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Dr. Kirit S. Parikh



सदस्य
योजना आयोग
योजना भवन
नई दिल्ली-११० ००१
MEMBER
PLANNING COMMISSION
YOJANA BHAWAN
NEW DELHI-110 001

May 15, 2009

Dear Prime Minister,

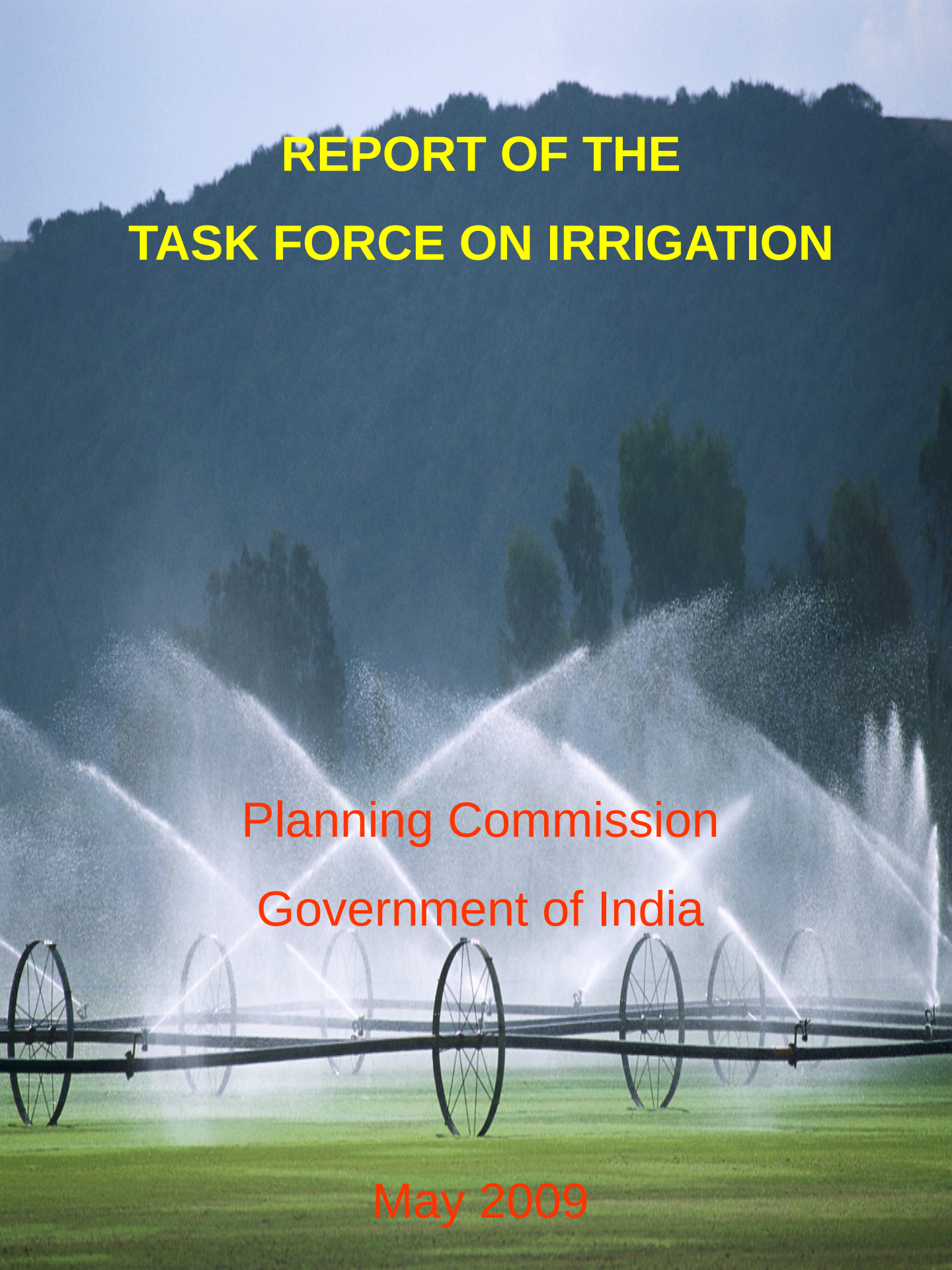
As you had proposed at the 54th meeting of National Development Council held on 19th December, 2007, the PMO had constituted a Task Force on Irrigation under my Chairmanship. I have enclosed the Report of the Task Force.

With best regards,

Yours sincerely,

(Kirit Parikh)

Dr. Manmohan Singh,
Hon'ble Prime Minister of India,
South Block,
New Delhi.



REPORT OF THE TASK FORCE ON IRRIGATION

**Planning Commission
Government of India**

May 2009

REPORT OF THE TASK FORCE ON IRRIGATION

**PLANNING COMMISSION
GOVERNMENT OF INDIA**

May 2009

Contents

	<u>Page No.</u>
Members of the Task Force	<i>i</i>
Preface	<i>ii</i>
Introduction	1-2
 Chapter 1. Irrigation Potential and Development	 3-19
1.1 Water Resources Potential of the Country	3
1.2 Ultimate Irrigation Potential of the Country	3-4
1.3 Storage Requirements	4-6
1.4 Demand of Water in Irrigation Sector	6
1.5 Development of Irrigation	6
1.5.1 Major and Medium Irrigation Sector	6-7
1.5.2 Minor Irrigation Sector	7
1.5.2.1 Surface Water Development	7-8
1.5.2.2 Ground Water Development	8-9
1.5.3 Potential Creation Targets vs. Achievements	9
1.5.4 Accelerated Irrigation Benefit Programme (AIBP)	10-11
1.6 Estimation of Potential Creation During XIth and XIIth Plan	11
1.6.1 Major and Medium Irrigation Sector	11-12
1.6.2 Minor Irrigation Sector	12
1.7 Creation of Additional Irrigation Potential as per National Perspective Plan (NPP) of Inter Basin Water Transfer (IBWT)	12-14
1.8 Status of Irrigation Potential	14
1.9 Criteria for Completion of Ongoing and Taking New Projects	14-15
1.9.1 Criteria Recommended by National Commission on Integrated Water Resources Development Plan (NCIWRDP)	15-16
1.9.2 Criteria Adopted by Working Group on Water Resources for XIth Plan	16-17
1.10 Recommendations	17-19
 Chapter 2. Efficient Utilisation of Irrigation Facilities	 20-36
2.1 Increasing Gap Between Capacity Created and Utilised	20-21
2.2 Irrigation Efficiency and Extent of the Problem	21-23
2.3 Reasons for Lower Efficiency	23-25
2.4 Ways of Improving the Irrigation Efficiency	26-33
2.5 Resources for Improving the Efficiency	33-34
2.6 Policy Recommendation	34-36
 Chapter 3. Raising Financial Resources for Irrigation Projects	 37-46
3.1 Cost of Creation of Irrigation Potential	37
3.2 Investment Requirement for Irrigation Sector During The XIth Five Year Plan (2007-12)	38
3.2.1 Overall Outlay for the XIth Five Year Plan	38
3.2.2 Annual Investment Required During the XIth Plan Period	38
3.3 Existing Mechanism of Funding Irrigation Projects	38-39
3.3.1 Rural Infrastructure Development Fund	39
3.3.2 Financing by National Bank for Rural Development	39-40
3.3.3 NABARD's Refinance Assistance to Financial Institutions for Minor Irrigation Sector	40
3.3.4 Financing for Artificial Recharge	41
3.3.5 Externally Assisted Projects	41-42
3.4 New Ways of Financing Irrigation Projects	42
3.4.1 Importance of Financing Irrigation Projects	42

3.4.2	<i>Raising Financial Resources for Irrigation Projects</i>	42-43
3.4.2.1	<i>Raising User Charges</i>	43
3.4.2.2	<i>Beneficiary Contribution</i>	43
3.4.2.3	<i>Public-Private Partnership</i>	43-44
3.4.2.4	<i>Raising Taxes</i>	44
3.4.3	<i>Funding for Debt Support</i>	44-45
3.4.4	<i>Channelising and Disbursing Funds</i>	45-46
Chapter 4. Capacity Building		47-51
4.1	<i>Capacity Needed</i>	47
4.2	<i>Reasons for Delay</i>	47-48
4.3	<i>Better Planning and Project Management</i>	48
4.4	<i>Strengthening Construction Industry</i>	48-49
4.4.1	<i>Investment in Human & Material Resources</i>	49-50
4.5	<i>Recommendations</i>	50-51
Chapter 5. Summary and Recommendations		52-59
5.1	<i>Irrigation Potential and Development</i>	52-54
5.2	<i>Efficient Utilization of Irrigation Facilities</i>	54-55
5.3	<i>Raising Financial Resources for Irrigation Projects</i>	55-56
5.4	<i>Financing Irrigation Projects</i>	56-58
5.5	<i>Capacity Building</i>	58-59
List of Tables		
Table 1.1	<i>Ultimate Irrigation Potential (UIP)</i>	1
Table 1.2	<i>Demand of Water in Irrigation Sector</i>	6
Table 1.3	<i>Plan-wise Position of Irrigation Potential Created</i>	9
Table 1.4	<i>Target vs. Achievements of Irrigation Potential Creation(IPC)</i>	10
Table 1.5	<i>Projects to be Covered Under XIth Plan</i>	12
Table 1.6	<i>Forecast of Potential Creation in the Irrigation (Major & Medium Irrigation)</i>	12
Table 1.7	<i>Forecast of Potential Creation in the Irrigation (Minor Irrigation)</i>	12
Table 1.8	<i>Likely Creation of Irrigation Potential from IBWT During XIth-XIVth Plan</i>	14
Table 1.9	<i>Status of Irrigation Potential and Its Likely Phasing</i>	14
Table 1.10	<i>Spillover Major, Medium and ERM Projects into XIth Plan</i>	15
Table 3.1	<i>Cost of Creation of Irrigation Potential - Type of Project</i>	37
Table 3.2	<i>The Overall Outlay for the Eleventh Five Year Plan</i>	38
Table 3.3	<i>Year-wise Projected Investment</i>	38
Table 3.4	<i>Details on the Irrigation Projects Sanctioned Under RIDF</i>	39
Table 3.5	<i>Minor Irrigation Structures Constructed as on March 2008 (With Refinance Support from NABARD)</i>	40
Table 3.6	<i>Details on Externally Assisted Project</i>	41
Table 5.1	<i>Status of Irrigation Potential and Its Likely Phasing</i>	53
Table 5.2	<i>Cost of Creation of Irrigation Potential - Type of Project</i>	55
Table 5.3	<i>The Overall Outlay for the Eleventh Five Year Plan</i>	56
List of Figures		
Figure 2.1	<i>Increasing Gap Between Capacity Created and Utilised</i>	20
List of Annexures		
Annexure 2.1	<i>Action Plan for Implementation of the Activities Identified for the Sub-Group-II on Efficient Utilisation of Existing Irrigation Facilities</i>	35-36

Preface

The XIth Five Year Plan targets a growth rate of 4 percent per annum for agriculture. For attaining inclusive growth, such a growth rate is critical as some 57 percent of the country's workforce is employed in agriculture.

Development of irrigation is vital for stable agricultural growth. Irrigation infrastructure, however, requires substantial investment. Since water is a State subject, irrigation investments have to be made by State governments, who find difficulties in raising the needed resources due to poor financial management of irrigation sector, low resources with the State Governments and limited availability of institutional finance at low interest rates.

Thus, the Prime Minister at the 54th Meeting of the National Development Council proposed to constitute a Task Force to access the balance irrigation potential which could be created quickly and to identify innovative ways of raising resources for the irrigation sector to implement projects for rapid economic development.

The Task Force Report has identified that there is a need to re-assess the ultimate irrigation potential in the country. As per present estimates irrigation potential of 37 Mha could be created in the XIth and XIIth Plan. The report also emphasises the need to increase irrigation efficiency and has suggested measures to do so. Innovative technologies in the irrigation sector needs to be developed and adopted including micro-irrigation techniques of sprinkler and drip irrigation. Resource mobilisation presents a huge challenge as farmers in general are not charged adequately for water. Resource mobilization requires a multi-prong approach through tax free concessional bonds, institutional finances at low interest, beneficiary contribution, imposition of irrigation cess which is leveraged through public-private partnership, etc.

It is my pleasure and also my privilege to thank all the Members of the Committee for their many important suggestions and for sparing their time towards the finalization of this report. I am thankful to the chairmen of various sub-groups for their valuable inputs. I also thank Shri Avinash Mishra, Dy. Adviser(WR), Planning Commission for his valuable contribution in bringing out this report. I am also thankful to Shri Yudhvir Uppal, Sr. Adviser(WR), Mrs. Vandana Sharma, Sr. Research Officer(WR), Shri A. Murlidharan, Sr. Research Officer(WR) and Shri Padma Kant Jha, Consultant(WR) for their contributions.

Further, I want to thank Shri Sanjay Vasnik and Ms. Beera Negi for diligently, carefully and cheerfully typing many drafts of the report.



(Kirit Parikh)
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Chairman, Task Force on Irrigation

We, the Members of the "Task Force on Irrigation", hereby submit our Final Report.



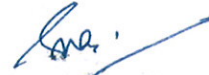
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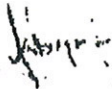
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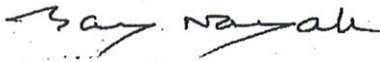
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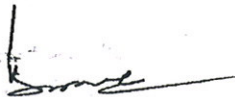
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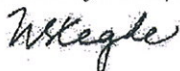
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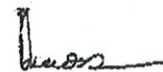
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INTRODUCTION

In the 54th meeting of the National Development Council held on 19.12.2007 the Prime Minister (in his closing remarks) mentioned that *“a number of issues have been raised by the Chief Ministers, I would like to respond to a few of them. From your interventions, it is apparent that irrigation is a priority area for almost all States. There is a feeling that we need far more resources to accelerate the current pace of irrigation projects. There is a feeling that is necessary to complement the major hikes in investment taking place in agriculture. I therefore, propose to constitute a Task Force in the Planning Commission to comprehensively examine the resource requirements for expanding irrigation and identifying a new approach to implementing irrigation projects. The Task Force should identify innovative ways of raising resources, designing projects and implementing projects so that we can rapidly achieve our irrigation potential”*.

Consequent upon the declaration of the Prime Minister the Planning Commission constituted the Task Force under the Chairmanship of Member (Water & Energy), Planning Commission with Member (Agriculture), Planning Commission, Secretary, Planning Commission, Secretary, Ministry of Environment & Forests, Secretary, Ministry of Water Resources, Secretary, Ministry of Rural Development, Managing Director, NABARD, Chairman, Central Water Commission, Pr. Secretary (Irrigation), Govt. of Andhra Pradesh, Pr. Secretary (Irrigation), Govt. of Assam, Pr. Secretary (Irrigation), Govt. of Maharashtra, Indian Institute of Management (Ahmedabad), a representative of NGO and a representative of construction industry.

The following Terms of Reference to the Task Force have been assigned.

- (i) To estimate irrigation potential which could be created efficiently and economically and within a time frame.
- (ii) To identify ways to fully utilize the created potential and tradeoff between new irrigation projects and improving efficiency of the existing potential.
- (iii) To set criteria for prioritizing completion of ongoing irrigation projects and undertaking new projects.
- (iv) To comprehensively examine the resource requirements for expanding irrigation.
- (v) To identify innovative ways of raising financial resources and for designing and implementing projects as to rapidly achieve irrigation potential.
- (vi) Any other pertinent issues.

The first meeting of the Task Force was held on 12.03.2008 wherein various Members expressed their view points for the additional resource mobilization and the need to assess the irrigation potential in the country, also it was mentioned that the data compiled by the Ministry of Agriculture on net irrigated area and the data on irrigation

potential created by the States needs to be reconciled to actually assess the gap in potential creation and utilization. The Ministry of Water Resources also informed that the study to assess the gap between potential creation and utilization along with the reasons have been assigned to four IIMs. In the first meeting of the Task Force, it was decided that Sub Groups of the Task Force would be constituted for addressing the challenges posed before the Task Force. Accordingly five Sub Groups have been constituted. These Sub Groups are: (i) Sub Group on Irrigation Development (ii) Sub Group on Efficient Utilisation of Existing Irrigation Facilities (iii) Raising Financial Resources for Irrigation Projects (iv) Capacity Building (v) Integrated Watershed Development and conjunctive use. Out of these five Sub Groups, four Sub Groups have submitted their final reports. Based on these inputs and other inputs available in Planning Commission, the Task Force Report on Irrigation has been prepared. The Report has chapters that address the issues raised in the TOR and a final chapter with conclusions and the way forward.

CHAPTER 1

IRRIGATION POTENTIAL AND DEVELOPMENT

The first task is to assess irrigation development so far and possibilities for future development to expand irrigation. This chapter addresses the following questions:

1. What is the ultimate irrigation potential that could be created in a specified time frame considering all the existing and ongoing development and future inter-basin water transfer possibilities ?
2. What should be the criteria for completion of ongoing irrigation projects and undertaking new projects? and
3. What are the financial resources needed to develop the potential?

1.1 Water Resources Potential of the Country:

Water resources potential of the country has been assessed from time to time by different agencies. As per the latest assessment annual average available water resource of the country is 1869 BCM. Within the limitations of physiographic conditions, socio political environment, constraints and the technology available at hand, the utilizable water resources of the country has been assessed as 1123 BCM, of which 690 BCM is from surface water and 433 BCM from ground water sources. Harnessing of 690 BCM of utilizable surface water is possible only if matching storages are built to the required extent.

1.2 Ultimate Irrigation Potential of the Country:

The Second Irrigation Commission (1972) assessed the ultimate irrigation potential (UIP) of the country as 113.47 Mha. comprising of 58.47 Mha from major & medium irrigation schemes and 55 Mha from minor schemes. In 1995, Central Ground Water Board (CGWB) brought out a publication entitled “Ground Water Resources of India” where potential from ground water has been reassessed as 64.05 Mha. The UIP from minor surface water schemes were also revised from 15 Mha to 17.38 Mha as per reassessment made by the Working Groups set up in each State in this context. Later on, the Ministry of Water Resources constituted a Committee in May, 1997 under the Chairmanship of Chairman, Central Water Commission to firm up the figures of ultimate irrigation potential from minor irrigation both surface and ground water. The Committee in its report of December, 1998 made the following observations:

- a) The figure of ultimate irrigation potential needs periodic review in accordance with revision in the scope of harnessing additional water resources and technological advancement taking place in the field of irrigation and agriculture. So, the revised figures of irrigation potential

from ground water in minor irrigation sector as assessed at present as 64.05 Mha may be accepted till further review is made in future when additional data/information becomes available.

- b) In respect of irrigation potential due to surface water, it is observed that the figure has undergone marginal upward revision primarily due to change in the criteria for classifying schemes as minor scheme from cost basis to area basis (now the schemes with command area less than 2000 ha. are classified as minor irrigation schemes). The Committee was of the view that the irrigation potential of 17.38 Mha from minor surface irrigation as reported by the States appeared reasonable and could be accepted.

Consequent upon acceptance of the above recommendation, the UIP of the country at present stands revised from 113.5 Mha to 139.9 Mha as detailed in *Table 1.1*.

Table 1.1: Ultimate Irrigation Potential (UIP)

(Million Hectares)		
Sector	1972 (Second Irrigation Commission)	Existing
i) Major & Medium Irrigation	58.47	58.47
ii) Minor Irrigation	55.00	81.43
a) Surface water	15.00	17.38
b) Ground water	40.00	64.05
Total:	113.47	139.90

Although the UIP of the country has undergone upward revision, the potential due to major and medium irrigation sector has remained unaltered since 1972. It has been noted in case of some States that potential created is more than the ultimate potential envisaged, whereas in some states the ultimate potential could not be achieved. So, a review of the ultimate potential on account of major and medium irrigation sector has also become necessary which should be taken up by the States in order to provide a more realistic base for formulation of future plans.

As per National Perspective Plan (NPP), the Implementation of Inter Basin Water Transfer (IBWT) proposals shall create additional irrigation potential of 35 Mha (13 Mha through peninsular and 22 Mha through Himalayan components).

With the inter-basin transfer of water in future, the ultimate potential in the country may go up to 175 Mha.

1.3 Storage Requirements:

In India, the rainfall pattern is widely varying in time and space. Bulk of the precipitation occurs during four monsoon months which amounts to about 75% of

the total annual rainfall. As a result, the Indian rivers, particularly those not fed by snow-melt, carry meager discharge during non-monsoon months. This situation warrants creation of storages as much as possible to hold the excess flow of monsoon months, in order to offset the imbalance arising out of skewed pattern of rainfall. The successive Five Year Plans initiated after independence, therefore laid emphasis on creation of storages that resulted in many significant achievements. Live storage capacity of major and medium projects which was only 15.6 BCM at the time of independence, has gone up to 225 BCM. Projects under construction are likely to add 64 BCM while 108 BCM can be contributed by the projects under contemplation.

The NCIWRDP has estimated that the total demand of water for various uses, by 2050, would be around 973 BCM per year (low projection) or 1180 BCM per year (high projection). Considering average demand scenario, surface and ground water use of about 700 BCM per year and 380 BCM per year respectively would be necessary (assuming additional return flows of about 214 BCM per year (low projection) or 259 BCM per year (high projection) would be available). The projected surface water use, in the face of large temporal variability would approximately require live storage of around 450 BCM. A rough estimate of the live storage, which would have to be created to meet this need, would be as follows:

Major & Medium Projects (Existing)	- 225 BCM
Major & Medium Projects (under construction)	- 64 BCM
Minor Storages (existing and under construction)	- 70 BCM
Total Live Storages in projects, existing and under construction	- 359 BCM
Likely loss in live storage due to sedimentation, up to 2050 which has to be compensated for	- 53 BCM
Balance available live storage from the above in 2050	- 359-53=306 BCM, say 300 BCM
Therefore, further new live storage to be created to have a live storage of 450 BCM, by 2050	- 150 BCM

Of this new live storage of 150 BCM which may have to be created by 2050, projects presently identified would be able to provide only about 108 BCM of live storage. This estimate does not take into account possible change in storage required due to altered hydrological regime resulting from climate change.

So far, the developments have been carried out on zonal basis which may not be able to equitably meet the requirements of the country as a whole. A scenario may emerge in which there would be surplus water in some regions whereas drought like situation may continue or may aggravate in some other regions. The proposal under inter-basin transfer of water may increase additional utilization of around

200 BCM, but still there may be a number of pockets which will face scarcity of water.

1.4 Demand of Water in Irrigation Sector:

Water requirement for various sectors has been assessed by “Standing Sub-Committee for assessment of availability and requirement of water”, (2000), and by the National Commission on Integrated Water Resources Development Plan(NCIWRDP) for high demand scenario. Water Requirement for Irrigation Sector as assessed by Standing Sub Committee and NCIWRDP is shown in the Table 1.2.

Table 1.2: Demand of Water in Irrigation Sector

		(in BCM)		
Year		2010	2025	2050
Standing Sub-Committee of MoWR		688	910	1072
NICWRD		557	611	807

Irrigation requirement estimated by NCIWRDP may be on a lower side as compared to that estimated by the Standing Sub-Committee because NCIWRDP assumed that the irrigation efficiency defined as volume of water required for consumptive use by the crop for its growth to the volume of water delivered from the source will increase to 60% from the present level of 35 to 40%.

1.5 Development of Irrigation:

In the pre-plan period prior to 1951, irrigation potential created in the country was 22.60 Mha the contribution of Major and Medium Irrigation Sector was 9.7 Mha while that of Minor irrigation sector was 12.9 Mha (6.4 from SW and 6.5 from GW).

1.5.1 Major and Medium Irrigation Sector:

In the initial phase of water resources development during the plan period, rapid harnessing of water resources was the prime objective. The State Governments were encouraged to expeditiously formulate and develop water resources projects for irrigation, flood control, hydro-power generation, drinking water supply, industrial and other miscellaneous uses, and a large number of dams, barrages, hydro-power structures, canal network etc. were constructed all over the country in successive Five Year Plans. The storage projects provide *assured* irrigation, hydro-power generation, water for domestic and industrial use, and also enable flood moderation. This contributed significantly to achieving self sufficiency in food production. It is also important since agriculture provides livelihood for 65% of the population, and irrigated agriculture is essential for poverty alleviation.

For speedy completion of ongoing projects in advance stage of construction Accelerated Irrigation Benefit Programme (AIBP) was launched in 1996-97. The guidelines for AIBP has been relaxed from time to time to make it more flexible. During the VIIIth Plan period irrigation potential of 2.22 Mha was created under major and medium sector at an annual rate of 0.44 Mha per annum. During the IXth Plan period this increased to 4.12 Mha out of which 1.65 Mha (nearly 40%) was through AIBP. Renovation, Modernization and Rehabilitation of old irrigation schemes gained momentum. User's participation in major and medium irrigation schemes received greater attention. Repairs and improvement to the minor irrigation projects, as a part of integrated micro-development, also received encouragement. Similarly, sprinkler and drip irrigation programmes and the conjunctive use of surface and ground water gained momentum. The major and medium projects completed, have created an estimated cumulative potential of about **42.35 Mha by the end of the Xth Plan.**

1.5.2 Minor Irrigation Sector:

The ultimate irrigation potential for the country in respect of surface MI schemes is estimated to be 17.38 Mha. Central Ground Water Board has estimated utilizable irrigation potential from ground water sources as 64.05 Mha. Thus ultimate minor irrigation potential in our country is 81.43 Mha.

The First Plan started in 1951 with an irrigated potential of only 22.60 Mha of which the contribution of Minor Irrigation was 12.90 Mha (surface water 6.40 Mha and ground water potential 6.50 Mha) from then onward in the successive plan periods, irrigation potential is getting augmented steadily. If the VIth Plan is taken as the mid-level to assess the complete plan-wise development for the six decades till the end of the XIth Plan, it is observed that, at the start of the VIth Plan (in 1980), surface water Minor Irrigation potential of 8.00 Mha and ground water potential of 22.00 Mha had been created. There was reportedly no gap between creation and utilisation till that period. The total potential creation at 30 Mha in 1980 indicates that the growth has been modest, more so, for surface water schemes. The momentum picked up after 1980 particularly for ground water schemes. For minor irrigation scenario as a whole, the cumulative potential created by the end of the Xth Plan is estimated to be 60.42 Mha.

1.5.2.1 Surface Water Development:

The growth in surface water irrigation potential has been modest. The augmentation rate per Plan gradually increased with every plan period crossing 1 Mha from the VIth Plan onwards. The criterion of minor irrigation schemes as those with estimated cost of less than Rs.25 lakhs was changed to culturable command area basis (less than 2000 ha) in 1978. Thereby, some of the earlier conceived medium irrigation schemes consisting of large dams and canal networks came under the scope of minor irrigation which gave an artificial boost to plan-

wise irrigation development particularly for surface water MI potential during the VIth Plan. By the end of the Ninth Plan, a potential of 13.60 Mha has been created and 11.44 Mha utilized as against ultimate potential of 17.38 Mha. While the all India figures may appear closer to ultimate, there is still a lot of potential left with eastern and northeastern states with sizable quantity from Madhya Pradesh and Karnataka also. The growth in creation of surface water irrigation potential has been modest all through these plan years. The estimation of ultimate irrigation potential requires detailed scrutiny.

1.5.2.2 Ground Water Development:

The ground water development supports irrigation, drinking water and industrial sectors. Ground water meets nearly 55% of irrigation requirements of the country besides meeting more than 85% of water requirement for domestic use in rural areas and over 50% for urban areas. Ground water has contributed immensely to drought proofing of agriculture.

Groundwater schemes have the inherent advantage that they are mostly for an individual or a small group of farmers. Over the last five years, rapid expansion in the use of ground water primarily for irrigation has contributed to agricultural and economic development of India. The progress in groundwater picked up momentum during the IIIrd Plan period (1961-1966) and continued till 1992. The VIIth Plan (1985-90) witnessed an unprecedented achievement of 7.80 Mha of groundwater potential. Ultimately, the cumulative groundwater potential rose to 38.89 Mha in 1992. During the VIIIth and IXth Plans however, there was perceptible drop as progress slackened to 1.91 Mha and 2.50 Mha respectively for the two Plan periods. The potential of ground water created till Xth Plan (up to 2007) was 46.11 Mha (tentative).

The ultimate irrigation potential that can be created from ground water has been assessed as 64.05 Mha. Going by the status of 46.11 Mha at the end of the Xth Plan, there is still large scope for continuing further ground water development to bring additional areas under ground water irrigation. However, the ground water development is not uniform all over the country. It is very high in alluvial areas of Indo-Gangetic plain of Punjab (145% of the state's potential) and Haryana (109%) and as low as 45% and less in many states including Bihar, West Bengal, Orissa, North Eastern States, etc. The ground water development in hard rock terrains of Tamil Nadu, Andhra Pradesh and Karnataka, States is also very high. Ground water development in Rajasthan, which covers part of Thar desert, is 125%. Though, over-development of resources in some parts of the country has created serious problems, a large portion of GW resources are still untapped in eastern and north eastern parts of the country mainly in the States of Assam, Bihar and West Bengal.

The Plan-wise irrigation potential created through Major and Medium irrigation sector and Minor Irrigation Sector is shown in *Table 1.3*.

Table 1.3: Plan-wise Position of Irrigation Potential Created

(Mha)						
Plan		Potential Created				Total
		Major & Medium	Minor			
			S.W.	G.W.	Total	
Upto 1951 (Pre-Plan)	Cumulative	9.70	6.40	6.50	12.90	22.60
I (1951-56)	During	2.50	0.03	1.13	1.16	3.66
	Cumulative	12.20	6.43	7.63	14.06	26.26
II (1956-61)	During	2.13	0.02	0.67	0.69	2.82
	Cumulative	14.33	6.45	8.30	14.75	29.08
III (1961-66)	During	2.24	0.03	2.22	2.25	4.49
	Cumulative	16.57	6.48	10.52	17.00	33.57
Annual (1966-1969)	During	1.53	0.02	1.98	2.00	3.53
	Cumulative	18.10	6.50	12.50	19.00	37.10
IV (1969-74)	During	2.60	0.50	4.00	4.50	7.10
	Cumulative	20.70	7.00	16.50	23.50	44.20
V (1974-78)	During	4.02	0.50	3.30	3.80	7.82
	Cumulative	24.72	7.50	19.80	27.30	52.02
Annual (1978-1980)	During	1.89	0.50	2.20	2.70	4.59
	Cumulative	26.61	8.00	22.00	30.00	56.61
VI (1980-85)	During	1.09	1.70	5.82	7.52	8.61
	Cumulative	27.70	9.70	27.82	37.52	65.22
VII (1985-90)	During	2.22	1.29	7.80	9.09	11.31
	Cumulative	29.92	10.90	35.62	46.52	76.44
Annual (1990-92)	During	0.82	0.47	3.27	3.74	4.56
	Cumulative	30.74	11.46	38.89	50.35	81.09
VIII (1992-97)	During	2.21	1.05	1.91	2.96	5.17
	Cumulative	32.95	12.51	40.80	53.31	86.26
IX (1997-2002)	During	4.10	1.09	2.50	3.59	7.69
	Cumulative	37.05	13.60	43.30	56.90	93.95
X (2002-2007)	During	5.30	0.71	2.81	3.52	8.82
	Cumulative	42.35	14.31	46.11	60.42	102.77

1.5.3 Potential Creation Targets vs. Achievements:

The targets set for creation of irrigation potential and achievements made during the VIIth Plan to Xth Plan is given in *Table 1.4*.

Table 1.4: Target vs. Achievements of Irrigation Potential Creation(IPC)

Plan	(in Mha)					
	Target			Achievements		
	MMI	MI	Total	MMI	MI	Total
VII	4.3	8.6	13	2.22	9.09	11.31
VIII	5.087	10.71	15.8	2.21	2.96	5.17
IX	9.81	7.24	17.05	4.1	3.59	7.69
X	9.936	6.807	16.74	5.3	3.52	8.82

1.5.4 Accelerated Irrigation Benefit Programme (AIBP):

Recognizing that many irrigation projects drag out for years before completion for want of adequate resources, AIBP was launched in 1996-97 to assist states for early and time bound completion of major and medium irrigation projects and extension, renovation and modernisation of completed major medium projects. Under the programme, Central assistance to the states was in the form of loan. During 2004-05 the programme funding was changed to a loan grant mix as normal central assistance. From 2005-06, the assistance is in the form of grant with 25% assistance to non Special Category States and 90% assistance to Special Category States. The remaining 75% and 10% amount respectively for non Special and Special category States are to be raised by the States from market borrowing or from own funds.

The surface water minor irrigation schemes in Special Category States as well as schemes benefiting tribal and drought prone areas in Non-Special Category States are also eligible for Central Assistance under AIBP. The funding of minor irrigation schemes for such areas is in the form of 90% grant for both category states.

Up to July 2007, 229 major and medium irrigation projects have been brought under AIBP out of which 91 are completed. The cumulative irrigation potential under these projects was 82.76 lakh ha. and by March 2007, 43.56 lakh ha. of irrigation potential created which is about 53%. In minor irrigation, by March 2007, out of the 6205 schemes included under the programme, 4418 schemes were completed. The irrigation potential of minor irrigation schemes included in AIBP was 3.85 lakh ha. out of which 1.87 lakh ha. has been created up to March 2007.

Some of the major reasons for delay in completion of major and medium irrigation projects under AIBP are financial constraints, land acquisition, environmental and forest clearance, resettlement & rehabilitation problems and contractual problems and litigation.

The AIBP has become a part of the flagship Bharat Nirman Programme from 2005-06. Under Bharat Nirman it was targeted to create 10 million ha. irrigation potential from a combination of AIBP assisted major medium projects and also from other ongoing projects of states. Out of 10 Mha target, 6.8 million ha. was targeted to be created through AIBP.

Till March 2008, irrigation potential of 4.919 Mha has been created. The achievement of 2007-08 is 1.30 Mha. The MoWR indicated that estimated cost of the projects included under AIBP is Rs. 78293.47 crore with the expenditure already incurred upon these projects is Rs. 47789.01 crore further requiring balance of Rs. 30504.46 crore as on 1.4.2007.

The year wise physical and financial achievements are as under.

Year	AIBP Release(Rs crore)			Potential created (in th ha)
	Loan	Grant	Total	
1996-97	500.0010	-	500.0010	74.50
1997-98	952.1900	-	952.1900	182.00
1998-99	1119.1800	-	1119.1800	259.00
1999-2000	1450.4768	-	1450.4768	223.20
2000-01	1856.2000	-	1856.2000	528.80
2001-02	2601.9810	-	2601.9810	442.80
2002-03	3061.7026	-	3061.7026	456.00
2003-04	3128.5009	-	3128.5009	447.00
2004-05	2087.2115	780.1257	2867.3372	496.00
2005-06	-	1900.3142	1900.3142	600.00
2006-07	-	2301.9722	2301.9722	932.00
2007-08 (till Jan 08)	-	5445.697	5445.697	620.30
Total	16757.4438	10428.1091	27185.5529	5261.60
2008-09 (projected)		7850.000	7850.000	1196.00

While the pace of development of MMI has improved significantly due to AIBP, that of MI has improved less as MI schemes became qualified for AIBP funding only in 1999 and that too for special category States and in 2001 for drought prone and tribal areas.

1.6 Estimation of Potential Creation During XIth and XIIth Plan:

1.6.1 Major and Medium Irrigation Sector:

The details on the irrigation projects proposed to be implemented during the XIth Five Year Plan under Major and Medium irrigation projects (MMI) and Minor irrigation project (MI) as detailed in the Report of the Working Group on Water Resources for XIth Plan and also the XIth Plan document is presented below.

Table 1.5: Projects to be Covered Under XIth Plan

Sl. No	Type of Project	Major	Medium	ERM	Total
1.	Ongoing Projects including Spill over	166	222	89	477
2.	New Projects	78	145	86	309
3.	Liability for the completed projects	48	91	39	178
	TOTAL	292	458	214	1178

The target potential creation under the above 1178 projects during XIth Plan period is 9.0 million hectares (Mha). It is reasonable to assume that the remaining potential of 7.0 million hectares will be developed in the XIIth Plan and also there would be additionality due to measures for improved efficiency thus a target of 9 Mha has been kept for XIIth Plan.

**Table 1.6: Forecast of Potential Creation in the Irrigation
(Major & Medium Irrigation)**

<i>(million ha)</i>	
<u>Plan Period</u>	Projected IPC During The Plan Period
XI	9
XII	9

1.6.2 Minor Irrigation Sector:

The Working Group on Water Resources for the XIth Plan has recommended creation of irrigation potential of 7 Mha during the XIth Plan.

**Table 1.7: Forecast of Potential Creation in the Irrigation
(Minor Irrigation)**

<i>(million ha)</i>	
<u>Plan Period</u>	Projected IPC During The Plan Period
XI	7
XII	12

1.7 Creation of Additional Irrigation Potential as per National Perspective Plan (NPP) of Inter Basin Water Transfer (IBWT):

As per NPP, the IBWT proposals would create additional irrigation potential of 35 million hectare (Mha), 13 Mha from Peninsular Component and 22 Mha from Himalayan Component. The irrigation potential which will be firmed up when detailed project reports (DPR) are prepared will be over & above the ultimate irrigation Potential of 139.9 Mha.

The work of IBWT proposals is at initial stage i.e. preparation of feasibility reports and Detailed Project Report. NWDA in consultation with MOWR has identified 5

priority links viz. (i) Ken-Betwa (ii) Par-Tapi-Narmada (iii) Damanganga-Pinjal (iv) Parbati-Kalisingh-Chambal and (v) Godavari (Polavaram) - Krishna (Vijayawada). The status of five priority links is as follows:

Sl. No.	Name of Link	Status
(i)	Ken-Betwa	DPR preparation completed in December 2008.
(ii)	Par-Tapi-Narmada	DPR preparation completed in December 2008.
(iii)	Damanganga – Pinjal	DPR preparation completed in December 2008.
(iv)	Parbati - Kalisindh – Chambal	Consensus is likely to be arrived shortly
(v)	Godavari – (Polavaram) - Krishna (Vijayawada)	Efforts are being made for consensus building.

The DPR of Ken-Betwa link is expected to be completed shortly and that for another two links by end of XIth Plan and one link in XIIth Plan depending upon date of signing of MOU with States.

IBWT proposals, by their very nature, are complex. They involve besides the hydrologic and engineering complexities, legal, social, political and economic issues as well. Therefore, after completion of DPRs, the following steps will be needed to implement of IBWT link project which is to be done by the concerned States.

- 1) Agreement between States for Water sharing and Water use based on DPR. Resolving Environmental and resettlement issues and clearance from MOEF and other agencies.
- 2) Investment clearance by Planning Commission on the basis of clearance/approval of various appraising agencies.
- 3) International agreements, if required.

Before a link scheme can be taken up for preparation of a DPR, a consensus among the concerned States is required. The construction of Ken-Betwa link by using modern machinery and equipment may take about 9 year's time after going through the above mentioned steps.

The expected creation of Irrigation potential from these links is given in *Table 1.8*. It can be seen from the *table* that during the XIth and XIIth Plan no additional irrigation potential is likely to be created from IBWT. However during the XIIIth Plan, 0.646 Mha and during the XIVth Plan (up to 2027), 0.381 Mha additional irrigation potential is likely to be created.

NWDA is in the process of identification of some more links as priority links for arriving at consensus so that preparation of their DPRs can be taken up in near future.

Table 1.8: Likely Creation of Irrigation Potential from IBWT During XIth-XIVth Plan

Plan Period	Irrigation Potential*	Remarks
XIth Plan (up to 03/2012)	NIL	DPR of Ken-Betwa link, Par-Tapi-Narmada link and Damanganga-Pinjal link targeted to be completed.
XIIth Plan (up to 03/2017)	NIL	DPR of Parbati-Kalisindh-Chambal, link targeted to be completed. Construction of Ken – Betwa link, Par-Tapi – Narmada link, Damanganga-Pinjal link and Parbati – Kalisindh – Chambal link likely to be started.
XIIIth Plan (up to 03/2022)	Ken-Betwa Link U.P.=1.56 lakh ha. M.P.=4.90 lakh ha. Total=6.46lakh ha.	Construction of Ken –Betwa link targeted to be completed, Par – Tapi – Narmada link, Damanganga – Pinjal link and Parbati – Kalisindh – Chambal link will remain under progress.
XIVth Plan (up to 03/2027)	Par-Tapi-Narmada link Guj.= 1.63 lakh ha. Parbati-Kalisingh-Chambal link M.P.=1.75 lakh ha Raj.=0.43 lakh ha Total=2.18 lakh ha.	Construction is expected to be completed and irrigation potential created.

* To be confirmed up at the DPR stage

1.8 Status of Irrigation Potential:

The status of irrigation potential of the country that remains to be created and its likely phasing overtime is summarized in *Table 1.9*.

Table 1.9: Status of Irrigation Potential and Its Likely Phasing

(Million Ha.)					
	Major & Medium Irrigation	Minor Irrigation		Inter Basin Water Transfer (IBWT)	Total
		Surface	Ground		
Ultimate	58.47	17.38	64.05	35.1	175.00
Developed Till the End of Xth Plan	42.35	14.31	46.11	-	102.77
Expected Addition In:					
XIth Plan	9.0	2.50	4.50	-	16.0
XIIth Plan	9.0	0.50	11.50	-	21.0
XIIIth Plan		0.07	1.94	0.65	2.66
XIVth Plan				0.38	
Subsequent Plans				34.1	

1.9 Criteria for Completion of Ongoing and Taking New Projects:

Major Irrigation Projects have normal gestation period of 15-20 years while Medium Projects take 5-10 years for completion. Against these general norms, a large number of major as well as medium projects are continuing as ongoing projects for 30-40 years or even more. Irrigation projects face problems at two stages, pre-approval stage consisting of environment and forest clearances, etc. and post-approval stage consisting of R&R issues, land acquisition problems, contractual litigation, inadequate resources due to too many projects etc.

The Working Group on Water Resources for the XIth Five Year Plan has estimated that 477 including 166 major, 222 medium and 89 ERM projects are likely to spillover into the XIth Plan from previous Plans. The status from the date of commencement of planning in the country is given in *Table 1.10* below.

Table 1.10: Spillover Major, Medium and ERM Projects into XIth Plan

Plan of Start	Major	Medium	ERM	Total
I	0	0	0	0
II	2	0	0	2
III	5	1	0	6
1966-69	2	0	0	2
IV	8	5	4	17
V	33	19	1	53
1978-80	2	9	3	14
VI	25	19	6	50
VII	10	13	11	34
1990-92	2	2	0	4
VIII	19	48	11	78
IX	20	40	17	77
X	38	66	36	140
Total	166	222	89	477

These 477 projects have an ultimate irrigation potential of 20.371 Mha of which 4.25 Mha has been created till March, 2007.

Among these projects, a number of projects have already achieved 90% or more of the targeted potential since long, but not declared completed as yet. Besides there are a number of projects where pace of progress is very slow which need to be reviewed for further continuance. Continuing such projects tie up manpower and increase costs. It is therefore necessary to consider if it is worthwhile to close some of them.

1.9.1 Criteria Recommended by National Commission on Integrated Water Resources Development Plan (NCIWRDP):

Medium and Minor Irrigation Projects

A medium or minor project will be treated as completed when 80 percent or more of the ultimate irrigation potential of the project is created and/or 90 percent or more of the project completion cost has been incurred and either one or both the conditions continue for a period of one year.

Major Irrigation Projects

Major projects will be divided into identifiable and meaningful subsystems. For distribution net-work each sub-system will have a command of about 10000 ha. Each subsystem will be treated as completed if either 80 percent or more of the ultimate irrigation potential of the project is created and/or 90 percent or more of the project completion cost has been incurred and either one or both the conditions continue for a period of one year. Other subsystem can continue to get plan funds. In order to operationalise this recommendation, it would be necessary to prepare cost estimates sub-system wise and to maintain sub-system accounts.

1.9.2 Criteria Adopted by Working Group on Water Resources for XIth Plan:

The Working Group on Water Resources for XIth Plan has adopted the following criteria in regard to completion of projects:

- (i) Ongoing projects which have already achieved 90% or more of the ultimate potential should be considered as completed. Critically review all such projects which are having only marginal benefit left or are near impossible to complete because of various problems, and declare them completed or curtailed or deleted. The balance cost of the remaining projects should be updated realistically for consideration under XIth Plan.
- (ii) Inter-se priority should be decided considering various aspects such as externally aided projects, interstate projects, projects benefiting drought prone or tribal areas, etc. as per the guidelines prepared by National Commission for Integrated Water Resources Development Plan.
- (iii) High priority should be accorded to the Pre-seventh and Seventh Plan Projects for funding under AIBP with emphasis to complete these projects during the XIth Plan.
- (iv) Foremost priority should be given for completion of ongoing projects and new projects should be taken up very selectively keeping in view the necessity for removal of regional imbalances and development of drought prone and tribal areas.

The Sub-Group deliberated the criteria for completion of ongoing and taking new projects and opined in favor of criteria adopted by Working Group on Water Resources for XIth Plan.

As per the available information total ultimate irrigation potential of the projects that should be considered close is 12.30 Mha of which potential of 5.792 Mha has been estimated to have been created by the end of Xth Plan. The remaining balance potential of 6.508 Mha should be written off.

1.10 Recommendations:

The following recommendations emerge from this chapter:

(a) Major and Medium Irrigation (MMI) Sector

- (i) Under MMI sector at the end of Xth Plan (out of balance UIP) 16.12 Mha, 9 Mha could be created during the XIth and XIIth Plans respectively, however, the additionality of 2 Mha in XIIth Plan is due to efficiency measures.
- (ii) Since Ultimate Irrigation Potential (UIP) was last assessed in 1972 and some of the States have either exceeded the limit or come close to creation of the UIP, there is urgent need for reassessment. Therefore, a separate 'Task Force' should be urgently setup for reassessing the UIP and IPC of the country.

(b) Minor Irrigation (MI) Sector

- (i) Under MI Sector, at the end of Xth Plan a balance UIP of 21.01 Mha remained of this 7 and 12 Mha potential is expected to be created during the XIth and XIIth Plans respectively. The balance UIP of 2.01 Mha remains to be created during subsequent Five Year Plans.
- (ii) Terms of Reference of the Task Forces to be set up for the re-assessment of UIP and IPC under MMI Sector should also include reassessment of UIP for Minor Irrigation.
- (iii) A small potential of 2.01 Mha remains to be created beyond the XIIth Plan, there is need for accelerating creation of potential. The funding for MI projects should be increased from sources like NABARD, AIBP etc. NABARD and other financial institutions engaged in rural infrastructure building should allocate funds for MI projects. A wider window should be provided to States for funding MI development.
- (iv) For development of minor irrigation through groundwater development, artificial recharge structures should be constructed on a large scale through group activity, both by private individuals and the Government with technical advice of CGWB, State Governments representatives, CIDC, active participation of NGOs etc.
- (v) State Governments should create a regulatory and legal framework for sustainable development, which inter-alia should include declaring groundwater as a common property resource, monitoring groundwater

tables to provide advice to villages on quantity of water that can be sustainably extracted and encouraging and facilitating cooperative management of groundwater.

(c) **Inter Basin Water Transfer**

- (i) During the XIth and the XIIth Plan no additional irrigation potential is likely to be created from Inter Basin Water Transfer Projects. During the XIIIth Plan, 0.646 Mha and during the XIVth Plan (up to 2027), 0.381 Mha additional irrigation potential is likely to be created from Inter Basin Water Transfer Projects.
- (ii) There is a need for expeditious action to initiate work on the individual components of the inter basin water transfer schemes. Presently 5 peninsular links viz. Ken-Betwa link, Parvati-Kalisindh-Chambal link, Godavari (Polavaram)-Krishna (Vijaywada) link, Par-Tapi-Narmada link and Damanganga-Pinjal link have been prioritized and should be implemented at the earliest.
- (iii) In addition to 5 prioritized peninsular links, priority should also be given to Manas-Sankosh-Tista-Ganga link as recently the Royal Govt. of Bhutan has shown interest in taking up Sankosh multipurpose project, a part of Manas-Sankosh-Tista-Ganga link. For expediting Himalayan links, agreements with neighboring countries need to be pursued.

(d) **Criteria for Completion of Ongoing and Taking New Projects**

- (i) Ongoing projects which have already achieved 90% or more of the ultimate potential should be considered as completed. Critical review of all such projects, having only marginal benefit left or near impossible to complete because of various problems, need to be taken and declared as completed/curtailed/deleted. The balance cost of the remaining projects should be updated realistically for consideration under the XIth Plan.
- (ii) Inter-se priority should be decided considering various aspects such as externally aided projects, interstate projects, projects benefiting drought prone or tribal areas, etc. as per the guidelines prepared by National Commission for Integrated Water Resources Development Plan.
- (iii) High priority should be accorded to the Pre-seventh and Seventh Plan Projects for funding under AIBP with emphasis to complete these projects during the XIth Plan.

(e) **Quicker Completion of Projects**

- (i) An Empowered Standing Group be constituted, under the auspices of Ministry of Water Resources, with active participation of State

Governments, Ministry of Environment & Forests and other expert organization to grant speedy approvals in the context of land acquisition, environment & forest and R&R issues.

- (ii) To minimize delay during construction stage, the following suggestions were made:
 - (a) Framing model 'Contractual Guidelines'.
 - (b) Constitution of a proper 'Dispute Resolution Mechanism' to address the dispute arising out of contractual litigation, and
 - (c) Speeding up of funding.
- (iii) A standard Procurement System, be detailed, in line with the ongoing initiatives of Central Electricity Authority and eliminate the impediments arising out of contractual issues.
- (iv) Foremost priority should be given for completion of ongoing projects and new projects should be taken up very selectively keeping in view the necessity for removal of regional imbalances and development of drought prone and tribal areas.
- (v) Thin spreading of resources should be avoided to ensure timely completion of ongoing projects and flow of benefit from the investment already made.

(f) Storage Projects

- (i) There is an urgent need to vigorously pursue the case for creating more storage to iron out temporal and spatial variations in rainfall and also to meet increasing demand of water for various sectors. Storages held in these dams provide insurance against the vagaries of nature.
- (ii) Conversion of potential storage sites for multipurpose projects into single sector Run-of-the-River (ROR) schemes solely catering to hydropower development should be discouraged.
- (iii) Wherever feasible enhancing storage capacity by raising the existing dam heights should be considered.
- (iv) The storage capacity of irrigation tanks should be increased by installing small gates wherever feasible.
- (v) The various soil conservation measures in the upper catchment needs to be adopted to prevent the entry of silt in the reservoir.

CHAPTER 2

EFFICIENT UTILIZATION OF IRRIGATION FACILITIES

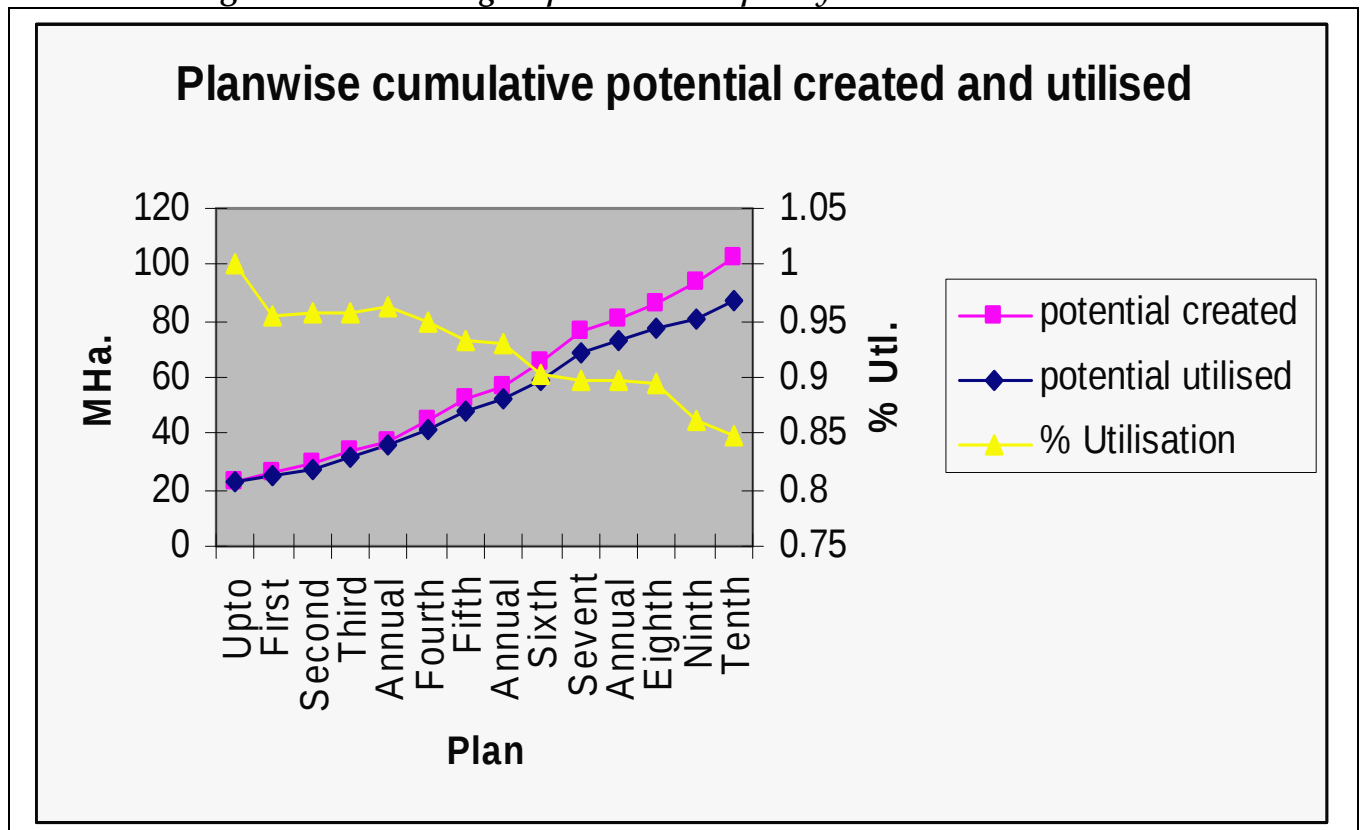
The gap between irrigation potential utilized and potential created has been increasing. Also water is not used efficiently. It is generally recognized that irrigation efficiency is low in India. Improving the efficiency would be one obvious way to expand area under irrigation given that water is a scarce commodity. The questions addressed in this chapter are the following:

- What are the reasons for the growing gap between potential created and utilized? How does one define irrigation efficiency? What is it in India and what is the extent of the problem?
- What are the reasons for low efficiency?
- How can irrigation efficiency be improved?
- How much would it cost and what policies are suggested?

2.1 Increasing Gap Between Capacity Created and Utilised:

There is a large and rising gap between irrigation-potential created and utilized. This is shown in *Figure 2.1*. The utilized/created ratio has come down from 1 in 1951 to 0.85 by 2007.

Figure 2.1: Increasing Gap Between Capacity Created and Utilised



Four Indian Institute of Managements (IIMs) were commissioned to study and assess the gap between irrigation potential created and utilized and the reasons behind the gaps. Their studies indicate that lack of proper operation and maintenance, incomplete distribution system, non-completion of command area development, changes in cropping pattern, and diversion of irrigated land to other purpose explained the gap. In their selected samples, 40% of the gap was due to poor maintenance and 25 to 40% due to incomplete distribution system. Both of these are in the control of the project authorities and available with better maintenance and execution of projects. Cropping pattern and land use charge accounted for 15 to 20% of the gap. Project authorities could do little about it.

2.2 Irrigation Efficiency and Extent of the Problem:

Irrigation efficiency may be defined as the ratio of volume of water required for consumptive use by the crop for its growth to the volume of water delivered from the source. Irrigation efficiency accounts for losses of water incurred during conveyance, distribution and application to the field. Irrigation efficiency comprises conveyance efficiency and field application efficiency. Conveyance efficiency E_c can be described as:

$$E_c = \frac{\text{Volume of water delivered to the field}}{\text{Volume of water released at canal head.}}$$

Sometimes conveyance efficiency E_c is split up into E_{c1} and E_{c2} as under:

$$E_{c1} = \frac{\text{Volume of water made available at outlet head}}{\text{Volume of water released at canal head}}$$

$$E_{c2} = \frac{\text{Volume of water delivered at the field}}{\text{Volume of water made available at outlet head}}$$

Field application efficiency E_a takes into account losses which take place in the field like evaporation and run-off from the field.

$$E_a = \frac{\text{Volume of water delivered at the root zone}}{\text{Volume of water drawn at field head}}$$

Overall project efficiency E_p is defined as

$$E_p = \frac{\text{Volume of water delivered to the root zone}}{\text{Volume of water released at the canal head}}$$

E_p is thus equal to $E_{c1} \times E_{c2} \times E_a$

For a gross irrigated area of about 80 Mha., the water use is 541 BCM which gives a delta of 0.68 m per ha. of gross irrigated area. The average annual rainfall is 1170 mm (1.17m). Taking 70% of the rainfall as effective for crop consumptive use, the gross water use is about 1.45 m (4.8 feet) per ha. of the gross irrigated area. This is very high as compared to water use in irrigation systems in say USA where water allocation is about 90 cm. This overuse in the country reflects low irrigation efficiency of about 25% to 35% in most irrigation systems, with efficiency of 40% to 45% in a few exceptional cases.

A basin wise study conducted by Dr. A. Vaidyanathan and K. Sivasubramaniam of the Madras Institute of Development Studies using potential evapotranspiration data and gross water withdrawals reports the overall irrigation efficiency in the country as 38%. The study reveals that the Krishna, Godavari, Cauvery and Mahanadi systems have a very low efficiency of around 27% while the Indus and Ganga systems are doing better with efficiencies in the range of 43%-47%. This is understandable as the peninsular rivers have large areas under irrigation in delta areas where the water management practices are poor while the rotational water supply ('warabandi') is practised in Indus and Ganga systems. However, this is only a macro-level study. Availability of project level data on irrigation efficiency unfortunately is minimal. It needs to be appreciated that 55% of the area irrigated is by groundwater sources where the efficiencies are quite high (70 to 80%) in view of absence of long conveyance systems. As per a study sponsored by FAO, it is estimated that on an average overall water use efficiency of irrigation in developing countries is only about 38 percent.

Evaluation Studies of CAD projects taken up by Ministry of Water Resources during Xth Plan have shown the following project-wise irrigation efficiencies, the gist of which is given below:

Sl.No.	Name of Project	WUE* without CAD works (%)	WUE with CAD Works (%)
1.	Upper Ganga Canal Uttar Pradesh	22	31
2.	Karjan Reservoir Project Gujarat	28	39.42
3.	Sirhind Feeder Canal Punjab	47.6	66
4.	Bhabur Sahib Lift Irrigation Himachal Pradesh	35	46.72
5.	Mahanadi Delta Stage –I Orissa	33	37

*Water Use Efficiency

The National Water Policy 2002 states that “Structures and systems created through massive investments should be properly maintained in good health. Appropriate annual provisions should be made for this purpose in the budget”. The National Commission on Integrated Water

Resources Development Plan (1999) has postulated that it is possible to achieve higher efficiencies in the order of 50-60 percent for surface water and 72-75 percent for ground water.

2.3 Reasons for Lower Efficiency:

The reasons that contribute to low irrigation efficiency can be identified as follows:

- (i) Completion of dam/head works ahead of canals: There are many examples of dams/head works being constructed much ahead of canals. Thus part of the command area gets developed in the head reaches where farmers over-use the available waters by either growing cash crops or applying larger-than-needed doses of water to crops like paddy. This not only affects crop productivity but also leads to water-logging and soil salinity (5 to 6 Mha of irrigated areas in major and medium irrigation commands is estimated to be water-logged). When the full command area subsequently develops with extension of canals, the head reach farmers are reluctant to cut down on their water allowance, which they have been enjoying for some time. This leads to conflicts and lesser supply to tail-enders than planned.
- (ii) Dilapidated irrigation systems: The Task Force on Efficient Utilization of Water Resources has estimated that 20 to 25 Mha. of surface water irrigation systems need extensive repairs. This situation arises mainly due to their poor maintenance by State Governments resulting from inadequate allocation for Operation & Maintenance (O&M). Some of the common malaise in irrigation canals is accumulation of silt, growth of weeds, damage to structures, slipping of canal banks and lining, rat holes etc. There are a large number of major and medium projects constructed and under operation in the country. The projects after completion are operated by the project authorities and require proper maintenance. Lack of proper maintenance has led to deterioration of irrigation systems, lowering productivity of agriculture in irrigated areas and also costly rehabilitation later. Rehabilitation of the old systems needs to be given priority in the plans to stabilize irrigation in those systems. Major and medium projects with irrigation potential of about 22 Mha from pre-independence period and those completed 25 years ago require renovation/up gradation.
- (iii) Unlined Canal Systems: From cost considerations, canal systems were not lined in the past. This causes excessive seepage especially in sandy loamy soils. Ground water recharge is often cited as a benefit of canal seepage. While in diversion structures, such recharge could be beneficial for use in winter and summer seasons, in storage structures it would be economical to save on seepage and use stored supplies by gravity rather than spend on pumping.

- (iv) Lack of field channels: Field channels are required for conveying water from outlet to each individual field. Lack of field channels leads to poor water management as flood irrigation has to be resorted to (as in delta irrigation systems). Field channels construction is taken up as a separate programme under Command Area Development (CAD). State Governments do not allocate enough funds for CAD as their priority is usually for dam & canal construction. Also with uncertainty of supply waters which comes only once in few years, farmers may be reluctant to forgo production from the land needed for field channels. Distribution through pumps and plastic pipes may be a more economic option.
- (v) Lack of canal communication network: Canal water gets wasted through canal escapes if there is sudden rainfall in command area when demand for irrigation water falls. An efficient canal communication system will keep the head works control room promptly informed of the weather conditions so that water is not unnecessarily released into the canals. Most irrigation systems do not have desired communication facilities.
- (vi) Lack of field drainage: While expansion of the irrigation system has received lot of attention in terms of funding, due attention has not been paid to drainage, especially field drainage. The main and intermediate drains, which have to carry off field drainage water, are mostly in a bad shape choked by weed growth.
- (vii) Improper field leveling: Farmers sometimes apply excess water to ensure that water reaches plants situated on higher ground.
- (viii) Absence of volumetric supply: Irrigation water charges are based practically in all states on the basis of area and type of crop and has no reference to the volume of water used. The irrigation water rates in most states not only do not convey the scarcity value of water but are also grossly inadequate to meet even the O&M costs. A large portion of the O&M allocation gets consumed by the establishment component. The actual realization of water charges as a percentage of the demand is also very low in most states due to inefficient collection system, loop-holes in irrigation acts and remissions announced on account of drought.

Data collected by the Planning Commission for a few states for the year 1998-99 is very revealing in this regard.

(Rs. lakhs)					
State	Total O&M Expenditure	Revenue Realised Through Water Charges	%	Percentage Expenditure on Works	Establishment & Others
Andhra Pradesh	12627	9316	73.8	13.4	86.6
Assam	565	0.4	0.07	0.8	99.2
Gujarat	3005	848	28.2	44.6	54.4
Haryana	15157	4016	26.5	6.9	93.1

- (ix) Inadequate extension services: Farmers need to be continuously educated on cropping pattern suited to soil and agro climatic conditions, periodicity of water application, fertilizer, weedicide, pesticide uses, etc. The extension services in most states are weak and do not cater to all the above areas.
- (x) Silting of reservoirs: There are large number of major and medium projects constructed and under operation in the country. Recent capacity surveys of some of the major reservoirs have revealed that the rate of silting was more than what was assumed originally and the dead storage provided to accommodate the silt flow into the reservoirs. Assessment of sedimentation in Bhakra Reservoir by National Institute of Hydrology, Roorkee using remote sensing technology indicates that during the period of 32 years (1965 to 1997), the loss in dead storage due to sedimentation was about 668.2 MCM, whereas in live storage it was 666.85 MCM. Thus the average sedimentation rate was found to be 20.88 and 20.84 MCM per year for the dead and live zones respectively. As per the "Compendium on Silting of Reservoir in India" published by CWC in January, 2001 the live and gross storage created in the country is about 177 and 217 cubic km respectively. Based on the sedimentation data of 144 reservoirs, the weighted average annual loss in gross storage due to siltation computed is 0.44%. Thus likely annual loss in the gross storage of 217 cubic km is 0.95 cubic km. Similarly the annual loss in the live storage is 0.31% based on the data of 42 reservoirs. Thus the likely annual loss in the total live storage is 0.55 cubic km. Considering the average density of 1.137 tonnes cubic m. based on the data of 13 reservoirs, the weight of the total sediment deposits in all the reservoirs in India is about 1080 million tones. The problem of soil erosion in the catchments is also a cause of concern to control the sedimentation rate. In recent years rigorous procedure for environmental impact assessment has been introduced and project proposals are required to be cleared from the Ministry of Environment and Forests of GOI from environmental and forest angle.

2.4 Ways of Improving the Irrigation Efficiency:

Faster Completion of Irrigation Projects: Faster completion of projects would reduce the possibility of some farmers getting used to lot of water. As per the XIth Plan document, the number of spilled over projects into the XIth Plan works out to 477 including 166 major, 222 medium and 89 ERM projects. About 63% of these projects are unapproved (not having the investment approval of Planning Commission). The main reasons for such a large backlog of projects are:

- (i) Water being a State subject, approval of projects by the Centre is not a statutory requirement. States have been taking up too many irrigation projects on the plea of correcting regional imbalances or in order to quickly utilise allocations made by Tribunals on inter-State rivers.
- (ii) The investments in State Plans for the irrigation sector have been declining over the successive Plans (From 22.54% of the plan budget in the First Plan to 6.28% in the Tenth Plan).
- iii) There have been time and cost over runs for practically every project due to inadequate annual allocation and delays in environmental and forest clearances, resettlement of project affected families, land acquisition difficulties, inadequate project preparation and contracting disputes.

The National Commission for Integrated Water Resources Development, in its Report of September 1999, has strongly advocated prioritization of projects by States based on twelve attributes and allocation of funds to higher priority projects for their early completion. These twelve attributes are (i) Low residual cost (ii) Efficiency of residual benefits/residual unit cost (iii) Inter State projects (iv) Discouraging change in scope (v) Progress of environment/forest/R&R action plan (vi) Availability of simultaneous detailed planning and design of secondary canal system (vii) Infrastructure for geological investigations (viii) Infrastructure for quality control (ix) Infrastructure for design (x) Timely submission of revised estimate (xi) Multipurpose project (xii) Group of attributes of local importance (regional imbalances, projects with provision of bulk drinking water supply, projects serving areas of poor quality of ground water, projects benefiting tribal population, projects benefiting drought prone area and projects involving Tribunal Awards). All States must be directed to adopt this methodology for allocation of funds to projects from 2009-10 onwards. The Accelerated Irrigation Benefit Programme could be linked to such an exercise so that higher priority projects can benefit from this funding. Under AIBP, projects need to be identified with low balance cost per ha. of balance potential so that maximum returns are assured for every rupee spent. Modern tools like remote sensing should be used to monitor potential creation. One of the observations of the CAG while reviewing the programme is that States delay release of AIBP funds to project authorities. The Centre could consider placing of AIBP funds directly with banks from where project authorities could draw as per requirement without depending on State Finance Dept.

Modernization of Irrigation Projects: It is estimated that about 20 to 25 Mha. of irrigation systems in the country need rehabilitation & modernisation. XIth Plan has suggested an

allocation of Rs 30670 crore for special repairs to irrigation systems. The main components of modernisation would be desilting of canals, weed removal, repairs to banks and lining, selective new lining in vulnerable reaches, repairs to structures, provision of off-line storages and communication system. It is estimated that even a 10% improvement in efficiency can make available about 50 BCM additional water. System improvement can lead to other benefits, besides water savings, like equity in supplies, reduction in water logging and improvement in crop productivity. There is no scheme with the Centre to assist the States in this area. A National Irrigation System Modernisation Project needs to be launched linking to reforms like raising of water charges and participatory irrigation management for sustainability of assets repaired. This is necessary so as to restore the irrigated area which otherwise may go out of irrigation, either partly or fully, due to deterioration in performance of the systems. The modernization proposal should be backed by diagnostic analysis of the performance of the scheme. Benchmarking can also be used as a tool to identify the areas of concern where improvement in performance is also possible without modernization or otherwise.

Restoration of Water Bodies: The Third Minor Irrigation Census 2000-01 has enumerated 5.56 lakh tanks and storages in the country with an irrigation potential of 6.27 Mha. The numbers of tanks are largest in West Bengal followed by Maharashtra and Andhra Pradesh. Besides these, Madhya Pradesh, Tamilnadu, Chhattisgarh and Jharkhand have significant tank population. The above seven States account for about 75% of total tank population. For assisting the States to restore the defunct water bodies, Government of India has already launched the external and domestically assisted repair, renovation and restoration of water bodies programme with an approved outlay of Rs.2500 crore for the XIth Plan. The funding is to be ring-fenced through AIBP to the participating States. State which have either availed of or in the process of availing of the external assistance are Tamilnadu, Andhra Pradesh, Karnataka, West Bengal and Orissa. Major tank population states like Maharashtra and Madhya Pradesh should avail of the external assistance for bringing back the lost irrigation through tanks restoration.

Operation and Maintenance (O&M) of Irrigation Systems: Adequate and timely maintenance of an irrigation system is imperative for proper irrigation management. Efficient water management cannot be achieved unless the infrastructure for water conveyance and delivery system is in a reasonably good condition to retain its operational efficiency. The water rates being charged at present are low and are not able to meet even the operation and maintenance charges of irrigation projects. Under pricing of water adversely affects the availability of resources for maintenance of irrigation systems. This consequently leads to deterioration of system and is responsible for the poor quality of services. Low water rates also encourage excessive and wasteful use of water. It is imperative that the tariff structure of irrigation water is reviewed and revised to restore the efficiencies of the irrigation systems. Participation of Water Users' Associations may greatly help in the O&M of the systems provided appropriate legal and administrative measures are taken to empower them to take up this responsibility effectively (described in later paragraphs).

In most of the states water rates are subsidized and are nominal due to which it is not possible to maintain the irrigation system causing low water use efficiency. There is need to rationalize water rates so that proper O&M could be possible. Some of the progressive states like Maharashtra have established Water Regulatory Authority to enhance the water rates periodically which will enable the State Government to maintain the irrigation system well. Similar reforms are required to be adopted by the other states also.

Participatory Irrigation Management(PIM): Community participation in India in development and management of water resources has ancient roots. However, during British era construction and management of irrigation works were taken over by the States and over the last 200 years or so, the management of large irrigation systems became so centralized and one sided that there was a near exclusion of farmers from the management of irrigation systems. It is now fully recognized that a major factor leading to the inefficient operation and management of canal irrigation systems had been lack of involvement of farmers or water users in the management of irrigation services. The importance of need for improved O&M practices was felt by incorporating enhanced scope for farmers' participation and their active involvement in irrigation development and management, right from the planning of the project.

The concept attracted the attention of Government of India way back in 1985 when Ministry of Water Resources advocated farmer's participation in water distribution and management of tertiary system in the projects covered under Centrally Sponsored Command Area Development programme. Recognizing the importance of farmers in effective involvement in the management of water resources, the concept was then adopted as a policy and relevant provisions were made in National Water Policy of 1987 updated in 2002. Over 56,540 Water Users Associations covering an area of 13.156 Mha have so far been formed all over the country. These WUAs need to be made functional and empowered to charge water rate on volumetric basis and retain a part of it so that it will yield enough revenue to these associations for meeting maintenance cost. These associations in turn may be made responsible for distribution, operation and maintenance of the secondary and tertiary portions of the distribution network, namely below distributary or minor head up to the farm gate. To facilitate the process of PIM, 13 States namely - Andhra Pradesh, Assam, Bihar, Chhattisgarh, Goa, Gujarat, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Rajasthan and Tamil Nadu have enacted exclusive legislation for involvement of farmers in irrigation management. But operationalisation of the provisions of these acts by the respective State Governments needs to be done at a faster pace so as to empower the WUAs legally and financially to perform the task effectively.

On-Farm Development (OFD) Works: Out of the irrigation potential of 102 Mha created so far about 87 Mha is estimated to be utilized, which corresponds to about 85 percent utilization of the created potential. Some gap between the two is bound to occur when river inflows and consequent irrigation supplies are inadequate as our systems are generally designed with 70% confidence level inflows and some even with lower confidence level. Delay in construction of distribution networks, poor maintenance of

canals, actual cropping pattern being different from the one envisaged during planning, more diversion of water for domestic/industrial water supply than planned, are some of the reasons for the gap in potential created and utilized. Activities under the Command Area Development Programme (CADP) such as construction of field channels/water courses, land leveling/shaping, ensuring timeliness in supplies can help reduce the gap. The pace of coverage of OFD works has, however, been slow as during past 30-35 years of launch of CAD Programme only about 18 Mha Culturable Command Area has been covered due to inadequacy of Plan outlays by GOI and the matching share by the State Governments. Obviously much higher outlays are required to be provided for speeding up the pace of implementation of OFD works. The CADWM Programme was restructured in 2004 to partly take care of the deferred maintenance of canals of up to 4.25 cumec (150 cusec) capacity.

Enforcement of Warabandi for Equitable Water Distribution: One of the reasons for the inequitable water distribution is lack of enforcement of Warabandi or rotational supply of irrigation water to farmers in a majority of irrigation projects in the country. The Warabandi system is being implemented only in the States of Punjab, Haryana and parts of Rajasthan and Western Uttar Pradesh and is missing in most part of the country. This is largely responsible for poor water management at the farm level. Many a time mismatch between Warabandi schedules and operation of canals also results in inequitable water distribution. In practice, the command area in the head reaches generally gets the lion's share of water while tail areas of the command are deprived of water for irrigation. In order to overcome this situation, "Warabandi" or other methods prevalent in various parts of country for equitable distribution of water such as "Shejpali" in Maharashtra need to be made mandatory all over the country for which states will have to take necessary administrative measures. Properly functional WUAs can help in this regard to a great extent.

Volumetric Supply and Pricing of Water: This is an important tool to avoid wastage of water and improve water use efficiency. Appropriate technical and administrative interventions by the state governments are necessary to introduce the practice of volumetric supply and pricing of water.

Promotion of Efficient Irrigation Practices: Water requirement of a crop varies according to the stage of crop growth. Also the method of irrigation will vary from crop to crop depending upon crop geometry. Information and education on appropriate techniques, therefore need to be provided to upgrade knowledge and skills of farmers on proper irrigation methods. Adaptive trials and demonstrations at farmers' fields, focused on optimum water management techniques, need to be taken up on a massive scale in all the irrigation projects to promote efficient irrigation practices at farm level.

Promotion of Micro-Irrigation Systems: In Sprinkler system, water is conveyed through a network of pipes under pressure and sprinkled on crops as drops forced through nozzles of smaller diameter. The system has been reported to be techno-economically viable for a wide variety of crops as per details given in the following table:

Crops	Water Saving (%)	Yield Increase (%)
Bajra	56	19
Barley	56	16
Bhindi (Okra)	28	23
Cabbage	40	3
Cauliflower	35	12
Chillies	33	24
Cotton	36	50
Cowpea	19	3
Fenugreek	29	35
Garlic	28	6
Gram	69	57
Groundnut	20	40
Jowar	55	34
Lucerne	16	27
Maize	41	36
Onion	33	23
Sunflower	33	20
Wheat	35	24

Source: Micro-Irrigation Division of Ministry of Agriculture, GOI

From the above table it is seen that water saving in various crops ranges from 16% to 69% over the traditional method and increase in crop yield from 3% to 57%.

Drip Irrigation method is well suited for wide spaced high value crops. The required quantity of water is provided to each plant daily at the root zone through a network of piping system. Hence there is no loss of water either in the conveyance or in the distribution. Evaporation losses from the soil surface are also very little since water is given only to the root zone and crop canopy provides shade to prevent evaporation. Research studies have indicated that the water saving is about 5% to 68% and the yield is increased by 10% to 50% for various crops, when the drip method is used. Details of increased yield and water saving under drip irrigation with various crops are given below:

Crop	Location	% Increase in Yield (% Drip Over Surface Irrigation)	Water Saving (%)
Banana	Navsari	30-40	9-60
Bottle gourd	Pantnagar	20	45
Brinjal	Pantnagar	18	44
Cabbage	Navsari	34	46
Cauliflower	Navsari	44	20
Chilli	Pantnagar	10	68
Cotton	Navsari	40-47	5-33
Okara	Pantnagar	27	15
Pomegranate	Hyderabad	21	51
Potato	Pantnagar	20	49
Rose	Navsari	20	40
Sapota	Navsari	20 – 40	17
Sugarcane	Delhi	50	35
Tomato	Delhi	25	40

Source: Progress Report 2001, National Committee on Plasticulture Applications in Horticulture, MoA, India.

The added advantage of drip irrigation is that fertilizer and plant protection chemicals can also be applied with the irrigation with enhanced efficiency.

So far these pressurized irrigation systems are being used only on tube wells/dug wells etc. Now these practices need to be used under surface irrigation systems as well for which necessary tools and techniques have now been developed. What is required is to develop necessary infrastructure below the outlet up to farmers' fields to supply water at an appropriate pressure to run the pressurized irrigation systems. If water is supplied by a group, who could be a WUA, through plastic pipes under pressure, it can eliminate the need for field channels saving scarce land, facilitate volumetric charging and collection and increase efficiency of irrigation.

Sprinklers are useful in undulating land with cereal crops and save 25%–33% of water. Out of the 69 Mha net irrigated areas in the country, only 0.5 Mha under drip and 0.7 Mha under sprinkler have been achieved. Maharashtra has 46% of the area under drip in the country. Karnataka, Tamil Nadu, and Andhra Pradesh follow with percentage area of 21%, 14%, and 12%, respectively. The total area under horticultural crops in the country is 19.4 Mha which offers good scope for installation of micro irrigation systems. The provision for implementation of Micro irrigation projects during the XIth Plan period as indicated in the XIth Plan document is Rs.3400 crore.

Crop Diversification: Irrigation projects in the humid and sub-humid regions of the country are rice-based. Rice crop requires more water and prefers a wet soil moisture regime. Obviously rice is the first crop choice during the south-west monsoon to utilize the available rain water to a greater extent. The projects are designed, constructed and operated to meet the irrigation requirement of the main rice crop grown from June to October. The crop receives roughly 50 % of its water requirement from monsoon rain and the rest is being supplied through canal irrigation. There is a need to limit rice area in each outlet command so that more area under irrigated dry crops like oil seeds, pulses, vegetables etc. can be irrigated and more farmers can benefit from the limited water available during dry season. In order to overcome these difficulties and to make agriculture remunerative and sustainable it is necessary to go for diversification of cropping from paddy to suitable high value non paddy crops as mentioned above, in the command areas.

Deficit Irrigation: The method advocated as a way of raising the economic efficiency of water use in irrigated agriculture is deficit irrigation. Its principal aim is to bring water costs down below the level required for maximum yields. With application of less water than required for optimum yield, however taking care of water requirement during critical growth period of the crop, some what lower yield may be obtained, but substantially more area can be irrigated with the same available quantity of water. An overall increase in produce can thus be achieved. This., however, is difficult to achieve in our country with millions of farmers with very small holdings. A farmer wants to

maximize returns from her land and would pay little attention to maximizing social product of water.

Conjunctive Use of Surface and Ground Water: During initial phase of irrigation development more emphasis was given to development of surface irrigation which though helped in strengthening the economy to a large extent, resulted in degradation of land in some of the commands. Gradual rise in water table with associated problems of water logging and soil salinity/Alkalinity have surfaced mainly because of lack of drainage provision, improper water management practices, inadequate maintenance support etc. It is estimated that in India irrigated area of 2.46 Mha is affected by water logging, 3.06 Mha by soil salinity and 0.24 Mha by alkalinity. Integrated and coordinated development of surface and ground water commonly known as conjunctive use is now widely recognized as a most suitable strategy for irrigation development in alluvial plains. Conjunctive Use of surface and ground water on the one hand increases the irrigation potential while at the same time will also mitigate the problem of water logging to a large extent.

Performance Evaluation: Performance evaluation is basically an exercise primarily to view the actual performance of the system vis a vis the assumed objectives/assumptions. The study helps to identify deficiencies if any and find a viable and economical solution of various problems. Performance evaluation of an irrigation system is a stock-taking exercise to methodically analyze the functioning of the system and assess the achievements of the system. This evaluation process identifies the components of the system, which are not performing well, and needs upgradation. Performance evaluation of a system will go a long way in enabling the concerned authorities to take timely and appropriate remedial measures not only for enhancing the present system performance but also to plan a proper strategy for future improvements in management and operation. Performance evaluation is thus an effective tool for efficiency improvement. To decide whether the system has performed as it should, a set of indicators, which represent the performance of different components and different aspects, have been identified. Some of the states like Maharashtra and Andhra Pradesh have initiated performance evaluation studies of irrigation projects. Other states also need to initiate this exercise.

Benchmarking of Irrigation Systems: Benchmarking is a management tool which has proved to be valuable in helping individual systems evaluate their competitive position. Benchmarking is a continuous process of measuring one's own performance and practices against the best competitors, and is a sequential exercise of learning from other's experience. Opportunities for improvement are identified by conducting an internal assessment and making comparative measurements with best practice organizations to determine the performance gap between current practice and best practice. Selected best practices can then be suitably adopted to fit into the Organization's needs and implemented. The cycle of improvement continues.

In the irrigation sector this would mean more productive and efficient use of the water i.e. 'more crop per drop'. Reforming irrigation institutions is central to increasing the

productivity and the efficiency of irrigation systems in a transparent and accountable manner. Within the general efforts of reform, the benchmarking of irrigation system can provide essential input. By using appropriate performance indicators of benchmarking it is possible not only to improve the water use efficiency and financial viability of the system but also ensure adoption of best management practices and the environmental sustainability in the irrigated agriculture systems. Benchmarking would ultimately help in appropriate interventions and in formulation and implementation of policies for improvement of projects.

Preventing Reservoir Losses: Sedimentation is a major problem which reduces the life of reservoirs. As such there is need to prevent silt loss in the catchment of reservoirs by way of catchment area treatment. According to the estimates of Ministry of Agriculture (MoA) an area of 275.00 lakh ha. is required to be treated in the catchments of River Valley Projects. For catchment area treatment MoA had launched a scheme “Soil Conservation in the catchment of River Valley Projects” in the Third Five Year Plan. However till March, 2008 only an area of 68.00 lakh ha. had been treated under the scheme. Obviously the pace of coverage needs to be enhanced as only 24.72 % of the catchment area has been treated in the last 5 Plans. Further, there are considerable seepage losses as well as evaporation losses in the reservoir which need to be reduced by adopting various measures. For reducing the seepage losses, strengthening of reservoir bunds in vulnerable sections needs to be done by gross turfing, stone pitching etc.

Evaporation losses in the reservoir are also substantial due to high temperatures and arid condition in about 1/3 of the country. According to the report of Central Water Commission on “Evaporation Control in reservoirs (2006), the annual evaporation varies from 50-75 cm over parts of Himalayan region to as high as 325 cm over Western Rajasthan. The Deccan Plateau and Saurashtra region also have high evaporation ranging from 250-325 cm per annum. The Central Water Commission in their publication “Status Report on Evaporation control in Reservoirs” 1988 had indicated that on an average there is loss of about 450 MCM of water every month from an area of 2,000 square kilometer, which amounts to an annual loss of 5,400 MCM. Further assessment of evaporation losses from reservoirs was made by CWC in 1990 according which at the ultimate stage of development the total surface area of large and medium storages, tanks and lakes will be about 25,000 sq. km. and annual evaporation losses would be of the order of 56,000 MCM. Assuming that 20% of the above area falls in scarcity and drought areas, it may be necessary to tackle 5000 sq. km. area. It is estimated that 30% evaporation retardation may be achieved by known evapo-retardation methods such as physical, biological and chemical methods out of these chemical methods are more prevalent where ethyl alcohol and alkorey ethanols are used.

2.5 Resources for Improving the Efficiency:

While most of the irrigation efficiency enhancement techniques require change in the mindset and effective communication strategy to the farmers, specific requirements for operation and maintenance of irrigation systems worked out by the Ministry of Water

Resources is mentioned here. Besides this, allocation through the State Plans (Rs 1.82 lakh crore as per the XIth Plan document including Rs 30670 crore for modernization of old irrigation systems) would be additional.

Following norms for O&M of irrigation system are suggested/recommended:

- (i) The funding norm for Major & Medium Surface (gravity) flow projects should be Rs. 1500/- per ha. and for Lift Irrigation Schemes Rs. 3000/- per ha. for utilized potential. For un-utilised potential 50% of the above norms may be adopted.
- (ii) 2/3rd of the above norms for Minor irrigation (gravity and lift) schemes. uniformly for utilized and un-utilised potential.
60% enhancement of norms at (i) & (ii) above for hilly and special category states.
- (iii) Out of the above norms 20% funds may be earmarked for O&M of the headworks irrespective of the type of control structure.
- (iv) The ceiling for Establishment component may be of the order of 40% of the O&M funds as was suggested by the Committee constituted by the National Conference of Irrigation and Water Resources Ministers in 1986.
- (v) Additional funds for special repairs may be provided @ 20% of O&M norms in the first year which could be gradually reduced to 5% in the fifth (last) year.

For assessment of the Overall Financial Resources Requirement, the irrigation potential of 102.77 Mha (M&M Project: 42.35 Mha and MI project: 60.42 Mha) created up to the end of March, 2007 and the O&M rates recommended by the Ministry of Water Resources to the 13th Finance Commission has been taken. The O&M rate of Rs.1500 /- per ha. for Major and Medium Schemes and Rs.1000/- per ha. for MI schemes has been taken in respect of irrigation potential created under these categories and accordingly yearly financial resource requirement for O&M is worked out as under:

i)	M& M project @ Rs.1500/- for 42.35 Mha potential created	= Rs.6352.50 crore
ii)	MI project @ Rs.1000/- ha. for 60.42 Mha potential created	= Rs.6042.00 crore
	<u>Total Yearly Financial Requirement</u>	= Rs.12,394.50 crore

2.6 Policy Recommendation:

- Irrigation efficiency need to be brought at par with international standards i.e. 60% in surface water.
- Irrigation efficiency in ground water should be targeted to 80-85%.
- Irrigation water management should be the utmost priority, the water users associations should be formed, the methods like warabandi etc. should be promulgated.
- Adequate funds should be provided for the operation and maintenance of the irrigation system. The sustenance of the existing infrastructure is more important than building new one.
- The adequate service charges (water rates) may be recovered from the irrigation system and major part of it should be ploughed back to maintain these.

ANNEXURE 2.1

ACTION PLAN FOR IMPLEMENTATION OF THE ACTIVITIES IDENTIFIED FOR THE SUB-GROUP-II ON EFFICIENT UTILISATION OF EXISTING IRRIGATION FACILITIES

Activity		XIth Plan				Organisation/Agencies to Initiate the Process	Remarks
		2 nd Year	3 rd Year	4 th Year	5 th Year		
1.	Catchment area treatment to reduce sedimentation in the reservoirs. Total identified area = 275.00 lakh ha Area covered up to Mar 2008 = 68 lakh ha Balance area to be covered = 207 lakh ha Area to be covered during XIth Plan in lakh ha	2.50	2.50	2.50	2.50	Ministry of Agriculture/State Government	The pace of the schemes for catchment area treatment need to be enhanced to cover the target area at the earliest.
2.	Use of evaporation retardants in the reservoirs. Total surface area at ultimate stage = 25,000 Sq.km As of now 70% irrigation potential created (102 Mha out of 139 Mha of ultimate irrigation potential) and thus surface area of existing reservoirs will be approximately 17500 Sq. km Assuming 20% of the above area falls in scarcity and drought area, an area of 3500 Sq.km needs to be tackled (Unit in Sq.Km)	--20% of reservoirs	the total may be	surface covered --	area of	State Government	-
3.	Lining of field channels to control conveyance losses Area to be taken up under field channel = 1.32 Mha (Unit in Mha)	0.27	0.35	0.35	0.35	State Government	Under CADWM Programme of MOWR
4.	R&D on lining material for different soils and climatic conditions					State Government	-
5.	Setting up of State Water Regulatory Authority to rationalize water rates.					State Government	-

6.	Remodeling and modernisation of existing irrigation system to improve performance (89 ERM projects spill over in XIth Plan to be taken up for completion)	09	20	30	30	State Government	-
7.	Enactment of Participatory Irrigation Management Act and formation of Water Users' Associations					State Government	-
8.	Enforcement of Warabandi/similar practices for equitable distribution of water					State Government	-
9.	Information, education and communication activities about water resources management.					MoWR/State Government	-
10.	Introduction of micro-irrigation system in the areas of deficient water availability Total area to be taken up = 14.00 Mha (Unit in Mha)	3.5	3.5	3.5	3.5	State Government	-
11.	Conjunctive use of surface and ground water Total waterlogged area = 2.46 Mha Area reclaimed up to March '08=0.046M.ha Balance waterlogged area to be reclaimed =2.414 Mha Area to be reclaimed during XIth Plan=0.102 Mha		0.022	0.022	0.022	State Government	Under CADWM Programme of MoWR
12.	Project-wise assessment of resource requirement for O&M building up the same in the Annual Plan documents.					State Government	-

CHAPTER 3

RAISING FINANCIAL RESOURCES FOR IRRIGATION PROJECTS

Irrigation projects are projects of long gestation period because of their size, delay in land acquisition, geological surprises at the time of implementation and inadequate funding.

Irrigation being a State subject, State Plan outlays are the major source for funding irrigation projects. The resources at times are so inadequate that they cannot even meet the escalation cost of the project. This leads to delay in implementation of the project, deterioration in partly executed projects and loss of faith by the public on the capability of the project executors.

Mobilization of resources and adequate funding of irrigation projects is thus of paramount importance. In this chapter we analyze the requirement and the availability and suggest innovative funding mechanism through which the gap in the requirement and availability can be bridged.

3.1 Cost of Creation of Irrigation Potential:

The average cost of creation of irrigation potential based on the type of projects is as under

Table 3.1: Cost of Creation of Irrigation Potential - Type of Project

Sl. No.	Type of Project	Cost of Creation of Irrigation Potential (Rs./ha) Average During Xth Plan
1.	Major & Medium Irrigation Project	1,70,000
2.	Minor Irrigation	
	— Surface Water	90,000
	— Ground Water	45,000
3.	RRR of Water Bodies	1,10,000
4.	Micro Irrigation	15,000 to 75,000

In view of the large undeveloped irrigation potential a total outlay of Rs.2,32,311 crore is estimated during XIth Plan.

3.2 Investment Requirement for Irrigation Sector During The XIth Five Year Plan (2007-12):

3.2.1 Overall Outlay for the XIth Five Year Plan:

The XIth Plan outlay for Ministry of Water Resources (MoWR) is Rs 3246 crore. Since as per the constitution, irrigation is a State subject, substantial part of the investment will be contributed by the State Governments in this sector. The details of the outlays for the XIth Five Year Plan for State and Central sector are indicated in *Table 3.2*. These include investments for creating irrigation potential, costs of ERM projects and micro-irrigation expansion. Inclusive of an outlay of Rs.20990 crores for Water Shed Development projects the total comes to Rs.253301 crores. Similar or larger resources would be required for the XIIth Plan.

Table 3.2: The Overall Outlay for the Eleventh Five Year Plan

(Rs. in crores)		
Sl.No	Particulars	Outlay (2006-07 prices)
1.	State Plan	182050
2.	State Sector Schemes, i.e. AIBP and Others	47015
3.	Central Plan	3246
	Total	232311

3.2.2 Annual Investment Required During the XIth Plan Period:

The year wise projection of investment required for water resources sector, during the XIth Plan period.

Table 3.3: Year-wise Projected Investment

(Rs.crore at 2006-07 prices)				
Sl.No	Year	States' Share	Central Share	Total
1	2007-08	24130	3367	27497
2	2008-09	31911	4006	35916
3	2009-10	42407	4782	47189
4	2010-11	56540	5726	62266
5	2011-12	73554	6879	80433
	Total	228543	24759	253301

The resources for the funds are reported to be both budgetary resources and Internal & Extra Budgetary Resources (IEBR) and it does not have any private source component. The projected investment of Rs.253301 crore amounts to 12.32% of the total allocation for infrastructure proposed under the XIth Plan.

3.3 Existing Mechanism of Funding Irrigation Projects:

In Water Resources Sector, bulk of the investment for projects for creation of irrigation potential, distribution and utilization would have to come from the public sector and

water being the State's subject, major portion of the investments have to come from the budgetary resources of the State Government. Central Government's assistance is provided to the States by way of Grant Based Schemes (GBS) such as AIBP and Watershed Development Programme.

3.3.1 Rural Infrastructure Development Fund:

The Rural Infrastructure Development Fund(RIDF) was set up during 1995-96 with a initial corpus of Rs.2000 crore to accelerated development of rural infrastructure and in particular for completing ongoing projects. It has since been continued with overall allocation being announced in the Union Budget. The XIVth tranche (2008-09) with RIDF Loan of Rs.14000 crore was announced in the Union Budget 2008-09 taking the aggregate corpus to Rs.82000 crore (excluding the allocation of Rs.12000 crore for rural roads sector under Bharat Nirman. As against the total corpus of Rs.87000 crore encompassing RIDF Tranches I-XIV, sanctions aggregating to Rs.79920 crore were accorded to various State Governments and Rs.12000 crore to National Rural Roads Development Agency (NRRDA) as on August 2008. An amount of Rs.48615 crore has been disbursed so far.

RIDF Tranche I was dedicated for completing ongoing irrigation projects. Though, several other sectors/purposes have been included in the subsequent years under RIDF, Irrigation Sector continues to be the thrust area under RIDF.

RIDF loan assistance for irrigation projects is being given at a concessional rate of interest i.e. 0.5% above bank rate which is 6.5% in March 2009. 95% of the total eligible project cost is sanctioned as loan and disbursement is made by way of reimbursement. The phasing of the project is up to 5 years. Out of the total sanctions of Rs.79992 crore, the share of the irrigation sector is to the tune of Rs.26775 crore which constitutes 33.5% of the total sanction. The details of the number of irrigation projects and RIDF loan sanctioned as of 31 August 2008, are indicated in *Table 3.4*.

Table 3.4: Details on the Irrigation Projects Sanctioned Under RIDF

Sl. No.	Type of Projects	No. of Projects Sanctioned	RIDF Loan (Rs. Crore)	
			Amount Sanctioned	Amount Disbursed
1.	Major Irrigation	271	8756	4824
2.	Medium Irrigation	267	4453	3121
3.	Minor Irrigation	15994	12696	7354
4.	Micro Irrigation	322	870	323
	Total	160854	26775	15622

3.3.2 Financing by National Bank for Rural Development:

At present irrigation is financed as per different models.

Model 1 - (Wholly funded by State Govt.): This model envisages entire capital investment for the project being funded by the State Government, with loan

support from NABARD. Under this model, 95% of the eligible project cost is provided by NABARD as loan to the State Governments.

Model 2 - (Community participating with the State): Under this model, the benefiting community contributes a part of the project cost (varying from 20-40% of the total cost) and the remaining cost is borne by the State Government with 95% of the States' eligible share being supported by loans from NABARD

Model 3 - (Dovetailing Grant support from GoI): The irrigation projects being implemented under the Accelerated Irrigation Benefits Programme (AIBP) and the National Micro Irrigation Projects by various State Governments receive grant support from the GoI up to 40%. The remaining portion of the eligible project cost is funded by the State Governments with 95% loan support from NABARD. 7 Major Irrigation Projects with RIDF Loan assistance of Rs.3584 crore have been sanctioned to the States of Madhya Pradesh, Gujarat and Uttar Pradesh under this category. 322 micro irrigation projects with RIDF loan assistance of Rs.870 crore have also been sanctioned.

3.3.3 NABARD's Refinance Assistance to Financial Institutions for Minor Irrigation Sector:

NABARD extends the refinance assistance to Financial Institutions including Commercial Banks, Regional Rural Banks and Cooperative Banks for supporting loans for individual farmers and Farmers Cooperative Societies for Minor Irrigation (MI) investments. The MI investments include surface water based Lift Irrigation Schemes and Water Harvesting Structures, Ground Water based Bore/Tube/Dug wells fitted with mechanical water lifting devices and Micro Irrigation Systems.

A cumulative refinance assistance of Rs.13844 crore has so far been disbursed to various Financial Institutions in different States of the country.

The details on the physical structures completed, as on March 2008, is furnished in the *Table 3.5*.

***Table 3.5: Minor Irrigation Structures Constructed as on March 2008
(With Refinance Support from NABARD)***

Sl. No	Type of MIS Structures	No. of units completed (in lakh units)
1	Tube wells/bore wells with pump sets	15.82
2	Dug wells with pump set	20.63
3	Dug wells with conventional lift	17.06
4	Pump sets on existing wells	24.22
5	Deepening of wells, storage/water harvesting structures, lift irrigation, Micro Irrigation systems	18.05
	Total	95.78

3.3.4 Financing for Artificial Recharge:

Ministry of Water Resources (MoWR), GOI has formulated a subsidy scheme, under State Sector, for artificial recharge of ground water through dug wells in hard rock areas in 115 blocks/taluks falling in 146 districts in the States of Tamil Nadu, Karnataka, Andhra Pradesh, Maharashtra, Madhya Pradesh, Gujarat and Rajasthan. An estimated 44.5 lakh dug wells are to be covered under the scheme. The scheme is phased over a period of three years i.e. 2007-10. The total subsidy is Rs.1500 crore. The rate of subsidy is 100% and 50% of the approved unit cost to Marginal Farmers/Small Farmers (MF/SF) and Other Farmers (OF) respectively. The unit cost of the structures varies from Rs.3600 to Rs.5100 in different States. The subsidy funds are being routed through NABARD. As of September 2008, an amount of Rs.30.12 crore was disbursed as indicated below:

Details of amount disbursed

<i>Sl.No</i>	<i>Particulars</i>	Amount Disbursed (Rs.crore)
1.	Funds released to States' Nodal Agencies for IEC activities	14.00
2.	Funds released towards subsidy to 19523 beneficiary farmers	16.12
	Total	30.12

3.3.5 Externally Assisted Projects:

The Ministry of Water Resources provides necessary assistance in preparation of proposals in the prescribed format for seeking external assistance. In this regard, the guidelines and instructions issued from time to time are also conveyed by MoWR to all State Govts. Generally, all the external funding agencies seek proposals for inclusion in their rolling plan to be considered in due course. There are as many as 16 externally assisted projects ongoing under the water resources sector. The agency wise details on the projects are furnished in the *Table 3.6* given below.

Table 3.6: Details on Externally Assisted Project

<i>(Rs. in crores)</i>			
Sl.No.	Funding Agency	No. of projects	Loan Amount
1	World Bank	9	7979
2	Asian Development Bank	1	198
3	Japan Bank for International Cooperation	4	1826
4	KFW (Germany)	1	130
5	GTZ (Germany)	1	15
	Total		10148

Out of the 16 externally assisted projects, 1 project i.e. Hydrology project (Phase II) is a multi-State project being implemented in different states. The remaining 15 projects are

being implemented in the States of Karnataka, Madhya Pradesh, Maharashtra, Rajasthan, Uttar Pradesh, Tamil Nadu, Andhra Pradesh, Chattisgarh, Orissa & Himachal Pradesh.

3.4 New Ways of Financing Irrigation Projects:

Planning Commission puts the total investment requirement for infrastructure during the XIth Plan Period at Rs. 21 lakh crore. This includes infrastructure needs for urban and rural sectors. Out of this, rural infrastructure investment needs are estimated at Rs.4 lakh crore, which comprises Rs.2.53 lakh crore investment in irrigation including watershed. Against this estimated investment need, the allocations under *Bharat Nirman* for four years stand at Rs.1, 75,000 crore. If an amount of Rs.50,000 crore is added for the next 5 years extrapolating available data on RIDF, it still leaves a significant gap of Rs. 35,000 crore per annum which needs to be funded for rural infrastructure during the XIth Plan Period, and more than 60% of this gap would be for irrigation related projects alone. As such massive investments are not likely to be funded through budgetary resources, the implementing agencies (GoI and State Governments or bodies set up for the purpose) will need to take assistance from FIs for participating in some of the resource mobilization efforts.

3.4.1 Importance of Financing Irrigation Projects:

Access to financial resources is crucial and a lot would depend on it to achieve the necessary autonomy needed for rapid execution. This is widely reflected in the observations and responses received from not only the State Governments, but also various autonomous bodies which have been engaged in water resource development, as well as other bodies such as, the National Highway Authority of India (NHAI) implementing the National Highway Development Programme (NHDP). Without a significant source of guaranteed finance and autonomy, rapid implementation of the programme will be very difficult. Delays and partly completed infrastructure will substantially raise the financial costs with no benefits accruing.

3.4.2 Raising Financial Resources for Irrigation Projects:

Innovative means must be evolved and developed for raising finance for the massive resources needed.

Whether finance through PPP or government support, the following considerations would be important in attracting finance for irrigation development:

- ROI: Demonstrating a good return on investment (ROI) is important
- Duration: Long duration and delays is a problem for irrigation projects
- Risks: There are many risks and these need to be addressed
- Subsidies: Subsidies available from the government should be utilised in the best possible manner.
- Control/Management: Who will manage and control is important for investors

- Performance: Getting performance and a good record is important
- Recovery: Effective means/methods of recovering expenses/returns are required
- Taking care of environment and rehabilitation: These issues are important in themselves and also to reduce risks of delays.
- Escalation: Cost escalations are a reality and should be thought of from the beginning.

Given these problems, raising resources through private investors or markets would require special efforts.

Financial resources can be raised by raising user charges, beneficiary contribution, raising taxes, borrowing in the market either from private investors, from financial institutions or through external assistance and through public-private partnership. Also the funds raised should be disbursed in an effective way keeping transaction costs to a low level.

3.4.2.1 Raising User Charges:

Raising water charges at least to cover the costs of operation and maintenance is critical if the capacity created is not to degrade. It is also important to charge for water on a volumetric basis to encourage efficient use of water.

In fact raising water rates beyond that can help generate a revenue stream that can be used to finance investment to expand irrigation facilities. Such a positive revenue stream may also make it possible to attract private investors through public-private partnership.

3.4.2.2 Beneficiary Contribution:

The benefiting community may be required to contribute a part of the project cost (varying from 20-40% of the total cost) and the remaining cost may be borne by the State Government with bulk of the States' eligible share being supported by institutional loan. The contribution of the community could either be through 'sweat equity' at the delivery stage, or through capitalizing and underwriting operation and maintenance costs, thereby improving the efficiency and economic life of the investment.

3.4.2.3 Public-Private Partnership:

Resource generation for irrigation projects through PPP is one of the options which needs to be explored. The Govt. should devise a mechanism for offering either an annuity or viability gap funding (VGF) upfront as in the case of National Highways Project where the VGF is up to 40%. The main constraints in implementing projects under PPP mode is the long gestation periods of the irrigation projects, problems and delays in land acquisition and statutory clearances, and the complete uncertainty on return on investment. Adequate pricing of irrigation water and a model for its recovery needs to be developed, may be with the intervention of Water Regulatory Authority, for ensuring returns on investment. Only then can PPP become a viable option.

If PPP is not feasible, the only option is for the Centre and State Governments to raise resources. Even for PPP, government has to raise resources for annuity payment or viability gap funding.

3.4.2.4 Raising Taxes:

If irrigation is to be financed by the government, raising income tax is the best solution. In the real world, however, irrigation would have to compete with other demands on government funds and the allocation may not be optimal.

A cess earmarked for irrigation, such as found in the case of NHAI/NHDP, where a fuel cess is specially earmarked for construction of highways can be used to raise the core finance for irrigation. A variety of possibilities could be explored, such as tax on use of rivers, tax on construction materials such as cement, market taxes on agricultural produce, or taxes on some agricultural inputs. While from public finance point of view a cess is not the best tax, a cess that can be considered a user charge can be justified. If expansion of irrigation leads to cheaper agricultural products that benefit the consumer, a cess or tax on agricultural produce can be considered less distortionary. One or more of these could be instituted, and in such a way that the proceeds are deposited in a separate account meant exclusively for irrigation projects.

3.4.3 Funding for Debt Support:

Irrigation projects may access market funds for financing irrigation projects. To access market funds at a cost effective manner and to support the funding through borrowed funds, GoI may consider supporting floatation of various types of infrastructure bonds, with guarantee cover. These could include:

(a) Infrastructure Bonds on the line of Oil and Food Bonds

To compensate the Oil PSUs for their losses due to controlled subsidized oil prices, Government of India has allowed them to issue Oil Bonds, which are issued at lower yield as compared to normal AAA bonds. Basic features of such bonds are as under.

- Quasi SLR status may be given to such Infrastructure Bonds. I.e. it will qualify for 25% G-Sec holding category for Insurance Companies, PFs, RRBs and Cooperative banks.
- Similar kinds of bonds are already issued by the oil companies (Oil Bonds) as well as FCI (Food Bonds). Generally Insurance Companies and Provident Fund Trusts are the key investors in such bonds.
- Since it will qualify for SLR status for certain class of investors, it may be given Government guarantee without any fees for the same.
- Eligibility for REPO operations of RBI.

(b) Irrigation Bonds on lines of Tax Free Bonds of Municipalities

In the Budget Speech of 1999-2000 the Finance Minister announced the GoI's intention to permit Urban Local Bodies to issue tax-free municipal bonds. Subsequently the Central Government amended the Income Tax Act, 1961 (vide the Finance Bill 2000) to exempt interest income from bonds issued by local authorities from income tax. Similar facility may extend to Infrastructure Bonds to be issued by financial institutions for funding irrigation projects.

(c) Priority Sector Status for Irrigation Bonds

Government may, in consultation with RBI, consider allowing priority sector status to specially floated irrigation bonds by institutions. The target investors will be Commercial Banks (especially Foreign Banks) who have fallen short of their priority sector lending criteria. The amount invested in such bonds will be eligible for fulfilling the priority sector requirement of Commercial Banks (specifically Foreign Banks). It will give irrigation sector access to cheaper funds in higher volumes.

(d) External Commercial Borrowing (bi-lateral and multi-lateral agencies)

External Commercial Borrowings (ECB) can be a source of cheaper funds. These may include:

- Commercial bank loans,
- Buyer's credit
- Supplier's credit
- Securitised instruments such as floating rate notes, fixed rate bonds etc.
- Credit from official export credit agencies
- commercial borrowings from the private sector window of multilateral financial institutions such as International Finance Corporation (IFC), Asian Development Bank (ADB), Atlantiz Financial Corporation (AFIC), Commonwealth Development Corporation (CDC) etc. and
- Investment by Foreign Institutional Investors (FIIs) in dedicated debt funds

3.4.4 Channelising and Disbursing Funds:

In view of the large requirement for financial resources, it would be useful to set up a specialised entity for financing irrigation projects, to access equity support. Through this route, equity can be sourced from GoI, State Governments as also from financial and other institutions, which are willing to partner in that venture. Recognising this need, the following announcement was made by the Hon'ble Union Finance Minister in the Budget Speech for 2008-09:

“... I propose to establish the Irrigation and Water Resources Finance Corporation (IWRFC) with an initial capital of Rs. 100 crore contributed by the Central Government. State Governments and other financial institutions will be invited to contribute to the equity. It is our intention to mobilize the very large resources that will be required to fund major and medium irrigation projects. I hope to be able to incorporate IWRFC as a company before 31 March 2008.”

NABARD has communicated to GoI its readiness to participate in the proposed IWRFC with equity and other supporting systems.

Funds must be disbursed in a way that provides incentives for efficient implementation of projects.

The entire capital investment for the project may be funded by the State Government, with loan support from an institutional agency. Under this model, a major percentage of the eligible project cost is provided by the financial institution as loan to the State Governments. In order to promote on-time completion of projects, GoI may consider interest subvention support for the loans to State Governments as an incentive to control time and cost overruns.

Irrigation projects being implemented under the Accelerated Irrigation Benefits Programme (AIBP) and National Micro Irrigation Projects by various State Governments receive grant support from the GoI up to 40%. The remaining portion of the eligible project cost may be funded by financial institutions. This would enable the States to reduce delays in implementation due to lack of budgetary allocations from the State Government revenues. NABARD has already taken the initiative to extend this type of support to a few States under RIDF, to a limited extent. IWRFC may also provide additional support.

Raising financial resources is not the only key for quick and timely implementation of projects. Capacity to absorb the resources efficiently is an equally important factor. This would require a capacity building process at National level which we discuss in the next chapter.

CHAPTER 4

CAPACITY BUILDING

The Task Force was set up at the behest of the Prime Minister with a view to ensure early completion of irrigation projects and provide for self sufficiency in food production. As has been indicated in preceding chapters, the need for irrigation for self reliance of food, rural economy and agro based industries is of utmost importance.

Apart from availability of finance, inadequate construction capacity to execute projects is another cause that hinders timely completion of projects. The issues relating to management, laws and regulation should be the responsibility of project management. In this chapter the focus will be on the issues of capacity building that involves management of man and material i.e. human resource, contractual capabilities and efficient monitoring for timely implementation of the projects.

4.1 Capacity Needed:

Works of Rs. 2.32 lakh crores is required to be implemented during the XIth Five Year Plan. This will cover the implementation of 477 ongoing projects, 309 new projects and projects of Flood Control and Command Area Development (CAD). In these the core construction activities are for Rs. 1.65 lakh crore.

The details are indicated below:

- Proposed Capital investment over next five years - Rs. 1, 64,700 crores
- Construction Intensity - Rs. 0.70 crores
- Effective value of work - Rs.1,15, 290 Crores
- Distribution of work (Annually) using Gaussian distribution.
Average annual output - Rs. 23, 058 Crores
 - Y I = Rs. 13, 835 Crores
 - YII = Rs 25, 363 Crores
 - YIII = Rs 36, 894 Crores
 - YIV = Rs 25, 363 Crores
 - YV = Rs. 13, 835 Crores

4.2 Reasons for Delay:

The reasons for delay in projects execution are as under:

Project Management:

- a. Land acquisition
- b. R & R Issues
- c. Contractual litigations
- d. Pending environmental & forest clearances and
- e. Thin spreading of resources

Contract Laws and Regulation:

- a. Inequity and disharmony in contracting & bidding conditions
- b. Absence of an institutional system of contract dispute resolution
- c. Absence of a unified & uniform taxation system for service providers
- d. Absence of a uniform regulatory frame work governing construction activities
- e. Non availability of adequate risk mitigation products (insurance instruments)

Construction Industry:

- a. Inadequacy of capable, skilled and trained human resources
- b. Inadequacy of availability of construction equipment
- c. Absence of availability of institutional finances to the service providers
- d. Access to better business opportunity to the service providers in other sub-sectors
- e. Consequent lack of interest of the service providers to take up construction work in irrigation sector

4.3 Better Planning and Project Management:

The delays due to project management, contract laws and regulations could be taken care of by better planning and project management.

It has been noticed that in the Irrigation sector average implementation time of the project varies from 15-20 years and because of such delays in implementation, there are time and cost over run and contractual difficulties. There is an urgent need to introduce suitable methods of project management which involve project scheduling for completion along with all other parallel activities that need to be taken up for early completion. The construction management techniques such as Critical Path Method (CPM), Project Evaluation and Review Technique (PERT) are rarely being used in the irrigation sector.

These are critical if the primary causes listed above are to be satisfactorily resolved in time. Specific responsibilities for land acquisition, R&R, environmental clearance and preparation of contracts that minimize scope for litigation and time frames should be given to members of the project management team.

Monitoring and evaluation of irrigation projects is one of the most important issues in irrigation management. International consultants consider efficient planning, close monitoring and evaluation of the projects as crucial components of project management which is not in practice in our country.

4.4 Strengthening Construction Industry:

It is acknowledged that apart from regulating, planning, & monitoring the projects at macro level, strengthening of the construction industry has been identified as one of the major areas, needing improvement. It is important to do so as the construction sector contributes to: (i) generation of employment, (ii) provides sustenance to manufacturing

and agricultural sector and (iii) creates secondary impact on the overall growth of the economy.

4.4.1 Investment in Human & Material Resources:

With works effectively valued at Rs. 1,15,290 crores, there is need for investment in manpower and material resources. The shortages in these vital spheres are indicated below:

Human Resources and Material requirements

Year	Value of Equipment (Rs Crores)	Total Manpower (Nos)	Engineers Managers (Nos)	Supervisors (Nos)	Worker/ Operators (Nos)	Construction Materials Value in Crores
I	2767	83, 010	3, 320	6,640	73, 050	4, 843
II	5073	1,52, 190	6, 088	12,176	1, 33, 926	8,877
III	7379	2, 21, 370	8, 855	17,710	1, 94, 805	12,913
IV	5073	1,52, 190	6, 088	12,176	1, 33, 926	8,877
V	2767	83, 010	3, 320	6,640	73, 050	4,843
Total	23059	23059	46118	55,342	147,578	35,510

Due to ongoing works in other sub sectors, substantial shortages in human resource exist as is evident from the analysis of the XIth Plan Document. The shortfall calls for a major programme of capacity building.

Shortage of Human Resources in percentage terms

Occupation	Numbers (in 00s) (1995)	%	Numbers (in 00s) (2005)	%
Engineers	687	4.71	822	2.65
Technicians & Foreman etc.	359	2.46	573	1.85
Clerical	646	4.40	738	2.38
Skilled workers	2, 241	15.34	3, 267	10.57
Unskilled workers	10, 670	73.08	25, 600	82.45
Total	14, 600	100.00	31, 000	100.00

To overcome the above shortfalls, in equipment and manpower there is urgent need to develop appropriate strategies. Since some of the limitations of the construction industry

for irrigation sector cannot be tackled without dealing with the entire construction industry, the many of the measures deal with the industry as a whole.

4.5 Recommendations:

To speed up project implementation, the following recommendations are made:

- (i) **Project Management and Monitoring:**
 - (a) Modern methods of project management must be used.
 - (b) Specific responsibilities and timeframes should be given to members of the project team for land acquisition, environmental clearance, R&R, etc.
 - (c) Monitoring and evaluation must be a part of every project.
- (ii) **Regulatory Measures:**
 - (a) Nomination of an identified apex Institution/regulator.
 - (b) Development of a National Law for Construction Activities.
 - (c) Establishing a National Institute of Construction Economics.
- (iii) **Reforming Contracting/Bidding Practices:**

The Ministry of Programme Implementation, Govt. of India, has finalized and issued a set of Uniform Contract Conditions, and a model bidding document for domestic contracts as a guideline. These need adoption by various Government departments/organizations and PSUs. The private sector should also be advised to harmonize their procedures suitably with those being followed by the public sector.

 - (a) Instead of pre-qualifying the agencies time and again, departments desirous of engaging contractors can resort to choosing them on the basis of their grading, followed by a periodical surveillance.
 - (b) Resort to electronic tendering process, publishing tender notices online, online Contract Bidding documents and 'Reverse Bidding' to eliminate unfair competition.
 - (c) The Bidding Process can be online, including tender opening, evaluation, submission of earnest money and award.
- (iv) **Mechanism for Dispute Resolution:**

It is suggested that identified institutions such as the Construction Industry Arbitration Council be nominated to administer effective dispute resolution.
- (v) **Integrated Procurement System:**

There should be a proper integrated procurement system.

- (vi) Human Resource and Entrepreneurial Development Framework:
It is proposed to create a dedicated fund for HRD in the construction industry and a National Plan on HRD. A dedicated fund of Rs.1000 crores (0.60% of the total outlay) be kept aside as the training fund for irrigation sector.
- (vii) Equipment & Plants:
(a) Budgetary Support/Subsidies be provided to establish a series of construction equipment banks, through out the country, along with appurtenant logistical support centers.
(b) Fiscal benefits be provided to lower the Cost of equipment.
- (viii) Construction Finance:
A National Banking Policy for construction activities may be developed.
- (ix) Insurance & Indemnities:
 - Substantial ground needs to be covered in this area such as:
 - Development of a veritable database to facilitate the development of Insurance/Non Insurance products.
 - Development of service providers and insurance companies, who can offer relevant risk coverage innovative instruments.
 - Due to substantial size of construction industry the monetary implications of the business risks and often technology risks is also very high, under the action plan, establishing an insurance company with a focus on construction related (specially on non-life side) business to meet the exigent requirement could be considered.
- (x) Maintenance of Assets:
A irrigation asset management agency be constituted.
- (xi) Encouragement to Contractors & Other Service Providers to Take Up Works in Irrigation Sector:
A series of workshops & meets be organized to apprise the contractors of the modifications being implemented. Adequate allocation of funds for this initiative be made, and as a start up exercise, Rs. 50 crores/annum be set aside.

CHAPTER 5

SUMMARY AND RECOMMENDATIONS

The Task Force was created on the eve of 54th meeting of National Development Council held on 19th Dec. 2007 wherein in the closing remark, the Prime Minister mentioned that the various issues raised by the Chief Ministers, indicate that we need far more resources to accelerate current pace of irrigation projects and therefore, a Task Force has been constituted under the Chairmanship of Member (Water & Energy), Planning Commission with Members i.e. Member(Agriculture), Planning Commission, Secretary, Planning Commission, Secretary, Ministry of Environment & Forests, Secretary, Ministry of Water Resources, Secretary, Ministry of Rural Development, Managing Director, NABARD, Chairman, Central Water Commission, Pr. Secretary(Irrigation), Govt. of Andhra Pradesh, Pr. Secretary (Irrigation), Govt. of Assam, Pr. Secretary(Irrigation), Govt. of Maharashtra, Prof. IIM, a representative of NGO and a representative of construction industry.

5.1 Irrigation Potential and Development:

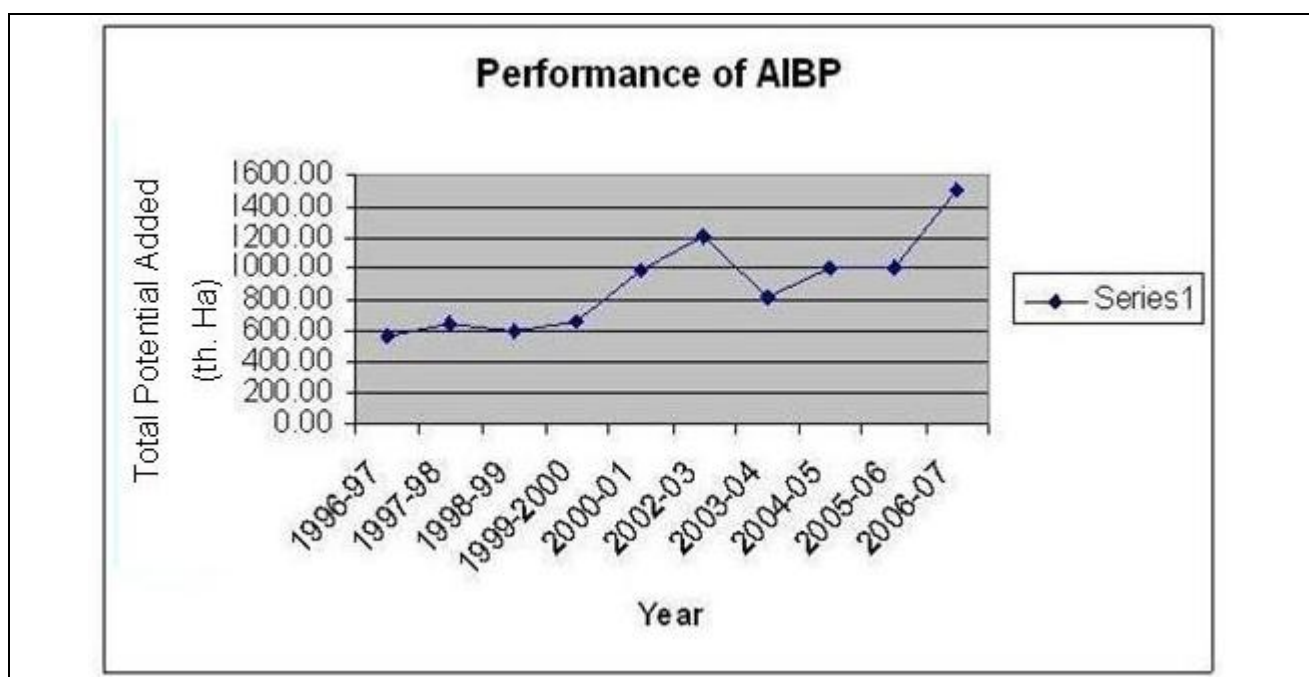
(a) Ultimate Irrigation Potential	-	139.90 Mha
Major & Medium Irrigation (MMI)	-	58.47 Mha
Minor Irrigation (MI)	-	81.43 Mha
(b) Potential developed(by the end of X Plan)	-	102.77 Mha
(c) Under development	-	16 Mha
(d) Potential remaining to be developed	-	21.13 Mha

Irrigation development has long gestation period due to resources spread thinly over many projects, also land acquisition, R&R issues, contractual litigation and environment and forest clearance further adds delay in the projects.

The irrigation potential can be improved by inter-basin water transfer and also by improving the efficiency of irrigation. Inter-basin water transfer can raise the UIP to 175 Mha. On the other hand improving the efficiency from 40% to 60% can cause the irrigation potential even without inter-basin transfers to 170 Mha.

Irrigation potential is measured in terms of area irrigated. Underlying this estimate is an assessment of water needed per hectare of irrigation, naturally if efficiency of irrigation can be improved, more area can be brought under irrigation.

The rate at which irrigation potential is created has improved since the start of AIBP- under which the Centre provides Central assistance to the States to complete ongoing projects.



The pace of development of MI has not stepped up as it was included in AIBP only in 1999. It is now expected to pick up.

Groundwater irrigation has developed rapidly and in 2000-01 irrigated 45% of total irrigation area. Ground water irrigation is available on demand and is thus more productive. Farmers prefer it particularly when power is supplied free or at a very low tariff. As a consequent overuse of groundwater has led to lowering of water tables in 1065 blocks, out of 5723 blocks in the country.

The status of irrigation development is summarized in the *Table 5.1* below.

Table 5.1: Status of Irrigation Potential and Its Likely Phasing

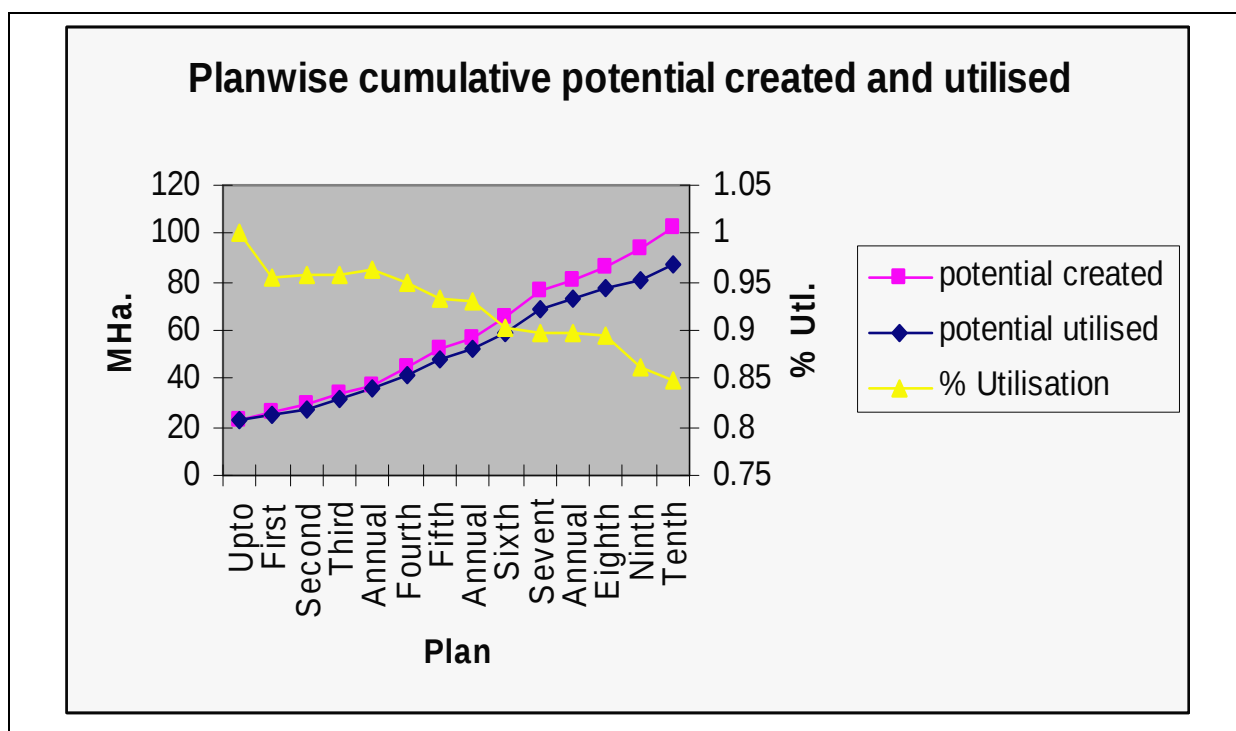
(Million Ha.)					
	Major & Medium Irrigation	Minor Irrigation		Inter Basin Water Transfer (IBWT)	Total
		Surface	Ground		
Ultimate	58.47	17.38	64.05	35.1	175.00
Developed Till the End of Xth Plan	42.35	14.31	46.11	-	102.77
Expected Addition In:					
XIth Plan	9.0	2.50	4.50	-	16.0
XIIth Plan	9.0	0.50	11.50	-	21.0
XIIIth Plan		0.07	1.94	0.65	2.66
XIVth Plan				0.38	
Subsequent Plans				34.1	

At the beginning of the XIth Plan, we had 477 MMI projects under implementation with a balance potential of 20.37 Mha. Of these 104 projects are under AIBP and are expected to be completed by the end of the XIth Plan with 5.5 M ha. of additional potential created.

Some of the projects drag on for years for some hitch or other in a small part of the project. It is better to consider such projects as completed, 205 major and medium projects (which could be considered delayed beyond normal gestation period need to be reviewed for declaring them completed and it should be taken on priority by the concerned State Government) with a UIP of 12.30 Mha have been going on since before 1992 but have created potential only 5.79 Mha.

5.2 Efficient Utilization of Irrigation Facilities:

There is a large and rising gap between irrigation-potential created and utilised.



The created/utilised ratio has come down from 1 in 1951 to 0.85 by 2007. Even when there is no gap between potential created and utilised, available water may be used inefficiently. If efficiently used more area can be irrigated with the same amount of water.

Recent studies carried out by four IIMs have identified the reasons for this gap. In their selected samples, 40% of the gap was due to poor maintenance and 25 to 40% due to incomplete distribution system. Both of these are in the control of the project authorities and available with better maintenance and execution of projects. Cropping pattern and land use charge accounted for 15 to 20% of the gap. Project authorities could do little about it. This suggests that

- Operation and maintenance are extremely important and should be given a high priority.

- Monitoring implementation through remote sensing can identify the missing links in distribution system which can be constructed in time.
- Appropriate pricing of water on volumetric basis can incentivise farmers to select socially desirable cropping patterns.

To increase irrigation efficiency, the following policy recommendations have been made:

- Irrigation efficiency need to be brought at par with international standards i.e. 60% in surface water.
- Irrigation efficiency in ground water should be targeted to 80-85%.
- Irrigation water management should be the utmost priority, the water users associations should be formed, the methods like warabandi etc. should be promulgated.
- The adequate funds should be provided for the operation and maintenance of the irrigation system. The sustenance of the existing infrastructure is as important than building new.
- The adequate service charges(water rates) may be recovered from the irrigation system and major part of it should be ploughed back to maintain these.

5.3 Raising Financial Resources for Irrigation Projects:

Irrigation being a State subject, State Plan outlays are the major source for funding irrigation projects. For want of adequate charges for water supplied, even O&M costs are not covered. Also undertaking many project at a time increases establishment costs. Thus the resources at times are so inadequate that they cannot even meet escalation cost of the projects under execution. This leads to delay in implementation of projects, deterioration in partly executed projects and loss of faith by the public on the capability of the project executors. Mobilization of resources and adequate funding of irrigation projects is thus of paramount importance.

The average cost of creation of irrigation potential based on the type of projects is given in *Table 5.2*.

Table 5.2: Cost of Creation of Irrigation Potential - Type of Project

Sl. No.	Type of Project	Cost of Creation of Irrigation Potential (Rs./ha) Average During Xth Plan
1.	Major & Medium Irrigation Project	1,70,000
2.	Minor Irrigation	
	— Surface Water	90,000
	— Ground Water	45,000
3.	RRR of Water Bodies	1,10,000
4.	Micro Irrigation	15,000 to 75,000

In view of the large undeveloped irrigation potential a total outlay of Rs.2,32,311 crore at 2006-07 prices is estimated during the XIth Plan. With Rs.20,990 crores for watershed development the total outlay is Rs.2.54 lakh crores. Similar or larger resources would be required for the XIIth Plan.

The XIth Plan outlay for Ministry of Water Resources (MoWR) is Rs.3246 crore. In addition Rs.47015 crores are envisaged for state sector schemes such as AIBP. Since as per the constitution, irrigation is a State subject, substantial part of the investment will be contributed by the State Governments in this sector. The details of the outlays for the XIth Five Year Plan for State and Central sector are indicated in *Table 5.3*.

Table 5.3: The Overall Outlay for the Eleventh Five Year Plan

(Rs. in crores)		
Sl.No	Particulars	Outlay (2006-07 prices)
1.	State Plan	182050
2.	State Sector Schemes, i.e. AIBP and Others	47015
3.	Central Plan	3246
	Total	232311

5.4 Financing Irrigation Projects:

Even after accounting for the considerable resources available through Bharat Nirman, RIDF, Watershed Development Programme and States own internal resources for irrigation, a resource gap of Rs.20,000 crores per year would be there for financing irrigation.

Conventional ways of financing is through various types of market borrowing. These include loans from financial institutions as well as external borrowings such as World Bank or ADB loans.

In mobilizing resources through loans or PPP, the state's ability to serve the loan or investment by generating a surplus from irrigation operations is crucial. Raising water charges at least to cover the costs of operation and maintenance is critical if the capacity created is not to degrade. It is also important to charge for water on a volumetric basis to encourage efficient use of water. In fact raising water rates beyond that can help generate a revenue stream that can be used to finance investment to expand irrigation facilities. Such a positive revenue stream may also make it possible to attract private investors through public-private partnership.

The benefiting community may be required to contribute a part of the project cost (varying from 20-40% of the total cost) and the remaining cost may borne by the State Government with bulk of the States' eligible share being supported by institutional loan. The contribution of the community could either be through 'sweat equity' at the delivery

stage, or through capitalizing and underwriting operation and maintenance costs, thereby improving the efficiency and economic life of the investment.

Whether financed through PPP or government support, the following considerations would be important in attracting finance for irrigation development:

- ROI: Demonstrating a good return on investment (ROI) is important
- Duration: Long duration and delays is a problem for irrigation projects
- Risks: There are many risks and these need to be addressed
- Subsidies: Subsidies available from the government should be utilised in the best possible manner.
- Control/Management: Who will manage and control is important for investors
- Performance: Getting performance and a good record is important
- Recovery: Effective means/methods of recovering expenses/returns are required
- Taking care of environment and rehabilitation: These issues are important in themselves and also to reduce risks of delays.
- Escalation: Cost escalations are a reality and should be thought of from the beginning.

Given these problems, raising resources through private investors or markets would require special efforts.

Resource generation for irrigation projects through PPP is one of the options which needs to be explored. The Govt. should devise a mechanism for offering either an annuity or viability gap funding (VGF) upfront as in the case of National Highways Project where the VGF is up to 40%. The main constraints in implementing projects under PPP mode is the long gestation periods of the irrigation projects, problems and delays in land acquisition and statutory clearances, and the complete uncertainty on return on investment. Adequate pricing of irrigation water and a model for its recovery needs to be developed, may be with the intervention of Water Regulatory Authority, for ensuring returns on investment. Only then can PPP become a viable option.

In view of the large requirement for financial resources, it would be useful to set up a specialised entity for financing irrigation projects, to access equity support. Through this route, equity can be sourced from GoI, State Governments as also from financial and other institutions, which are willing to partner in that venture. The Central Government has already incorporated the Irrigation and Water Resources Finance Corporation (IWRFC) with an initial capital of Rs. 100 crore contributed by the Central Government.

State Governments or Centre has to raise additional resources for annuity or VGF where PPP is used for financing irrigation themselves. The following options can be considered:

- (a) Raising Taxes: A cess earmarked for irrigation, such as found in the case of NHAI/NHDP, where a fuel cess is specially earmarked for construction of highways can be used to raise the core finance for irrigation. While from public

finance point of view a cess is not the best tax, a cess that can be considered a user charge can be justified. If expansion of irrigation leads to cheaper agricultural products that benefit the consumer, a cess or tax on agricultural produce can be considered less distortionary.

- (b) **Issuing Concessional Bonds:** Irrigation projects may access market funds for financing irrigation projects. To access market funds at a cost effective manner and to support the funding through borrowed funds, GoI may consider supporting floatation of various types of infrastructure bonds, with guarantee cover. These could include: Infrastructure Bonds on the line of Oil and Food Bonds, Irrigation Bonds on lines of Tax Free Bonds of Municipalities, Priority Sector Status for Irrigation Bonds as well as External Commercial Borrowing (bi-lateral and multi-lateral agencies)

Funds must be disbursed in a way that provides incentives for efficient implementation of projects. In order to promote on-time completion of projects, GoI may consider interest subvention support for the loans to State Governments as an incentive to control time and cost overruns. Thus for example support through AIBP requires timely completion and state's contribution.

5.5 Capacity Building:

Apart from availability of finance, inadequate construction capacity to execute projects is another cause that hinders timely completion of projects. The reasons relating to management, laws and regulation should be the responsibility of project management. In this chapter the focus will be on the issues of capacity building that involves management of man and material i.e. human resource, contractual capabilities and efficient monitoring for timely implementation of the projects.

Works of Rs. 2.32 lakh crores is required to be implemented during the XIth Five Year Plan. This will cover the implementation of 477 ongoing projects, 309 new projects and projects of Flood Control and Command Area Development (CAD). However the core construction activities are for Rs. 1.65 lakh crore. Improvement in executing of projects and increasing capacity for construction a number of steps are needed.

For better execution of projects project management and monitoring have to be improved for which—

- (a) Modern methods of project management must be used.
- (b) Specific responsibilities and timeframes should be given to members of the project team for land acquisition, environmental clearance, R&R, etc.
- (c) Monitoring and evaluation must be a part of every project.

Since some of the limitations of the construction industry for irrigation sector cannot be tackled without dealing with the entire construction industry, the many of the measures

deal with the industry as a whole. This requires regulatory measures, reforming contracting/bidding practices, mechanisms for dispute resolution, integrated procurement system, human resource and entrepreneurial development framework, budgetary support for equipment & plants, construction finance and insurance & indemnities.

Encouragement to contractors & other service providers to take up works in irrigation sector: A series of workshops & meets be organized to apprise the contractors of the modifications being implemented. Adequate allocation of funds for this initiative be made, and as a start up exercise, Rs. 50 crores/annum be set aside.