# RIVER LINKING FOR HYDRO-POWER WITH PARTICULAR REFERENCE TO BRAHMAPUTRA-GANGA LINK

**Prof. S.K. Mazumder**
Former AICTE Emeritus Professor of Civil Engineering
Delhi College of Engineering (Now Delhi Technology University)
E-mail:somendrak64@gmail.com

Abstract

*National Water Development Agency (NWDA), under the Ministry of Jalshakti, Govt. of India, is executing the national perspective scheme (NPP) of linking Indian rivers through construction of 30 link canals -14 in the Himalayan region and 16 in the Peninsular region of India. Several merits and demerits of the scheme are discussed. Brahmaputra-Ganga (Link-1) is vital for utilization of untapped hydro-power potential of north east region (NER) which is 40% of the country's total hydro-power potential. 93% of hydro-power potential of NER still remains unutilized. Besides hydro-power, the link will be useful for transfer of excess water of Brahmaputra basin to Ganga basin for satisfying the water need of Bangladesh and drought prone areas of India in the Southern and Northwest part of India. The link will also help in navigation, water supply and lean flow augmentation-both for India and Bangladesh.*

## 1.0 INTRODUCTION

Concept of river linking for effective management of flood and drought situations in India was introduced by a number of eminent persons like Sir Arthur Cotton, Dr. K.L. Rao, Captain M. N. Dastur and many others [1,2]. But these proposals were rejected as they were found to be techno-economically not viable. It was Indira Gandhi who set up the National Water Development Agency (NWDA) in 1982 to study the possibility of water transfer from surplus basins in the GANGA -Brahmaputra basins to deficit basins in the south and west of India. NWDA - under the Ministry of Water Resources, River Development and Ganga Rejuvenation (now Ministry of Jalshakti), Govt. of India- proposed the National Perspective Plan (NPP) consisting of 14 river links under the Himalayan component and 16 river links under the peninsular component as shown in Fig.1[3]. National Commission of Integrated Water Resources Development [4] was of the opinion that long distance river links may be taken up later and suggested to execute short links like, Ganga-Brahmaputra (Link-1), Kosi-Ghagra (link-2), Ken-Betwa (Link-24), Partapi-Narmada (link-27),Krishna-Pennar (Links-19,20) etc. should be taken up initially on priority basis. The past UPA Govt. wanted to hear the views of all the stakeholders and experts before taking a final decision. A standing committee under the chairmanship of Sh. Sambashiva Rao, M.P., was formed and the committee invited suggestions /opinions of public and experts in the subject. The committee examined the representations and finally gave its recommendation to the Govt. of India regarding implementation of the proposed NPP scheme. Iyer [6] remarked that NPP scheme should be undertaken with full recognition of the serious ecological damages that may be caused by interlinking rivers. Under NPP scheme, it is proposed to construct 12,500 km long canals and 32 dams [7] for water storage and distribution networks to achieve several purposes e.g. irrigation, hydro-power, navigation, municipal water supply, flood control etc. The approximate cost of NPP Scheme at 2003 prices was 5.6 lac crores which is likely to increase manifold now due to cost and time over run.

## 2.0 Some Merits and Demerits of River Linking

There are several merits and demerits of the NPP scheme which are briefly summarised in the following paragraphs.

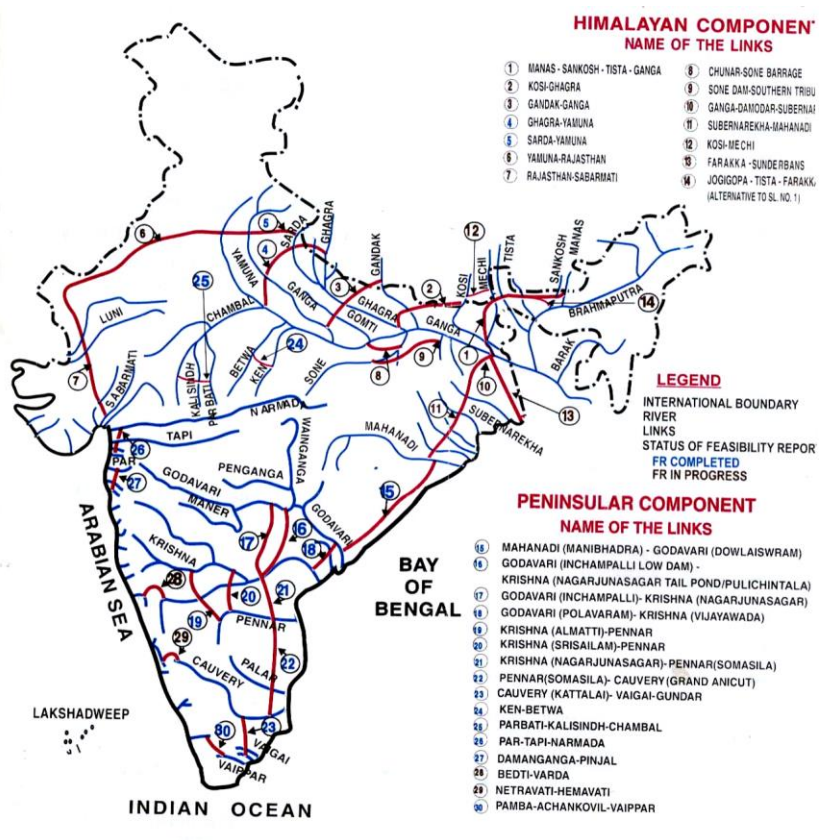


Fig.1 NPP Rivers (Blue Colour) & Link Canals (in Red colour)
Showing Manas –Sankosh –Tista-Ganga (Link-1), NWDA [5]

## 2.1 Merits of Interlinking

Proponents of NPP favouring river linking claim several benefits [8], namely

(i) Food security through irrigation of an additional area of 35mha
(ii) Additional hydro-power generation of the order of 50,000 MW
(iii) Water supply for drinking and Industry
(iv) Navigation for inland water transport
(v) Employment opportunities in rural areas
(vi) Lean flow augmentation by releasing stored water

### 2.2 Demerits of Interlinking

Implementation of NPP scheme is opposed [9,10] due to following reasons:

(i) Environmental Damage
(ii) Massive Investment in Water sector Depriving Other Sectors
(iii) Falacy of Flood control-only 3% of flood volume will be stored
(iv) Interstate Water Dispute for Long Distance links
(v) Poor Performance of Exiting Canal Projects-Link Canals may have same fate
(vi) Poor Economic Return & Faulty Pricing Policy resulting in lack of Maintenance

## 3.0 **Hydro-Power Development in North-East India**

Without entering into the conflicts about the proposed NPP, author wishes to discuss about the hydro-power aspects of the proposed NPP with particular reference to the huge hydro-power potential in the North-East region of India. Table-1[11] shows that out of a total hydro-

power potential of India i.e.1,48,701MW, potential available in north-east region (NER) is 58,971MW i.e. about 40% of the country's total hydro potential. Out of this huge potential, 54,329 MW i.e. 93.17% still remains untapped in NER. Share of hydro-power in the hydro-thermal mix is only19% today against an ideal share of 40%. It is only 12% of India's total installed capacity consisting of thermal, hydro, nuclear and other renewable powers (like solar, tidal and wind power). In the international climate conference, Indian Govt. has committed zero carbon emission by 2047 to keep the rise in temperature below$2^0$ C. Besides raising solar and nuclear energy, hydro-power development is a must to achieve the goal. The NER states in the Himalayas is attractive for hydro-power generation because the rivers in this region descend from around 3,500 m to 500 m in a short distance of 200-km stretch. The water wealth and terrain head in NER are nature's gift and a bounty for the relatively underdeveloped states in the NER. Apart from clean and renewable energy, the greatest

Hydro Electric Potential Development
(In terms of Installed capacity- Above 25MW as on 30.09.2020
(CBIP-2022)

| Region/ State | Identified Capacity as per reassessment study | | Capacity In Operation | | Capacity Under Construction | | Capacity In Operation + Under Construction | | Capacity yet to be taken up under construction | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Total | Above 25 MW | | | | | | | | |
| | (MW) | (MW) | (MW) | % | (MW) | (%) | (MW) | (%) | (MW) | % |
| **NORTHERN** | | | | | | | | | | |
| Jammu & Kashmir | 11769 | 11497 | 3360 | 29.23 | 2559.5 | 22.26 | 5919.5 | 51.49 | 5577.5 | 48.51 |
| ladakh | 2377 | 2046 | 89.0 | 4.35 | 0.0 | 0.0 | 89.0 | 4.35 | 1957.0 | 95.65 |
| Himachal Pradesh | 18820 | 18540 | 9809.00 | 52.91 | 2125.00 | 11.46 | 11934.00 | 64.37 | 6606.00 | 35.63 |
| Punjab | 971 | 971 | 1096.30 | 112.90 | 206.00 | 21.22 | 1302.30 | 134.12 | 0.00 | 0.00 |
| Haryana# | 64.00 | 64.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Rajasthan## | 496.00 | 483.00 | 411.00 | 85.09 | 0.00 | 0.00 | 411.00 | 85.09 | 0.00 | 0.00 |
| Uttarakhand | 18175 | 17998 | 3756.40 | 20.87 | 1490.0 | 8.28 | 5246.4 | 29.15 | 12751.6 | 70.85 |
| Uttar Pradesh* | 723 | 664 | 501.60 | 75.54 | 0.00 | 0.00 | 501.60 | 75.54 | 162.40 | 24.46 |
| Sub Total (NR) | 53395 | 52263 | 19023.30 | 36.40 | 6380.50 | 12.21 | 25403.8 | 48.61 | 26859.20 | 51.39 |
| **WESTERN** | | | | | | | | | | |
| Madhya Pradesh. | 2243 | 1970 | 2235.0 | 100 | 400.0 | 20.30 | 2635.0 | 100.00 | 0.0 | 0.00 |
| Chhattisgarh | 2242 | 2202 | 120.0 | 5.45 | 0.0 | 0.00 | 120.0 | 5.45 | 2082.0 | 94.55 |
| Gujarat### | 619 | 590 | 550.0 | 100 | 0.0 | 0.00 | 550.0 | 100.00 | 0.0 | 0.00 |
| Maharashtra | 3769 | 3314 | 2647.0 | 79.87 | 0.0 | 0.00 | 2647.0 | 79.87 | 667.0 | 20.13 |
| Goa | 55 | 55 | 0.0 | 0.00 | 0.0 | 0.00 | 0.0 | 0.00 | 55.0 | 100.00 |
| Sub total (WR) | 8928 | 8131 | 5552.0 | 68.28 | 400.0 | 4.92 | 5952.0 | 73.20 | 2179.0 | 26.80 |
| **SOUTHERN** | | | | | | | | | | |
| Andhra Pradesh | 2366 | 2341 | 1610.0 | 68.77 | 960.0 | 41.01 | 2570.0 | 109.78 | 0.0 | 0.00 |
| Telangana | 2058 | 2019 | 800.0 | 39.62 | 0.0 | 0.00 | 800.0 | 39.62 | 1219.0 | 60.38 |
| Karnataka | 6602 | 6459 | 3644.2 | 56.42 | 0.0 | 0.00 | 3644.2 | 56.42 | 2814.8 | 43.58 |
| Kerala | 3514 | 3378 | 1856.5 | 54.96 | 100.0 | 2.96 | 1956.5 | 57.92 | 1421.5 | 42.08 |
| Tamilnadu | 1918 | 1693 | 1778.2 | 100 | 0.0 | 0.00 | 1778.2 | 100.00 | 0.0 | 0.00 |
| Sub Total (SR) | 16458 | 15890 | 9688.9 | 60.97 | 1060.0 | 6.67 | 10748.9 | 67.65 | 5141.1 | 32.35 |
| **EASTERN** | | | | | | | | | | |
| Jharkhand | 753 | 582 | 170.0 | 29.21 | 0.0 | 0.00 | 170.0 | 29.21 | 412.0 | 70.79 |
| Bihar#### | 70 | 40 | 0.0 | 0.00 | 0.0 | 0.00 | 0.0 | 0.00 | 0.0 | 0.00 |
| Odisha | 2999 | 2981 | 2142.3 | 71.86 | 0.0 | 0.00 | 2142.3 | 71.86 | 838.8 | 28.14 |
| West Bengal | 2841 | 2829 | 441.2 | 15.60 | 120.0 | 4.24 | 561.2 | 19.84 | 2267.8 | 80.16 |
| Sikkim | 4286 | 4248 | 2169.0 | 51.06 | 1133.0 | 26.67 | 3302.0 | 77.73 | 946.0 | 22.27 |
| Sub Total (ER) | 10949 | 10680 | 4922.5 | 46.09 | 1253.0 | 11.73 | 6175.5 | 57.82 | 4504.6 | 42.18 |
| **NORTH EASTERN** | | | | | | | | | | |
| Meghalaya | 2394 | 2298 | 322.0 | 14.01 | 0.0 | 0.00 | 322.0 | 14.01 | 1976.0 | 85.99 |
| Tripura | 15 | 0 | 0.0 | 0.00 | 0.0 | 0.00 | 0.0 | 0.00 | 0.0 | 0.00 |
| Manipur | 1784 | 1761 | 105.0 | 5.96 | 0.0 | 0.00 | 105.0 | 5.96 | 1656.0 | 94.04 |
| Assam | 680 | 650 | 350.0 | 53.85 | 0.0 | 0.00 | 350.0 | 53.85 | 300.0 | 46.15 |
| Nagaland | 1574 | 1452 | 75.0 | 5.17 | 0.0 | 0.00 | 75.0 | 5.17 | 1377.0 | 94.83 |
| Arunachal Pradesh | 50328 | 50064 | 815.0 | 1.63 | 2300.0 | 4.59 | 3115.0 | 6.22 | 46949.0 | 93.78 |
| Mizoram | 2196 | 2131 | 60.0 | 2.82 | 0.0 | 0.00 | 60.0 | 2.82 | 2071.0 | 97.18 |
| Sub Total (NER) | 58971 | 58356 | 1727.0 | 2.96 | 2300.0 | 3.94 | 4027.0 | 6.90 | 54329.0 | 93.10 |
| **ALL INDIA** | **148701** | **145320** | **40913.7** | **28.15** | **11393.5** | **7.84** | **52307.2** | **35.99** | **93012.9** | **64.01** |

advantage of hydro-power is its flexibility, long life and very little maintenance cost. India's current storage capacity of 300 BCM is too little to fight floods, droughts and ensure all

season navigation and water supply. Large storages e.g. Bhakra, DVC, Sardar Sarovar are however resisted due to displacement of people, their rehabilitation and other problems. But the NER terrain is ideal for development of run-off-the river type schemes where storage requirement is very little.

**4.0 Water Transfer from Ganga to Brahmaputra River**

India advocates inter-basin water transfer from the Brahmaputra basin to the Ganges basin through a link canal to augment the dry season flow in the Ganga basin downstream of Farakka barrage in order to address the grievances of Bangladesh. India's 1978 proposal consisted of a barrage 2460 m long barrage across the Brahmaputra river at Jogigopa (Fig.2) in Assam with a link canal 324 km long, 274 metre wide and 9 metre deep (passing mostly through Bangladesh) up to a point upstream of Farakka barrage in West Bengal as shown in Fig.2 [12] (dotted green Line**)**. This proposal was the shortest link between Brahmaputra and Ganga. It had no lift component and the flow was entirely through gravity. However, the proposal was rejected by the Bangladesh Government due to political reasons.

In its revised proposal, Govt. of India decided to connect Jogigopa barrage with Tista and Ganga bypassing Manas and Sankosh rivers (Fig.2-Full line). The proposal envisaged the construction of three storage reservoirs (Subansiri, Dihang and Tipaimukh) in the eastern foothills of the Himalayas to supplement the dry season flow of the Brahmaputra at Jogigopa. The idea is to divert water from these storages to the Ganges in the months February to April when (according to India's estimate) water is abundant in the Brahmaputra and scarce in the Ganges basin due to late arrival of Monsoon in Ganga basin as compared to Brahmaputra basin. The Dihang and Subansiri reservoirs were estimated to lower the flood peak in Bangladesh by 1.3m while the Tipaimukh dam would reduce the flood in the Meghna basin in Bangladesh, especially in Dhaka [13,].Owing to topographic factors, this link would involve a lift of 60 meter and require 7,500 MW of power [14]. However, it is exclusively within Indian territory and passes through the 32 km narrow belt (Known as Chicken Neck) separating India from Nepal and Bangladesh as shown in Fig.2.

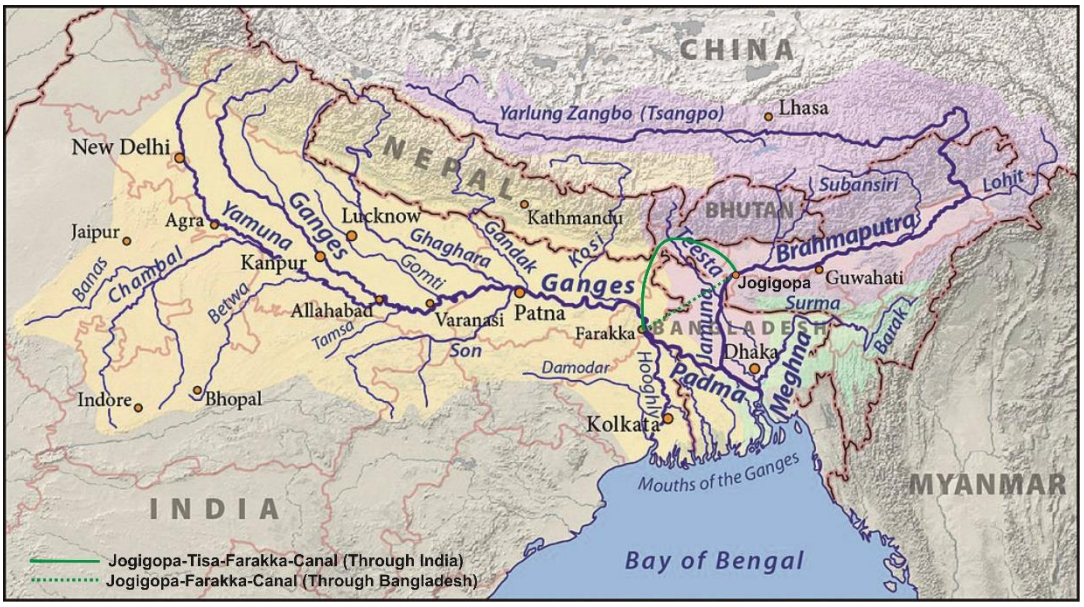


**Fig. 2 Brahmaputra-Ganga Link Through Bangladesh (Green--) and India (Full line¬¬)**

## 5.0 Benefits of India and Bangladesh from Brahmaputra-Ganga Link

Primary objective of the proposed Brahmaputra-Ganga link-1 is to transfer excess water of Brahmaputra basin to Ganga basin for augmenting dry weather flow of Teesta river for hydro power, irrigation, water supply, navigation, flood moderation. Teesta barrage project has an irrigation potential of 9.22 lakh ha in six northern districts of West Bengal, namely, Coochbihar, Darjeeling, Jalpaiguri, Uttar Dinajpur, Dakshin Dinajpur and Malda. Apart from proposed storages in Subansiri, Dihang and Tipaimukh, water stored in three storage dams on Teesta river in Sikkim will be diverted from barrages on Teesta, Mahananda and Douk rivers. The dams and the barrages on Tista are already completed and the construction of distribution canals are in progress. First part of the proposed Brahmaputra-Teesta link will be of immense benefit for India and Bangladesh ensuring firm water supply, especially during lean season. Tista project started in 1975 is yet to be completed partly due to land acquisition problem and partly due to inadequate lean season flow to meet demand of a huge command of 9.22 lakh ha in India on a firm basis.

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Second part of the link canal connecting Teesta with Ganga (Upstream of Farakka) will bring excess water of Brahmaputra basin to Ganga basin to augment dry weather flow at Farakka for transmission to Bhagirathi/Hoogly for survival of Kolkata port, Navigation (National Waterway-1 and 2), industrial use and water supply to Kolkata Metropolitan city and other innumerable towns on either side of Hoogly river. Link (no.1) is to be connected with other links (No.11,13, 16) for transfer of water from surplus basins of Brahmaputra and other eastern rivers to the water deficit basins through links 21 and 22 as proposed under NPP (Fig.1) to address the severe water crisis in Cauvery and Pennar Basins in the south.

All the three rivers i.e. Ganga,Teesta and Brahmaputra flow through Bangladesh which is a riparian country downstream. In fact 50 more rivers of India (Upper riparian country) pass through Bangladesh. Bangladesh wants the water resources of Ganga and Brahmaputra basins managed in such a way as to minimize flooding during monsoon months and address water shortage during lean months in Bangladesh. Sharing of dry weather Ganga flow downstream of Farakka barrage has been resolved by a joint river commission (JRC) for benefit of irrigation in Kushtia and Khulna districts in Bangladesh and recharging ground water for supplemental irrigation. Bangladesh wants similar agreement for sharing of Brahmaputra and Teesta water too. Construction of storage reservoirs behind Sankosh, Manash, Subansiri, Dihang, Lohit dams and a dam at Tipaimukh and flow diversion from Barrage at Jogigopa will definitely help in reduction of flood damages in Bangladesh during the Monsoon, recharge of its ground water and firm water supply for drinking, irrigation and other benefits including share of hydro- power to Bangladesh. At the 36th JRC meeting, India assured Bangladesh that it would implement the Brahmaputra-Ganga link and storage dams on Subansiri, Dihang and other tributaries of Brahmaputra river after consultation with Bangladesh [15]. India, however, has rejected the Bangladesh proposal to have a trilateral agreement between India, Bangladesh and China (Uppermost Riparian Country of river Brahmaputra) who has constructed large numbers of high dams on river Brahmaputra called Yarlung Zangbo and its tributaries in Tibet (Fig.2) without any agreement with either India or Bangladesh.

## Conclusions

Govt. of India is investigating and executing river linking scheme (NPP) for the development of irrigation, hydro-power, navigation, water supply for equitable distribution of river water.

Some of the short links are completed or under progress. Brahmaputra-Ganga link (No.1) is important to transfer excess water from water surplus river basins of Brahmaputra and Ganga to the water deficit basins in the south. Besides tapping huge hydro-potential of north east region, the link will benefit both India and Bangladesh. Although there is some problems, India and Bangladesh are trying to resolve the issues arising out of the proposed link through joint rivers commission for its early implementation of Brahmaputra-Ganga link-1.

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