Sectoral Allocation of Groundwater and its Pricing

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INTRODUCTION

As a result of two consecutive spells of severe droughts during 1965 to 1967, the National Development Council decided to reorient the focus of rural electrification to energisation of pumpsets for attaining self-sufficiency in food production rather than on mere electrification of villages by providing domestic connections and street lighting. The importance of the utilization of ground water through pumpset energisation became national phenomena to protect the crop from the vagaries of the monsoon.

The All India Rural Credit Review Committee set up by the RBI for evolving financial strategies for promoting agricultural production has resulted in the setting up in 1969 of Rural Electrification Corporation (REC) and Agricultural Refinance Corporation (ARC) presently known as National Bank for Agriculture and Rural Development (NABARD). The role of Rural Electrification Corporation was to promote development oriented rural electrification schemes in the country with project oriented and area-based concepts. Thus, REC assumed the role of a developmental financing institution. Similarly, NABARD provided refinance to commercial banks and Land Development Banks (LDBs) for various agricultural development programmes in rural areas.

To supplement the scarce Plan fund, the RBI working group recommended Special Project Agriculture (SPA) under priority sector lending for pumpset energisation through institutional funding by REC, banks and NABARD in equal ratio in 1978. The State Electricity Board (SEB) was to provide single window facility to individual farmer for obtaining service connections for electrical pumpset energisation. REC was given the role of coordinating the programme from project implementation stage to approval, sanction, completion of legal formalities, monitoring, scrutiny of schemes and closure of schemes. The finalization of banking plan was the responsibility of NABARD. With the withdrawal of NABARD from the programme in 1995, the Banking Plan responsibility had fallen on REC and SPA programme was funded directly in participation with banks under SPA-BP category of schemes. From 1998 onwards, REC started financing 100% funds for the SPA schemes.

ENERGISATION OF PUMPSETS

Over the last three decades more than 148 lakh pumpsets have been energized in the country and out of the above 85.65 lakh pumpsets have been energized under REC financed schemes till March 2006 (Fig. 1). Thus 58 per cent (Table 1) of pumpset energisation has been financed by REC.

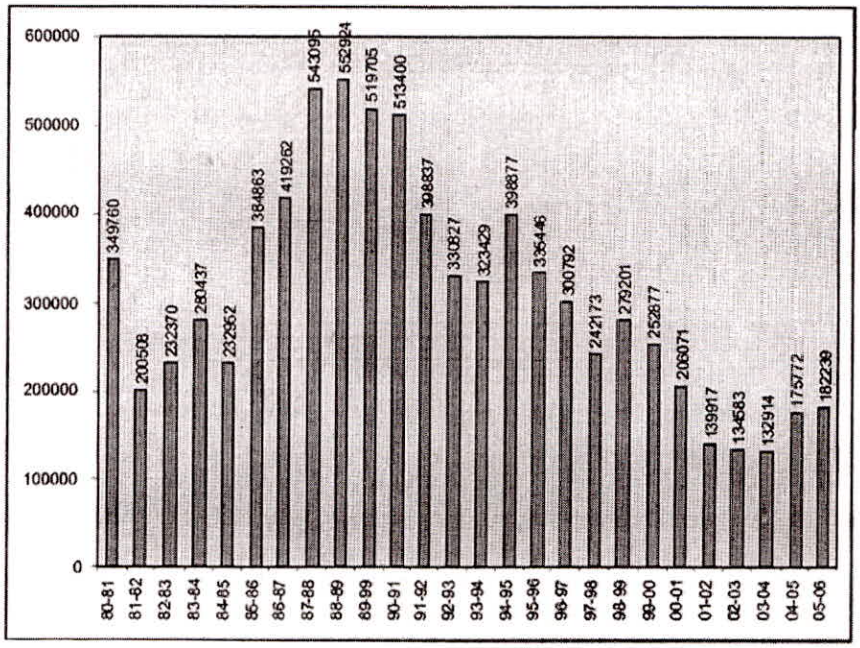

Fig. 1. Pumpsets energized under REC financed schemes (1980-81 to March 2006).

Table 1. State-wise estimated electric pumpsets and number of energized pumpsets

State	*Estimated electric pumpset potential*	*Pumpsets energized as on March 2006 (CEA)*	*Pumpsets energized under REC financed schemes March 2006*	*%age contribution*
A.P.	19181000	2440823	1512963	62
Arunchal Pd.	1200			
Assam	254000	2375	1922	81
Bihar	1352200	271169	113354	42
Jharkhand		9453		
Delhi		25583		
Goa	7800	7485		
Gujarat	779800	825262	417099	51
Haryana	470800	467973	223666	48
H.P.	14200	10259	5913	58
J&K	67200	9714	7872	81
Karnataka	1357000	1509025	862387	57
Kerala	435600	460470	329616	72
M.P.	2773600	1340123	1054106	72
Chattisgarh		130259		
Maharashtra	2449800	2623272	1607663	61
Manipur	37600	45	29	64
Meghalaya	14200	65	58	89
Mizoram				

State	*Estimated electric pumpset potential*	*Pumpsets energized as on March 2006 (CEA)*	*Pumpsets energized under REC financed schemes March 2006*	*%age contribution*
Nagaland	10000	194	164	84
Orissa	1214000	74625	63015	84
Punjab	751000	930311	477763	51
Rajasthan	630600	783703	480448	61
Sikkim	5000			
Tamil Nadu	1662600	1686147	944159	56
Tripura	14800	3273	1530	47
U.P.	2610000	844964	379544	45
Uttaranchal		17719		
West Bengal	650000	113938	82202	72
TOTAL	**19544000**	**14789829**	**8565493**	**58**
Chandigarh		623		
D.N. Haveli		953		
Daman & Diu	500000	1006		
Lakshadweep/ Pondicherry				
Grand total	**19594000**	**14803007**	**8565493**	**58**

Ground water is a dynamic resource, which is replenishable. The annual replenishable ground water in the entire country is worked out to be 433 billion cubic metres (bcm), out of which 34 bcm is natural discharge leaving net annual ground water available for the entire country as 399 bcm. The ultimate source of ground water is rainfall, and the other source that include canal seepage, returns flow from irrigation, seepage from water bodies like ponds/lakes and through artificial recharge. On an average the overall contribution of rainfall to the country's annual replenishable groundwater resource is around 67% (Table 2) and the combined contribution of the other resources are around 33% (Figs 2, 3 and 4). The annual groundwater draft is around 231 bcm.

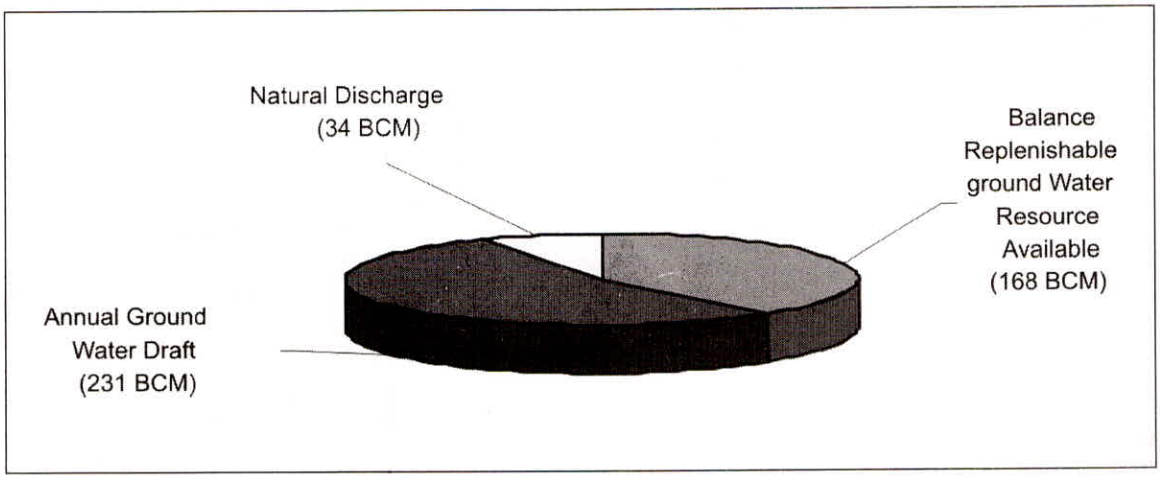

Fig. 2. Distribution of annual replenishable groundwater resource of 433 BCM.

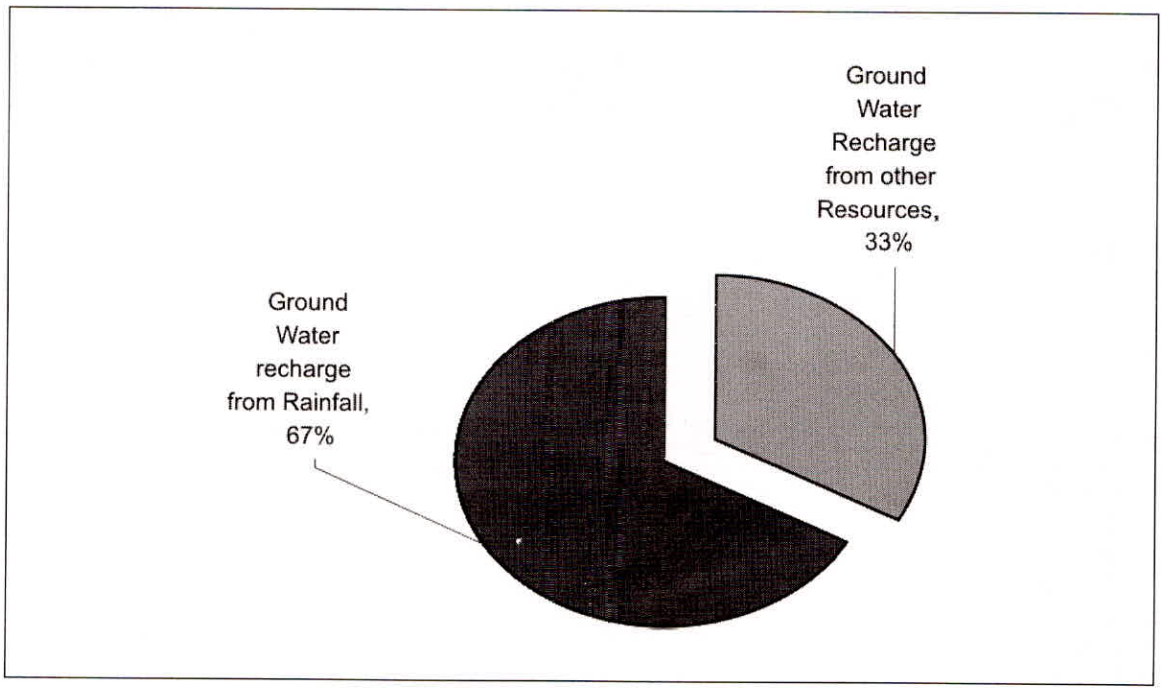

Fig. 3. Percent annual replenishable groundwater resource.

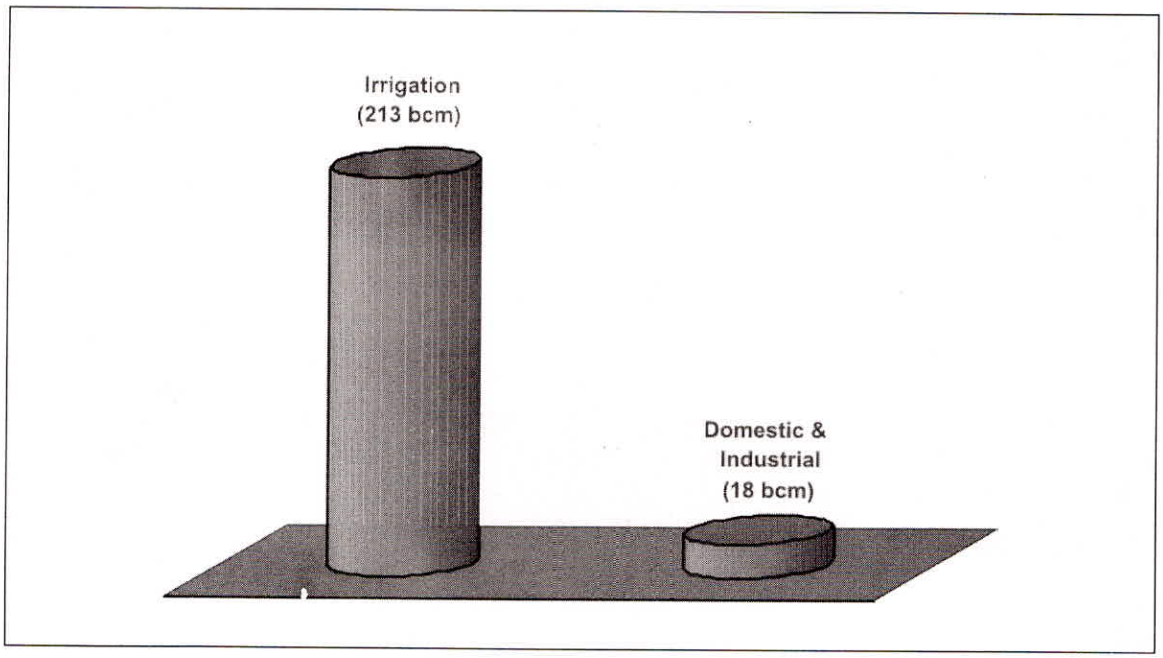

Fig. 4. Annual groundwater draft

Table 2. Annual replenishable groundwater resource

In bcm/year

States	*Annual replenishable groundwater resources*	*Natural discharge during monsoon*	*Net annual groundwater available*	*Annual draft*		*Total draft*	*Stage of development %*
				Through Irrigation	*Domestic/ Industrial uses*		
Andhra Pradesh	36.50	3.55	32.95	13.88	1.02	14.90	45
Arunchal Pradesh	2.56	0.26	2.30	0.0008	0.00	0.0008	0.04
Assam	27.23	2.34	24.89	4.85	0.59	5.44	22
Bihar	29.19	1.77	27.42	9.39	1.37	10.77	39
Jharkhand	14.93	1.25	13.68	2.31	0.48	2.80	20
Delhi	0.30	0.02	0.28	0.20	0.28	0.48	170
Goa	0.28	0.02	0.27	0.04	0.03	0.07	27
Gujarat	15.81	0.79	15.02	10.49	0.99	11.95	76
Haryana	9.31	0.68	8.63	9.10	0.35	9.45	109
H.P.	0.43	0.04	0.39	0.09	0.02	0.12	30
J&K	2.70	0.27	2.43	0.10	0.24	0.33	14
Karnataka	5.58	0.33	5.25	0.70	0.38	1.09	21
Kerala	15.93	0.63	15.30	9.75	0.97	10.71	70
M.P.	6.84	0.61	6.23	1.82	1.10	2.92	47
Chattisgarh	37.19	1.86	35.33	16.08	1.04	17.12	48
Maharashtra	32.96	1.75	31.21	14.24	0.85	15.09	48
Manipur	0.38	0.04	0.34	0.002	0.0005	0.002	0.65
Meghalaya	1.15	0.12	1.04	0.00	0.002	0.002	0.18
Mizoram	0.04	0.004	0.04	0.00	0.0004	0.0004	0.90
Nagaland	0.36	0.04	0.32	0.00	0.009	0.009	3
Orissa	23.09	2.08	21.01	3.01	0.84	3.85	18
Punjab	23.78	2.33	21.44	30.34	0.83	31.16	145
Rajasthan	11.56	1.18	10.38	11.60	1.39	12.99	125
Sikkim	0.08	0.00	0.08	0.00	0.01	0.01	16
Tamil Nadu	23.07	2.31	20.76	16.77	0.88	17.65	85
Tripura	2.19	0.22	1.97	0.08	0.09	0.17	9
U.P.	76.35	6.17	70.18	45.36	3.42	48.78	70
Uttaranchal	2.27	0.17	2.1	1.34	0.05	1.39	66
West Bengal	30.36	2.90	27.46	10.84	0.81	11.65	42
TOTAL	**432.42**	**33.73**	**398.7**	**212.38**	**18.04**	**230.44**	**58**
6 Nos. UTs	0.597	0.036	0.536	0.129	0.051	0.181	33
G . TOTAL	**433.02**	**33.77**	**399.25**	**212.51**	**18.09**	**230.62**	**58**

Ground water being hidden resource is often developed without proper understanding of its occurrence in time and space. According to a report, the amount of groundwater extracted in India is the highest in the world. About 200 billion cubic metres of ground water is pumped primarily for agricultural purposes. The primary reason for this growing dependence on ground water is that it provides assured and timely irrigation to farmers who otherwise are at the mercy of rains.

Groundwater development in different parts/regions of the country is not uniform and is influenced by hydrogeological parameters as also agricultural and socio-economic activities of the region.

Groundwater development in some parts of Haryana, Punjab, Rajasthan, Tamil Nadu etc. are quite intensive resulting in over-exploitation of resources. There are about 839 blocks/mandals/taluks (Table 3) in the country assessed to be over-exploited and about 226 numbers categorized as critical/dark (Fig. 5). Groundwater developments in these areas warrant special attention while planning for development.

Table 3. Categorization of block/taluks/mandals in India

State	*No. of units assessed*	*Safe*	*Semi-critical*	*Critical*	*Over-exploited*
A.P.	1231	760	175	77	219
Arunchal Pd.	13	13	0	0	0
Assam	23	23	0	0	0
Bihar	515	515	0	0	0
Chattisgarh	146	138	8	0	0
Delhi	9	2	0	0	7
Goa	11	11	0	0	0
Gujarat	223	97	69	12	31
Haryana	113	42	5	11	55
H.P.	5	5	0	0	0
J&K	8	8	0	0	0
Jharkhand	208	208	0	0	0
Karnataka	175	93	14	3	65
Kerala	151	101	30	15	5
M.P.	312	264	19	5	24
Maharashtra	318	287	23	11	7
Manipur	7	7	0	0	0
Meghalaya	7	7	0	0	0
Mizoram	22	22	0	0	0
Nagaland	7	7	0	0	0
Orissa	314	308	0	0	0
Punjab	137	25	4	5	103
Rajasthan	237	32	14	50	140
Sikkim	1	1	0	0	0
Tamil Nadu	385	145	57	33	142
Tripura	38	38	0	0	0
U.P.	803	665	88	13	37
Uttaranchal	17	1212	33	00	2
West Bengal	269	231	37	1	0
TOTAL	5705	4067	546	226	837
A & N	1	1	0	0	0
Chandigarh	1	1	0	0	0
D.N. Haveli	1	1	0	0	0
Daman & Diu	2	0	1	0	1
Lakshadweep	9	6	3	0	0
Pondicherry	4	2	0	0	1+1 Saline
TOTAL UTs	18	11	4	0	2
G.TOTAL	5723	4078	550	226	839

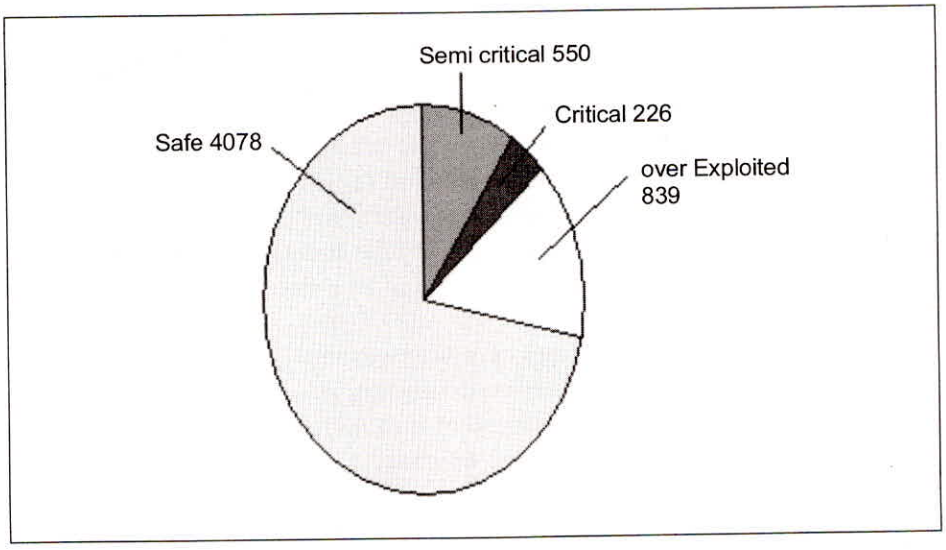

Fig. 5. Distribution of groundwater development.

REC's pumpset energisation programme is limited to safe and semi-critical areas based on the categorization of Central Ground Water Board from time to time. New pumpsets are energized in safe category/blocks/areas whereas only conversion of existing diesel pumpsets to electric pumpsets of same capacity is allowed in semi-critical/grey areas.

Growth process and expansion of economic activities inevitably lead to increasing demands for water for diverse purposes such as domestic, industrial, agricultural, hydro-power, etc. Water consumption by irrigation sector is around 83% of the available groundwater resource while the remaining 17% is assigned to domestic and industrial sector. While the gross irrigation potential has increased from 19.5 mha at the time of independence to about 139.9 million hectare by year 2005, further development of a substantial order is necessary if the food and fiber need of our growing population are to be met. The country's population, which is over 1027 million (2001) at present, is expected to reach a level of about 1390 million by 2025.

EMERGING ISSUES IN WATER MANAGEMENT

Importance of conservation and efficient use of water appeared prominently in plan documents, policy statements and discourses. But very little has been done in changing the ways supply systems are organized and managed as well as in demand side management including the reformulation of policies that influence the attitude and practices at the user's end.

While theoretically, there is a general consensus that: (i) water resource sector needs a holistic view, (ii) all stakeholders need to be involved in its management, and (iii) water being no more a free good, there ought to be some defined principle of water allocation. There is considerable gap between principles and practices mainly due to factors associated with absence of a clear-cut property rights and lack of governance or mis-governance in water sector. The epicenter of the problem lies in the current social, economic, legal and governance framework of water resource development, distribution and utilization.

Role of the State and Governance

The role of the State as planner and manager of present and future demand can be assessed by water policy, water laws and water administrative machinery. The objectives and goals of water policy cannot be achieved without appropriate water laws and efficient implementation mechanisms.

Water crisis in India is being ascribed to be because of: (a) growing gap between the scarcity value of water and realized value under the current pattern of water use and management, (b) weak governance and mis-governance of water resources by State; and (c) the absence of a clear cut property rights or ownership of water. Traditionally, water was perceived to be a free good available from nature. This perception has not materially changed.

The world over, the State or governments have been governed by three different but interrelated legal doctrines viz., (i) doctrine of riparian rights; (ii) doctrine of prior appropriation and (iii) doctrine of public trust. In the Indian context, the doctrine of riparian rights is in practice in case of surface water. The Indian Easement Act 1982 provided unlimited right on ground water to the owners of overlying land. There is no provision for prior appropriation or reasonable use.

The legal framework of irrigation in India implicitly presumes the absolute right of the State over water resources. The Centre lacks jurisdiction to enact legislation for regulation and control of ground water. However, three important developments require a mention. First, the Centre formulated a Model Groundwater (Control and Regulation) Bill 1970 and circulated to states for adoption. The Bill postulated some kind of water permit system linked to land rights. The bill did not find takers and was reportedly not adopted by any state. Secondly, the National Commission on Agriculture (1976) again emphasized the need for groundwater legislation. And third, a much-improved version of the Model Bill came in 1992. The Model Bill 1992 inter alia suggested for mandatory installation of water meters by all groundwater permits holders including the farmers. Only a few states have so far enacted legislation to regulate ground water.

Ownership of Water

In case of water resources, the ownership and the use rights vary across water sources, usage and states. Issues relating to ownership of water are not only complex but also different than for other resources. The use, control and ownership of water is linked to the ownership of land and irrigation structures. Thus water ownership issue cannot be discussed in isolation.

Broadly there is an increasing tendency, world over, for centralized control of water. Several countries have declared water as a state property. But still they allow decentralized independent decision-making. Certain western countries have opted for complete privatization.

In the absence of a well defined property right to it and with rapidly growing water markets and wide-spread use of modern water extraction technologies, ground water is prone to exploitation and is in fact being over-exploited in many parts of the country. For avoiding its over-exploitation and depletion, it is necessary to change the status of ground water from a common pool resource to a cooperative or a joint property of the users through creation of water users cooperative societies. Such a cooperative management of ground water would require, among other things, enactment of a groundwater law for governing the use of ground water and creation of groundwater management administrative bodies etc.

Water Allocation Priorities

In the planning and operation of systems, water allocation priorities should be broadly as follows :

- Drinking water
- Irrigation
- Hydro-power
- Ecology
- Agro-industries etc.

The groundwater resources should be so regulated as not to exceed the recharging possibilities as also to ensure social equity. The detrimental environmental consequences of over-exploitation of ground water need to be effectively prevented by Center and State Governments.

Water allocation in an irrigated system should be done with due regard to equity and social justice and supply of water should be on a volumetric basis subject to certain ceiling and rational pricing. Scientific water management practices such as sprinkler and drip system of irrigation should be adopted wherever feasible.

Water and Energy Nexus (WENEXA) Project under US Agency for International Development (USAID) recognizes the dual impact of uncontrolled groundwater extraction on both energy; and water sector. Under the first phase of this programme, conducted during 2001-03, several activities were implemented on pilot basis in Maheshwaram watershed in Ranga Reddy district of Andhra Pradesh such as improving quality of power supply to farmers while simultaneously promoting demand side management at farm level. This demand side management included potential crop shifts based on water balance studies, crop water budgeting, educating farmers on the changes in ground water and methods to plan their crops depending on the availability of ground water and introduced micro irrigation. Their results indicate that farm budgets can provide a basis for water conservation measures. These include improved crop choice from water intensive to non-water intensive crops. They also provided base line information to support sprinkle/drip irrigation that can reduce water and energy consumption by 50% per unit of land under cultivation. According to WENEXA report documenting the cause and effect relationship between declining groundwater tables and farm practices is important to education and outreach. In conjunction with the International Water Management Institute and National Geophysical Research Institute vast amount of information on status of ground water was collected and analyzed. A water balance analysis carried out documented an average one metre annual decline in water table that was directly correlated to the growth of bore well development.

Recently TERI was assigned to conduct a techno-economic evaluation study on REC's pumpset energisation programme. Under its heading as Leasing of Pumpsets, the report states:

"If irrigation were looked at as a service then the objective of the farmer would be to procure water for irrigation. However due to lack of proper centralized infrastructure and absence of on-demand delivery of resources, the farmer is forced to go in for a pumpset connection. In a totally service oriented scheme, water would be the service delivered to the farmer from a service provider.

In the present scenario, when the pumpset connections are provided, the utility has little or almost no control to influence the power and water usage of the pumpsets. Here two alternatives need examination (i) community pumpsets and (ii) leasing of pumpsets to farmers directly. With the RGGVY already providing the framework for the same, there is an urgent need to integrate this service provision (energized pumpset) - water for irrigation under franchisee agreement to not only

reduce the number of applicant for energized pumpsets but also promoting efficient and sustainable water management practices at local level.

Community Managed Pumpset Connections

Under this scheme either the Panchayat or a franchisee would be made responsible for delivery of water services through centralized pumpsets. The franchisee would be provided the capital investment, capacity building as well as back up support from the utility to keep the pumpsets running. The franchisee would charge the farmers for the water delivered and collect tariff (which can be arrived at between the panchayat, the SEB, the franchisee). However, for this model to succeed, all individual connections within the village would have to be disconnected.

Water Pricing

The subsidized power supply to agriculture necessitates rationing of the supply to avoid high financial losses due to negative rate of return from agriculture.

Metering of Agriculture connection

Taking into account the indiscriminate exploitation of groundwater beside power theft, effective metering should be the pre-requisite. States, such as, Rajasthan, Gujarat, Andhra Pradesh, Maharashtra and Karnataka have started metering of new pumpset connections.

Gujarat has launched Jyoti Gram Service (JGS) under which separation of agriculture and domestic/ commercial feeder in rural area is undertaken. Agriculture load is diverted to a distinct agriculture feeder supplying power for eight hours a day. Advantage of feeder separation is (i) improved servicing of agriculture load-power supply only when needed. This cuts down theft and losses to other sectors, (ii) Reduction of groundwater exploitation - as power is available only for a certain period of time, farmers would optimize utilization of water pumped out, resulting in lower groundwater exploitation and investment in demand-side water management measures.