INTERLINKING INDIAN RIVERS MERITS, DEMERITS AND DIFFICULTIES IN IMPLEMENTATION

S.K. Mazumder, Individual Consultant
Former AICTE Emeritus Professor, Delhi College of Engg. Delhi

ABSTRACT

Interlinking of Indian rivers is envisaged by the Govt. of India to transfer surplus water from the flood affected basins to drought prone areas. A national perspective planning has been proposed to construct 14 links in Himalayan and 16 links in the peninsular regions. Various merits and demerits of the proposal, the difficulties to be faced in the implementation of the proposed links and alternative to links have been discussed.. Priority of interlink for future development has been stated with recommendations.

Key Words: *Indian Rivers, Interlinking, Merits , Demerits, Difficulies, Priority*

1. INTRODUCTION

Concept of interlinking Indian rivers for effective management of flood and drought situations has been introduced by a number of eminent persons like Sir Arthur Cotton, Dr. K.L. Rao, Captain M. N. Dastur and many others [1].These proposals were duly examined and were rejected due to Techno-economic reasons. Lately, the National Water Development Agency (NWDA) under the Ministry of Water Resources, Govt. of India, has proposed the National Perspective Plan (NPP) consisting of 14 canal links under the Himalayan component and 16 canal links under the Peninsular component [2]for transfer of surplus water (mostly in the Himalayan Region) to the deficit areas (mostly in the southern and western region). Figure 1 illustrates the various links proposed by NWDA. The National Perspective Plan by NWDA is being debated all over the country. A group of people, mostly in the Govt. sector, are strongly advocating for immediate implementation of the project for our food security and other benefits. Another group of people, consisting mostly of NGOs, are strongly against the project as they apprehend that the project will bring disaster to the country [3]. A Task Force was appointed by the NDA Govt. under the chairmanship of Sri Suresh Prabhu [4], after the Supreme Court order, to implement the project in a period of 15 years (by 2016). The present UPA Govt., however, wished to know the views of all the stakeholders. A standing committee of Parliament was formed to hear the views of both the public and the experts in this matter. The committee after examining the presentations finally submitted its recommendations to the Govt. of India.

In this paper, author wishes to discuss the different merits and demerits of the NWDA scheme as pointed out by the two opposing groups followed by the various difficulties in its implementation. Recommendation of the NCIWRD [5] and the author's own thoughts regarding the implementation of the proposed national water grid are given at the end.

2. WATER DEFICIT AND SURPLUS AREAS IN INDIA

India is blessed with ample of water resources, but its enormous population growth has resulted in poor per capita availability. Table 1 gives the per capita water availability in different countries.

Table 1: Per Capita Availability of Fresh Water per Year (m^3 / Person)

USSR	USA	Australia	China	India	Ethiopia
19500	9900	5000	2420	2214	250

Areas with water availability less than 1000m^3 per capita per year are designated as scarcity areas. Although, the average figure (2,214 m^3.) for India [6] , as a whole, shows that it is not deficit, but when we look at the spatial distribution of water from basin to basin, it is noticed that there is a great deal of non-uniformity principally due to extreme non-uniform rainfall distribution. Table-2 gives the list of surplus and scarce basins in India.

Table 2: Surplus and Scarce Basins in India

Surplus Basins		Scarce Basins	
Basins	**Per Capita Availability in m^3 Per Year**	**Basins**	**Per Capita Availability in m^3 Per Year**
Brahmaputra Basin	18,417	East flowing Rivers between Mahanadi and Pennar	919
Barak Basin	7,646	Cauvery	666
West flowing Rivers between Tadri and Kanyakumari	3,538	Pennar	648
West flowing Rivers between Tapi and Tadri	3,194	West flowing River Basin of Kutch and Saurashtra including Luni	631
Narmada	2,855		
Brahmani-Baitarni	2,696		
Mahanadi	2,546	East flowing River Basins between Pennar and Kanyakumari	383
Godavari	2,026		
Indus	1,757		
Ganga	1,473		

The scarce basins are often subjected to droughts and the surplus basins are frequently devastated by floods. The flood and the drought occur almost simultaneously leading to loss of human life and animals, damage to crops and properties, disruption of communication and so many other miseries. Annual average flood damage in India has increased from Rs. 52 Crores in 1952 to Rs. 5,846 Crore in 1998. Flood prone area in India is about 40 million hectare out of which 7.5 million hectare gets flood affected almost every year. Droughts, on the other hand, result in loss of soil moisture leading to loss of standing crops and the people are deprived of even the basic need of drinking water. The flood-drought-flood syndrome in India, occurring almost regularly, is causing disaster to the nation.

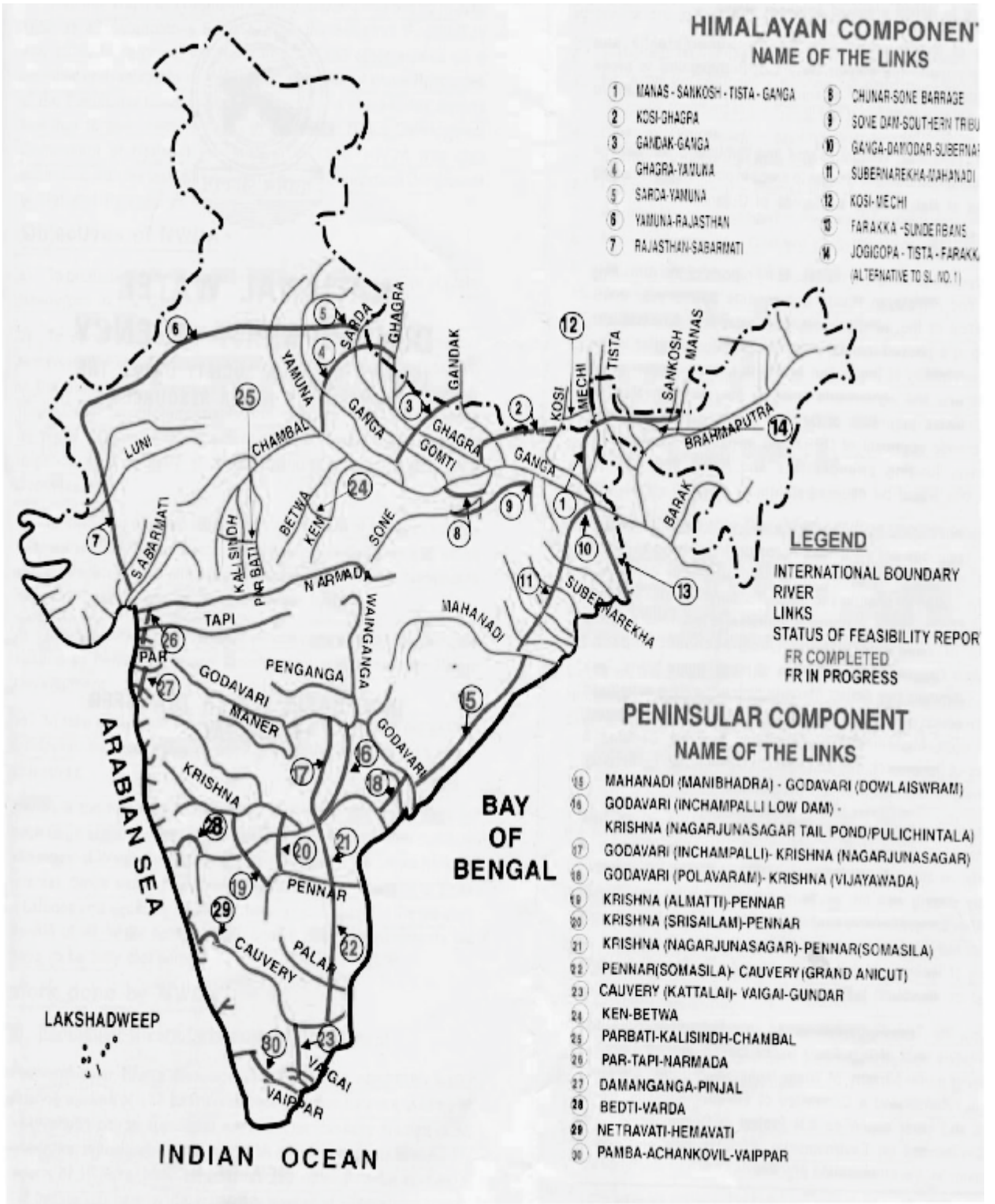

Fig.1 NWDA Plan (NPP) of Interlinking Indian Rivers by

Link Canals (numbered and shown in thick lines) for Himalayan and Peninsular components

3. HIMALAYAN AND PENINSULAR COMPONENTS OF INTERLINK

As shown in Fig. 1, there are two components of interlink - the Himalayan River Component and the Peninsular River component. These are briefly discussed underneath.

3.1 Himalayan River Component

As shown in Fig.1, fourteen link canals are proposed under this component. It envisages construction of storages on the main Ganga and the Brahmaputra rivers and their principal tributaries in India and Nepal so as to conserve monsoon flows for flood control, hydropower generation and irrigation. Inter-linking canal systems will be provided to transfer surplus flows of the Kosi, Gandak and Ghagra to the west. In addition, Brahmaputra-Ganga Link will be constructed for augmenting dry weather flows of the Ganga. Surplus flows available on account of inter-linking of Ganga and Yamuna are proposed to be transferred to the drought areas of Haryana, Rajasthan and Gujarat. The scheme will benefit not only parts of India but also our neighbours Nepal and Bangladesh. Planning and implementation of this scheme will have to include Nepal, Bhutan and Bangladesh as they also are part of the same hydrological unit.

3.2 Peninsular River Component

Sixteen link canals are proposed under this component as illustrated in Fig.1. Amongst the Peninsular rivers, the Mahanadi and Godavari have sizeable surpluses after meeting the existing and projected needs of the state within these basins. It is, therefore, proposed to provide terminal storages on Mahanadi and Godavari rivers to divert surplus flows of Mahanadi to the Godavari system and to further transfer surplus from the Godavari Systems to water short rivers namely, Krishna, Pennar and Cauvery. The link from Mahanadi to Godavari will be along the east coast and will not involve any lift. The link between Godavari and Krishna will be partly by gravity and partly by lift of the order of 120 m. The transfer of waters by successive exchange would enable irrigation in drought areas of Maharashtra, Karnataka, Andhra Pradesh and Tamil Nadu. It also envisages interlinking of west flowing rivers, benefiting states like Tamil Nadu, Karnataka, Gujarat, M.P. and Rajasthan.

4. OBJECTIVES OF INTERLINKING

As already stated, the primary purpose of interlinking of Indian rivers is to transfer water from the surplus basins to the deficit (scarce) basins for optimal use of national water resources and its equitable distribution amongst the states. By 2025 our total demand of water of 1050 km^3 (Food 770 km^3, Domestic Water Supply - 52 km^3, Industrial Use 120 km^3, Power 71 km^3, Miscellaneous e.g. Salinity, Pollution Control, Navigation, Recreation etc. 37 km^3) is going to be more or less equal to utilizable water resources of the country estimated as 1100 km^3 (700 km^3 from surface water and about 400 km^3 from ground water). Acute scarcity of water supply will arise after 2025 unless we control the growth of population and the increasing demand of water. Fig.2 illustrates the growth of population and the increase in demand for food grain up to the year 2050. It also shows the increase in irrigated areas with time. Whereas the demand for food will increase steadily, the areas under irrigation remains constant beyond 2001 primarily due to limited irrigation potential under conventional irrigation practice. It is estimated that an additional area up to 43 million hectare can be brought under irrigation due to water transfer through interlinking of rivers as proposed under NPP.

5. SOME EXAMPLES OF INTERLINKING RIVERS

India has successfully implemented a number of interlinks for water transfer in the past. These are

(i) Kurnool Cuddapah canal in the south executed as early as 1860-70.

(ii) Periyar-Vaigai link canal in the year 1986.

(iii) Beas-Sutlej link- transfering water from Pandoh dam on Beas to Sutlej river upstream of Bhakra dam.

(iv) Ravi-Beas link- transferring water from river Ravi to Beas upstream of Harike and Ferozepur.

(v) Sutlej-Yamuna link - proposed to connect river Sutlej with Yamuna River (Phase-I completed)

(vi) Teesta Irrigaion Scheme- connecting river Teesta with river Mahananda in north Bengal.

Similar links for transfer of surplus water have been successfully implemented in countries like USA, Canada, USSR, China, Iran etc.

6. DIFFERENT MERITS OF INTERLINKING

Those who strongly advocate implementation of the NPP cite the following merits which the project is likely to bring about for an all round development of the country.

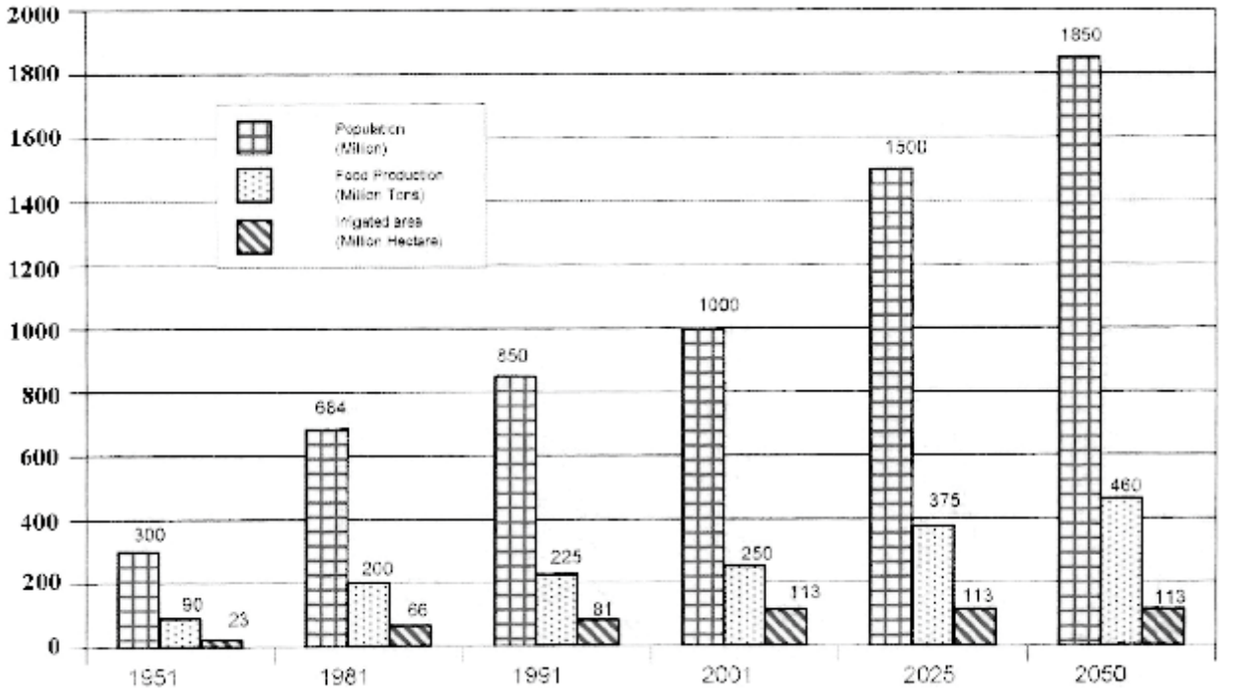

Fig.2 Projected Growth of Population, Food Requirement and Irrigated Area in India

6.1 Food Security

The projected population of India is expected to stabilize at about 1600 million by the year 2050 from the present population of about 1100 million. The food requirement for this increased population will rise from 260 million tonne at present to 460 million tonne in 2050. The proposed river link is going to increase irrigated area from the present 113 million hectare to 156 million hectare by 2050 ensuring our food security.

6.2 Hydropower Development

At present, the share of hydropower is only

about 25% of the total power generation. Our hydro-power development is only about 28,000 MW out of the potential of about 84,000 MW. Only 2% of the potential of north-east has been developed so far, although 45% of total hydro-power potential of the country lies there. The proposed grid, especially the Himalayan component, is going to provide 34,000 MW of additional hydropower for peaking purpose and for increasing the desired share of hydro to about 40%.

6.3 Water Supply for Drinking and Industry.

The proposed NPP envisages supply of clean drinking water and water for industrial use amounting to 90 and 64.8 billion m^3 respectively with a view to meet the demand by 2050. This will remove the current hardship, especially for the rural women who have to walk long distances daily to collect water for drinking and other domestic uses. No industrial growth is feasible without guaranteed water supply.

6.4 Navigation for inland water transport

Currently, the national waterways run only for about 120 days or so in a year due to inadequate depth in the rivers, which is less than the required minimum depth of about 2m. The proposed grid is going to ease pressure on railways and roads by introducing inland navigation through National Waterways (I, II, & III) by guaranteeing a minimum 2 m depth of water on all the 365 days in a year.

6.5 Flood and Drought Protection

As already pointed out, while one part of the country is devastated by recurring floods, the other part is suffering from drought due to acute shortage of water. The main challenge is how can the water causing devastation and running waste into the sea (especially from Brahmaputra, Ganga and Mahanadi Basins) can be diverted for productive use in the drought prone areas in the South and the West, so that the country gets rid of the current flood-drought-flood syndrome.

6.6 Increased Employment Opportunities in Rural Areas

People in the rural areas are now compelled to migrate to cities in search of jobs, causing rapid deterioration of our national economy. Villages are getting poorer and cities are getting congested resulting in unprecedented pollution of air, water and soil in the cities. Only way to reverse this unhealthy trend is to create more job opportunities in rural areas through agricultural and agro-industry based projects. As the proposed link canals and the storages are going to be mostly in rural areas, it is going to create large employment opportunities for the rural youths.

6.7 Dry Weather Flow Augmentation

Transfer of surplus water stored in reservoirs during monsoon and releasing it during dry season will ensure a minimum amount of dry weather flow in the rivers which will help in pollution control, navigation, fisheries, growth of forests, protection of wild life etc. Any water body either in storage reservoirs or in flowing link canals will be very attractive and offer recreational opportunities for both rural and urban people.

7. DIFFERENT DEMERITS OF INTERLINKING

Although NPP has several merits as mentioned above, it has several demerits too as pointed out by the opposing group. These are briefly discussed underneath.

7.1 Environmental Problems

A group of people, especially the NGOs, the Socio-Economic and the environmental lobby are strongly against the inter-link [8]. They apprehend that such a massive inter- basin transfer of water will eventually result in environmental degradation, climatic changes[9], evaporation losses , loss of aquatic eco-system, water logging and salinity and submergence of vast areas of land in reservoirs and the huge network of unlined open canals.

7.2 Loss of Livelihood & Displacement of Tribal Poor People

The project will definitely cause loss of land, forests, fisheries etc. on which most of the poor and tribal people sustain their livelihood. There will be massive displacement of people loosing their age old property, source of income, their culture and identity.

7.3 Massive Investment Required for Implementation

The estimated cost for the implementation of the project at 2000 price index is Rs.5.6 lakh crores, which is likely to further increase manifold [10] due to cost and time overrun (as illustrated in table-3). Such a massive investment in water sector is going to deprive important projects in other sectors for our socio-economic development due to inadequacy of funds.

Table-3 Cost & Time Overruns in Indian Water Sector

Project	Budget Year	Budget (Rs. Million)	Increase on Original Budget
Indra Sagar	1984-85	13928.5	
	1988-89	21676.7	56%
	1993-94	34967.9	151%
	2004-05	75000.0	438%
Onkareshwar	1984-85	5780.00	
	1988-89	19092.50	230%
	1993-94	40000.00	592%
	2004-05		
Maheshwar	1985-86	2412.70	
	1993-94	8240.00	242%
	2004-05	23000.00	853%
Sardar Sarowar	1984-85	42400.00	
	1986-87	64066.40	51%
	1992-93	131806.20	211%
	2004-05	275000.00	549%

Source "Between the Extremes: The Dam Dilemma": GG Puri

8. DIFFICULTIES IN IMPLEMENTATION OF NPP

Although the scheme has number of merits, there are a number of practical difficulties in its implementation as argued by the group opposing the project. These are briefly summarized below.

8.1 Lack of Transparency and Information

There is lack of transparency about the scheme, inadequate information and insufficient data regarding cost of other alternatives to inter-link. For example, the NGO's are eager to know the cost of transporting surplus foods (by increasing productivity of irrigated land) from water surplus areas to drought prone areas as an alternative to long distance water transfer for irrigation which will consume about 80% of water proposed to be transported.

8.2 Flood/Drought Control - a mere Publicity to Fool People

As only a small part of floodwater (approximately 3 % of flood volume) will be stored and transferred through the link canals, there will be hardly any flood relief. Droughts may not occur concurrently with floods and it may not be feasible to remove drought in all the distant areas, especially those lying in higher altitude due to excessive cost of pumping.

8.3 Change in Constitution

Water is a state subject under entry 17 of state list- II subject to entry 56 of central list- I at present. Even if the project is found to be techno-economically feasible, implementation of the same will be a Herculean task. It needs constitutional amendment. Most of the donor states, even though surplus, will be reluctant to part with its resources free of cost and shall try to project their future demands stating that their surpluses are owing to insufficient storage due to lack of investment in their states. To provide incentive, water has to be considered as a trading commodity like electricity and other raw materials and the beneficiary states will have to be asked for paying the price of water possessed legally by the surplus states. Is it desirable to bring water from state subject to central subject and finally privatise it as is being done in the case of public sector undertakings now-a day?

8.4 Interstate Dispute

In almost all the projects executed in the country so far, water of a river basin has been shared only by the riparian states. The proposed scheme envisages transfer of water from surplus basins to drought prone basins irrespective of whether they are riparian/cobasin or not. Recently, the country has witnessed bitter quarrel and animosity amongst the states of Karnataka and TamilNadu over the sharing of water from rivers Cauveri and Krishna, even though both the states are riparian states. One can well imagine the degree of complexity and the dispute that will arise over sharing of water from the proposed scheme where a large numbers of states are involved, resulting in tension and rivalry amongst the people of different states. Who is going to control, operate and maintain this mega project?

8.5 Resistance of People in the East and North-East

Most of the surplus water lies in the East and North-East states where people are economically backward mainly due to lack of investment. People may resist inter- basin transfer of their water resources free of cost to the beneficiary states unless the Govt. of India bring their economic condition at par with other developed states of the country. Equity in economic development is no less important than equity in water distribution for a healthy and prosperous nation. There is a massive unemployment and unrest amongst the unemployed youths in these states. Unless the Govt. addresses these problems first by taking up those components of the project through in-basin development of water for hydro-power, irrigation, flood control, inland waterways, communication and development of other infra-structures for these states, it may be almost impossible for the project authorities to implement the proposed interlinks, however well planned it may be.

8.6 Poor Performance of Many Existing Projects

It is extremely important to evaluate and improve the performance of the existing river valley projects and address the genuine problems being faced by the people especially those who are affected and who oppose river valley projects for fear unfounded. Performances of many of the existing projects are not satisfactory [11]. About 65% to 70% of irrigation water is wasted due to improper maintenance, lack of proper co-ordination between users and controlling authorities, mismanagement of water at farm level, wrong and unrevised pricing policy etc. Almost one third of the irrigated land is subjected to water logging and salt problems. Farmers of Punjab

state are not allowing completion of phase-II of Sutlej- Yamuna river link while phase-I of the project is already completed by the Haryana Govt. long back and the entire investment is lying idle. The Punjab farmers are resisting mainly due to their fear of water logging and salinity experienced by them from Bhakra-Nangal scheme. Not a single drop of water has flown in the Telegi- Ganga link project so far inspite of massive investment for this link since upper riparian states are objecting. Teesta irrigation project in the northern part of West Bengal is half completed even after 30 years from its inception due to lack of funds. One of the DVC main canals which were designed for inland navigation has not carried a single vessel so far inspite of large investments and wastage of prime agricultural lands which had to be occupied for the construction of the wide canal. The state of Kosi canals and the problems being faced in river training after construction of Kosi barrage [12] and Farakka barrage [13] are well known. These are only a few examples to illustrate the utter mismanagement in water sector. Many such projects which were earlier considered to be national assets have now become national liabilities. Unless and until we can correct the situation and improve the performance of these existing projects, it will be very difficult to earn people's confidence and convince the people for implementing a massive programme like NPP , however justified it may be.

8.7 Poor Economic Return & Faulty Pricing Policy

Unlike other commodities, water for irrigation is currently distributed almost free of cost. The present irrigation water rates are extremely poor and the realization of even those low rates is still poorer. Whereas during the British days, 87% of the maintenance cost used to be realised from water users, today the revenue receipt has come down so low that only 15% of maintenance cost could be met [14]. As a result, there is hardly any maintenance of the irrigation projects after their execution. There is tremendous wastage of water due to losses in conveyance and operation as well as in the farms since farmers get it almost free of cost. Presently, the overall irrigation efficiency of most of the surface irrigation schemes, which consume about 80% of total water supply, is about 30% to 35% only. Should we build such things which we can not maintain? The savings of water due to even a marginal improvement in irrigation efficiency and use of return flow through scientific management of irrigation water may be sufficient to irrigate the additional areas for increased food production. It will be wise to charge the beneficiary states for the water they will receive and pay a part of the revenue to the donor states as a price of the water they legally posses. The present practice of distributing irrigation water almost free of cost must be abandoned and the water rates so fixed that the revenue realized could pay for at least the annual maintenance and overhead costs if not the annual depreciation, interest on borrowed capital and the amount to be paid to the donor states.

9. NCIWRD RECOMMENDATION

The National Commission on Integrated Water Resources Development (NCIWRD) has projected the improved irrigation efficiencies of the surface and groundwater irrigation system for the future. The Commission also assessed the return flow from the various uses, which would flow into the hydrologic system and thus make it available for reuse. The Commission recognized that inter-basin transfer of water is an outstandingly large complex program of water management. Studies have to be done with the help of computer simulation models and systems analysis. They recommended that with improved management and in-basin development, there would be no major water scarcity problem up to the year 2050, except a few isolated pockets for which short links may be provided and there is no need of long distance water transfer at present.

10. PRIORITY OF INTER LINKING OF RIVERS FOR WATER TRANSFER

To meet the growing requirements of water for

various uses and to be counted as a developed nation, it is imperative not only to develop the new water sources but to conserve, recycle and reuse water wherever possible. For the food security of our growing population, various options have been considered in as many quantitative terms as possible. These include: (i) conservation of water through rainwater harvesting and groundwater recharge, (ii) recycling and reuse of municipal and industrial wastewater,(iii) utilizing increased return flow from irrigation and other supplies, (iv) virtual water and (v) intra and inter basin transfer of surplus water.

The planning for both intra- and inter-basin transfer of water has to clearly begin now because of the long gestation period involved. It is also important to note that only through projects of this nature can we generate the power required for groundwater pumping, provide water for inland navigation and meet ecological requirements. Every developed society has to provide for such requirements. Therefore, it is clear that India as a nation has to now initiate actions on all fronts for developing its water resources. The priority of action, however, must be for increasing productivity of land, choice of proper crops as per prevailing climatic conditions, increase in irrigation efficiency of existing projects through improved water management, rainwater harvesting and groundwater recharge, recycling and reuse of wastewater, preservation of water in tanks to be followed by intra basin and inter basin transfers..

11. CONCLUDING REMARKS

Under the above circumstances, it will be wise not to hurry for interlinking of the rivers in the first phase of development but to keep it as a long-term goal. The immediate need is to examine the feasibility of the river links and other alternatives to interlinks with more data and sound economic analysis of cost- benefit of different alternatives to achieve the same objectives. A master plan should be prepared adopting a strategy of implementing the different components of the master plan (including river-linking) in a phased manner so that the immediate problems of the donor states are given the topmost priority for their economic upliftment. The first phase of the execution should be to develop water resources management within the river basin and then to interlink the rivers to facilitate transfer of water from surplus areas to deficit areas.

References:

1. IWRS, “Inter-basin transfer of water for national development- problems and Prospects”, theme paper published. on water resources day by IWRS, New Delhi, 1996.

2. IWRS, “Water Vision 2050”, Theme paper published on water resources day by IWRS, New Delhi, March 22nd, 1999

3. lyer, Ramaswamy R., “River link to Disaster', published in the daily news paper: The Statesman, April 5th, 2003.

4. Task Force for inter-linking of rivers, Agenda for the meeting of IITs and IISC under the chairmanship of Suresh Prabhu, chairman, task force, August, 2003.

5. Bharat Singh, “Inter basin water transfer- review of need and problems”, Theme paper published in the proceedings of “All India seminar on Water and Environment-Issues and Challenges”, organised by IWRS and WRDTC, Roorkee, Oct. 2002

6. Iyer S. S., "Water resources of India", Journal of IWRS, April, 1989.

7. Mazumder S.K., "Interlinking Indian Rivers-Issues and Challenges", Proceedings of National Conference On Hydraulic and Water Resources Engineering, HYDRO-2003, organised by ISH and CW&PRS, Pune.

8. NWDA, "Water for life", 11th National Water Convention, New Delhi, May, 11th, 2005.

9. Desai V.R.,Ghosh S.N and Patro J., "National Water Grid-its Objectives and Challenges", ISH Journal of Hyd. Engineering., Vol. 11, No.1, March, 2005

10. Khitolya A.K, Goyal A.K and. Kumar D., "Environmental and other Aspects of Interlinking Rivers", Proceedings of Recent Advances in Water Resources Development and Management organised by Deptt. Of Water Resources Development and Management (WRDM earlier known as WRDTC), IIT, Roorkee, 23-25 Nov. 2005.

11. Mazumder S.K, "Performance of surface irrigation schemes in India", keynote speech pub. in the proceedings of All India seminar on water and environment-issues and challenges, organized by IWRS and WRDTC, IIT (Roorkee), Oct. 2002.

12. Chitale S.V, "Future of Kosi river and Kosi project", Journal of Instn. Of Engrs(I), vol.81, Dec.,1999.

13. Mazumder S.K, Training river Ganga near Farakka barrage, Proceedings of national conference On hydraulics and water resources HYDRO-2001, org. by ISH and CW&PRS, Pune, Dec.2001

14. Mohile A.D, "River valley development- a comprehensive approach", proceedings of International conference On hydro-power and river valley development, Oxford & IBH Pub. Co. pvt. Ltd, New Delhi, Dec., 2000.