

DAM, ENVIRONMENT AND DEVELOPMENT

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ABSTRACT

Subansiri Lower Hydro-electric project (2000 MW) is India's largest Hydro Power project presently under construction by NHPC Ltd. at Arunachal Pradesh/ Assam is a gateway to clean energy development in the North-eastern region. The project is actively engaged in providing direct employment to more than 7500 local population and contractors manpower engaged in construction activities in addition to numerous indirect employment opportunities to the population in the local region. The project is also providing benefits of river bank protection downstream of the Subansiri Lower River up to the confluence of mighty Brahmaputra River thereby protecting the river banks and providing security to the local populace downstream of the river. In addition the project has undertaken various skill development programmes for the sustainable development and livelihood of local population in long run. Although the project which was started in 2003 had encountered various hurdles both geological as well as agitation by anti-dam protester, however, the benefits imparted by the project is unparalleled by way of uplifting the lives of stakeholders, boom in commercial activities and uplifting of lifestyle on economic scales. The project will further keep on providing direct as well as indirect benefits even post construction stage also in addition to free power to the states, creating huge corpus of funds for local area development as well as opening new avenues for commercial activities and industry in future.

INTRODUCTION

Subansiri Lower Hydro Electric Project, 2000 MW (8 no. x 250 MW) of NHPC, is the India's largest Hydro Power projects under construction stage and is located at Assam & Arunachal Pradesh. The project was envisaged in way back in 1955 by the Brahmaputra Flood Control Commission (BFCC) with 125m high dam at Gerukamukh, Assam. The Detailed investigations started by Brahmaputra Board was completed in 1976 and later on in 1995 the project was planned for Cascade development i.e. Subansiri Lower HE Project with Dam height of 116m, Subansiri Middle HE Project with dam height of 213m and Subansiri Upper HE Project with dam height of 265m. The project was handed over to NHPC in 2000 from Brahmaputra Board. The CCEA¹ sanction to the project was accorded in Sep 2003 and NHPC started construction works in Jan 2005 after Final Forest Clearance on 12.10.2004. The construction work was halted in December, 2011 due to agitation by some Pressure Groups of Assam opposing construction of project. Hon'ble NGT² dismissed all the petitions and cleared the project and the construction work of the Project resumed w.e.f. 15th October, 19.

The salient features of the project comprises Concrete Gravity Dam 116m high and 283 m long, Spillway radial Gates: 9 Nos. 11.5m x 14.0m, HRT Intake Gates: 8 Nos. 7.3m x 9.5m, HRT: 8 nos., 9.5 m dia, Horse Shoe Shaped, 7124 m total length, 8 nos. Vertical Pressure Shafts each 48m deep.(Circular, Dia varying from 9.5 to 7m and length 209m to 231m), Surge Tunnel: 8 nos., 9.5 m dia, Horse Shoe Shaped, 3545 m total length, Surface Power House (285m x 61m x 64m), Tailrace Channel: 35m long and 206m wide, Gross head: 91 m and Design Discharge for each machine: 322.4 cumec. The Annual Energy Generation from the project will be 7422 MU in a 90% dependable year. The power allocation from the project is at Table 1:

1. Cabinet Committee on Economic affairs

2. National Green Tribunal

Table 1

Assam (25*+508)	533 MW
Arunachal Pradesh (240* + 34)	274 MW
Other North Eastern States (Manipur, Meghalay, Nagaland, Tripura & Mizoram)	198MW
Northern States (Haryana, Punjab, Rajasthan, U.P, Chandigarh & Delhi)	500 MW
Western States (Gujarat,M.P, Chattisgarh, Maharashtra & Goa)	500 MW
TOTAL	2000MW

*Free Power. 0.25% (5 MW) free power to Assam to be absorbed by NHPC from its own resources

GENERAL LAYOUT OF PROJECT PROPONENTS

The Subansiri Lower Hydro electric project is a very compact project with Dam and Power house only about 300 m apart. The right bank of river Subansiri is situated in Arunachal Pradesh and left bank is in Assam. At the right bank of river Subansiri all the major project component viz. Intake, HRT and Power House, TRC etc are situated and on the left bank Diversion Tunnels are situated. A 3D layout of the project is given at Figure 1.

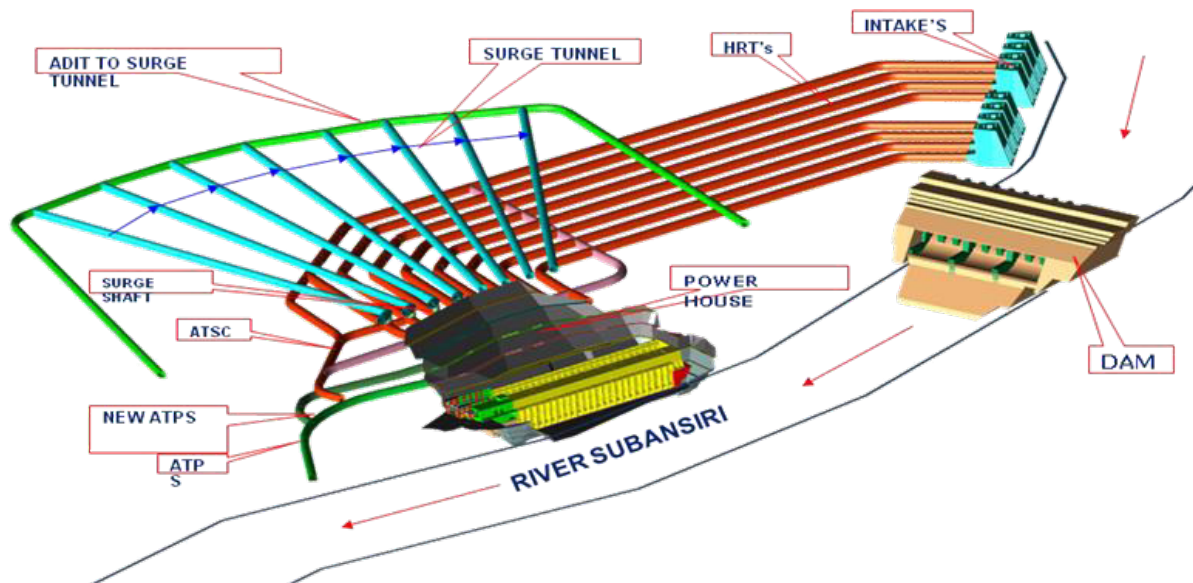


Fig. 1 : 3D layout of the Project

HINDRANCES & WAY FORWARD

The project had witnessed various hindrances during the construction stages viz. failure of Power House back slope, Deo-Nallah³ slope failure at Diversion Tunnel Outlet Channel, unprecedented heavy floods and agitation from the downstream population citing fear psychosis on safety issues of Dam post-construction. The agitation against the Project by various groups of activists and stakeholders brought down the project to standstill in December 2011. The apprehensions raised were dam Safety and Dam Downstream Impacts based on the report of Expert Group. Consequently, the Planning commission constituted a TEC⁴ to look into these aspects and give recommendations for addressing the issue. The TEC in its report, recommended for setting up a DDRP⁵ to review the Dam safety inter alia suggesting various other measures to mitigate the downstream impacts of Dam. Accordingly, a DDRP was set up by Ministry of Power, GOI to review Dam safety and to give suitable recommendations. The DDRP after reviewing the safety of Dam recommended various changes in Dam Design which include extension of length of spillway blocks, changes in layout & quantum of Cut-off walls and shifting of plunge

3. Deo-Nallah is seasonal Nallah (stream) on left bank downstream of Dam with heavy discharge during monsoon period
4. Technical Experts Committee
5. Dam Design Review Panel

pool downstream further. The above recommendations were accepted by MoP in June 2013 NHPC implemented the same to take the Project forward. The pictorial view depicting the detailed recommendations of DDRP is at Figure 2.

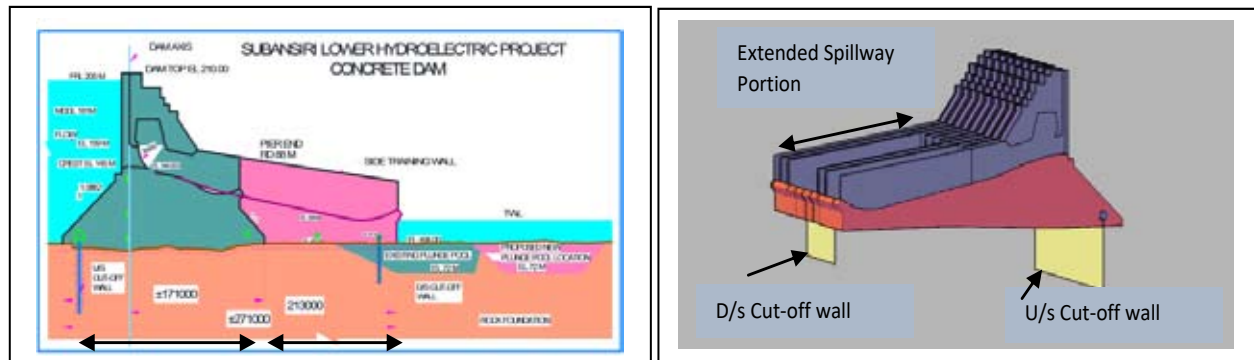


Fig. 2

MAJOR MODIFICATIONS IN DAM POST-DDRP

- DDRP recommended changes in energy dissipation arrangement and Cut-off Walls of the Dam
- Extension of Spillway beyond RD 88m from the dam axis to RD 213m with change in glacis slope. As a result the width of dam along the river flow has increased by 100m
- Additional Cut-Off walls introduced at EL 97m (d/s Cut-off wall) as well as at higher elevation in non overflow blocks (EL 173m left bank, EL 155m right bank, EL 185m right bank).
- Plunge pool shifted further downstream with its left side falling on the path of water flow from the diversion tunnel outlet.
- The changes necessitated by DDRP recommendations had to be introduced in Dam Design while the Dam construction was mid-way.
- Consequently, these changes impacted specified sequence and timing of construction, enhanced the construction schedule envisaged under the Contract besides demolition of already constructed works.
- These changes have resulted in additional cost impact on concreting above EL 120m in the original Dam section.

MAJOR CONTRACT PACKAGES

At present, four major contractors are working at the project round the clock handling Civil, Hydro-mechanical and Electro-mechanical works. Complete stoppages of the works from Dec 2011 had resulted in foreclosure of contract package of Power House and Underground works being carried out by M/s L&T. The balance works has now been awarded to M/s Patel Engg. This unprecedented event had resulted in contractual disputes with almost all the major contractor, raising of huge claims by contractors on account of idling charges, additional cost due to replacement of damaged / worn out parts of the equipment. Huge arbitration claims have been lodged by the contractors. A list of major contractor is at Table-2:

Table 2

SL NO.	CONTRACT LOT	AGENCY	WORKS DESCRIPTION	DATE OF AWARD & VALUE
1	LOT- SSL-1	M/s BGS-SGS-SOMA JV	Diversion Tunnels, Concrete Dam	19.12.2003 1098.32 Cr.
2	LOT- SSL-2 & LOT -SSL-5	M/s L&T Ltd.	Power House, HRT, Intake & Surge Tunnel	19.12.2003/ 921.59 Cr. 14.05.2009/ 422.5 Cr. Contract foreclosed in April 2015 ⁶
3	LOT -SSL-3	M/s Texmaco Ltd	All Gates and Pressure Shaft Liners	19.6.2006 296.56 Cr.
4	LOT -SSL-4	M/s GE Ltd.	Electro – Mechanical Works	11.02.2005 1544.11 Cr.
5	LOT-SSL-6	M/s Patel Engg.	Balance work of Power House complex from Intake to Tail Race Channel	01.09.2020 1564.42 Cr.

6. Foreclosed due to suspension of works

PRESENT STATUS OF WORKS

At present the construction activities in the project is at a very advanced stage. About 78% of Dam concreting has been achieved so far, further, HRT⁷ excavation has been almost completed and lining has also been achieved about 83%. Power House concreting of 53% has been achieved. Major supplies of HM and E&M equipment have been completed and erection activities are in progress. The overall progress of works of project as on date is approx. 80%. Component wise progress of the project is at Table 3:

Table 3

SN.	Activities	Unit	Total	Cumulative Progress	Progress %	Balance
1	Dam Concreting	Cum	20,56, 804	16,08,686	78%	448118
2	Intake Concreting	Cum	279454	272973	98%	6481
3	HRT Excavation (Heading)	M	7102	7069	99%	33
4	HRT Excavation (Benching)	M	7102	6644	94%	458
5	HRT Overt lining	M	7102	5878	83%	1224
6	HRT Invert lining	M	7102	3348	47%	3754
7	Surge Tunnel heading excavation	M	3545	3210	91%	335
8	Surge Tunnel benching excavation	M	3545	1867	53%	1678
9	Powerhouse concreting	Cum	512000	271950	53%	24
10	Cut off Wall works	Completed (100%)				
11	HM ⁸ Works	Supply: 90%, Erection: DT-97%, Intake gate -76%, PS Liner-42%				
12	E&M ⁹ Works	Supply: 97% Erection: Unit #1 -35.5%, Unit #2- 24.23% Unit#3 – 5.4%, Unit #4 – 2.75%, Unit # 5- 4.75 %				

ENVIRONMENT

The project was awarded after obtaining all the statutory clearances including environment and forest clearances. The reservoir area is sparsely populated with negligible issues of R&R. Proper compensation has been disbursed to the land out see as per the R&R policy of government and NHPC and project has no pending issues. The project is committed to all the Environmental compliances and is being periodically audited by authorities. The utilisation certificate for the afforestation by state forest department is being carried out at regular intervals. The construction practices adopted by NHPC is to ensure that the detrimental effect on environment is minimal. To ensure strict compliance of the same, monthly reports are taken from all the contractors working at site. Post construction there will be almost negligible impact on the environment as the hydro power projects are clean energy sources.

7. Head Race Tunnel

8. Hydro-Mechanical works

9. Electro-mechanical works

PICTORIAL VIEW OF MAJOR PROJECT PROPONENTS



View of Dam from D/s end



HRT Intake



View of Diversion Tunnel, Dam and Intake



Head Race Tunnel



View of Power House



E&M works

DEVELOPMENTAL ACTIVITIES:

Due to construction activities in the area, an all round development of the area is seen. The presence of NHPC has opened new avenues of employment through contractors for construction activities. About 7500 people are directly employed through major contractor and their PRWs¹⁰ at the project.

¹⁰. Piece Rate Workers

Further NHPC has also undertaken river bank protection works under various phases with Phase-I Works from 4 Kms. to 12 Kms. D/s of Dam which stands completed. The Phase-II Works from 12 Kms. to about 23 Kms. D/s of Dam has also been completed. The total expenditure incurred on above is Rs. 145.00 Crs. In addition, Phase-III Works i.e. balance upto 30 Kms. D/s of Dam is likely to be completed by Dec 2024. The above works are duly vetted before execution and inspection/ quality check of works during execution would be got carried out by NHPC through an independent agency of repute i.e. IIT, Guwahati. The pictorial view of the river bank protection works before treatment and after treatment is shown at Figure-3



Fig. 3

The project has opened opportunity for better education through establishment of Kendriya Vidyalaya at Assam side and Vivekanad Kendriya Vidyalaya at Right bank Arunachal side. Project has distributed scholarship of Rs. 3,64,200/- & Rs. 7,10,000/- in FY 2016-17 & FY 2017-18 respectively to the meritorious students up to 12th class. The project has taken up construction of 3129 toilets in schools spread across 11 Districts of Assam and 4 districts of Ar. Pradesh. This has improved Sanitation standards of about 2 lakh students¹¹.

The project has full-fledged hospital providing healthcare facilities to the local population also. In addition, numerous indirect employment opportunities to the population in the local region have been provided viz. Local stores and market complex. The nearest market i.e. Gogamukh area has developed manifold with number of branded showrooms and shops which have come up due to economic upliftment and increase in purchase capacity of the local population.

NHPC has launched “SPANDAN” Project with 20 nos. of Mobile Medical Units and each mobile medical unit is staffed by a doctor, a nurse and supporting paramedics. The services under “SPANDAN” is being implemented by Piramal Swasthya (PSMRI) on behalf of NHPC. The beneficiaries of the same are five districts of Assam namely Dhemaji, Lakhimpur, Sonitpur, Biswanath charlie & Majuli with an estimated total no of beneficiaries as 7,24,238. The project has incurred an expenditure of Rs. 14.0 crore on it. Other than SPANDAN, NHPC has been conducting Medical Camps ‘SANJEEVNI’ on regular basis and also donated medical equipments.

Project has also undertaken “KALASH”- for providing safe Drinking water facilities at various locations of Dhemaji, Lakhimpur, Sonitpur, Narayanpur and Majuli district. The Local bodies/ Management committees are the implementing agencies of the same.

Project has taken up initiative of skill development in the nearby areas and in the year 2015-16- total 180 local unemployed youth got skill development training and used their skill in earning for livelihood support. In addition, 279 unemployed youth got employment linked skill training in different sectors such as construction industry, print media etc and are working in different industries. The project has installed of 20 nos. of Solar Street Light poles including heating arrangement in and around the Project area.

After the outbreak of the COVID-19 Pandemic in India, various emergent activities were carried out in the Project’s vicinity to fight against COVID-19 like distribution of PPE kits, sanitization works in and around vicinity of the project. The project had launched massive vaccination program¹² for the entire workforce engaged at the project in the year 2021.

11. As per records generated by NHPC

12 vaccination covered both the doses

The project is also providing benefits of river bank protection downstream of the Subansiri Lower river upto the confluence of mighty Brahmaputra river thereby protecting the river banks and providing security to the local populace downstream of the river. In addition the project has undertaken various skill development programmes for the sustainable development of local population in long run.

In addition NHPC is also sponsoring the self employment program for local women by encouraging the pig farming, sericulture, and handloom. The scheme involves imparting training to the local women for sustainable development and self employment. Further, NHPC also helps in marketing of the produce by branding it and facilitates its sale to the open market. The above works will gradually culminate into branding of the products and its sale in times to come.

NHPC has prepared the Master Plan of Gogamukh to be developed as a modern town. Further District Development Plans of Dhemaji and Lakhimpur districts are being prepared with the help of School of Planning and Architecture, New Delhi.

CONCLUSION

The presence of such a mega power project in the area has undoubtedly created enormous growth in the local area and opened new avenues of skill development. During construction activities, project has witnessed that the unskilled workforce has developed into a very skilled category of workforce viz. Electrician, welders, bar benders, carpenters, machine mechanic to name a few. NHPC has many upcoming projects in the North-Eastern region especially in Arunachal Pradesh. Various projects to be taken up in near future are Dibang Multipurpose HE Project (2880 MW), Subansiri Middle & Upper (2000 MW) and Siang Lower project. These trained work force have become repository for the development of hydro electric projects in near future. The skill development as well as sustainable development programs initiated by NHPC is aimed at providing long term solution for employment generation programs. The above activities undertaken by NHPC have not only gained confidence of the local population but have also imparted intangible benefits and assisted in development and growth of the region.

(Note: The views expressed above are only of the authors and are not of NHPC management)