implemented in a manner that it would preserve the region's biodiversity and protect the people's livelihood in its vicinity, chances of it facing local opposition seem significantly less. Therefore, with due consideration of the local context in the national or regional development agenda, engineering marvels like Pumped Storage will achieve their objective inclusively.

Endnotes

[i] Welton, S., & Eisen, J. (2019). Clean energy justice: Charting an emerging agenda. *Harv. Envtl. L. Rev.*, *43*, 307.
[ii] https://www.energy.gov/eere/water/pumped-storage-hydropower
[iii] Crampes, C., & Moreaux, M. (2010). Pumped storage and cost-saving. *Energy Economics*, *32*(2), 325-333.
[iv] Yang, C. J. (2016). Pumped hydroelectric storage. In *Storing Energy* (pp. 25-38). Elsevier.
[v] https://www.groundxero.in/2018/10/17/new-hydro-project-at-ajodhya-hills-recipe-for-a-disaster/
[vi] https://india.mongabay.com/2019/06/the-ajodhya-hills-are-alive-with-the-sound-of-resistance/
[vii] https://www.wbsedcl.in/irj/go/km/docs/internet/new_website/PPSP.html
[viii] https://sandrp.in/2019/03/02/devastating-developments-in-ayodhya-hills/#_edn4
[ix] While Sutantundi is an assembly point used primarily to settle disputes, Sitakund mentions in the Ramayana as Ram and Sita spent some time during their exile in the Ajodhya hills. Ram is said to have dug out a well with his arrow in this region to quench Sita's thirst. It attracts many tourists who gather here for the 'Shikar Utsav' every year. Given its cultural and spiritual significance, the tribals demand these places be kept free of any form of development and commercialization.
[x] https://www.edexlive.com/news/2019/jul/03/battle-for-the-hill-meet-the-men-who-helped-the-tribals-win-back-bengals-ayodhya-hills-6882.html
[xi] Mahanta, C. (2010). India's North East and Hydropower Development. South Asian Survey, 17(1), 131–146.
[xii] Asthana, V. (2018). Forced displacement: a gendered analysis of the Tehri Dam project. In *India migration report 2017* (pp. 46-63). Routledge India.
[xiii] https://www.downtoearth.org.in/coverage/power-point-11671
[xiv] Dreveskracht, R. D. (2012). Alternative energy in American Indian country: Catering to both sides of the coin. *Energy LJ*, *33*, 431.

CUTS International
D-217, Bhaskar Marg, Bani Park, Jaipur 302 016, India.
Ph: +91.141.228 2821 Fx: +91.141.228 2485,
E-mail: cuts@cuts.org, Web: www.cuts-international.org.

Also at Delhi, Calcutta and Chittorgarh (India); Lusaka (Zambia); Nairobi (Kenya); Accra (Ghana); Hanoi (Vietnam); Geneva (Switzerland); and Washington DC (USA).