Energy-Water Co-management Opportunities and Challenges in the Tembu Lift Irrigation Scheme, Atpadi Taluka, Maharashtra

K. J. Joy and Suhas Paranjape

(Assisted by: Raju Adagale and Ravi Pomane)

Society for Promoting Participative Ecosystem Management (SOPPECOM)
16 Kale Park, Someshwarwadi Road
Pashan, Pune 411008, Maharashtra, India
Phones: 020-5880786; 5886542
Email: soppecom@vsnl.com

SUMMARY

This paper is based on a study of issues in co-management of water and energy in the context of the Tembu Lift Irrigation Scheme (TLIS) one of the many government operated high lift schemes that are coming up in the Krishna River basin in Maharashtra. High lifts conveyance options have been chosen for three main reasons: the demand for their share of water by the drought prone upper reaches of the Eastern portion of the Krishna valley that cannot be reached by other means, the `race' for the Bachhawat Award and the increasing tendency to let dam water into the stream to be picked up and lifted by users.

The Atpadi taluka which falls under the TLIS is a special case because the SKSS, the organisation spearheading the agitation for equitable sharing of Krishna waters is also committed to a vision of equitable and sustainable prosperity and has succeeded through a series of agitations and negotiations to get the MKVDC to agree to the principle and the feasibility of its application to Atpadi taluka portion of TLIS. MKVDC and SKSS have jointly proposed to the government that the Atpadi portion of TLIS be treated as a pilot project for restructuring the scheme along equitable and sustainable lines.

The paper argues that conveyance costs should be pooled at the basin level and so applied and that baseline energy costs should be worked out on the basis of matching low cost supply with high priority uses and presents a rough analysis at the basin level. It also argues that proper co-management of energy and water through end-use planning of the biomass produced can pay for the costs of high lifts. It presents a tentative analysis of these conditions in respect of the Atpadi portion of TLIS in this respect.

Two stakeholders' meetings were organised to discuss these ideas. Group discussions were also carried out in 10 villages in Atpadi taluka. The paper also reports these discussions and ends by discussing some of the crucial issues that need to be tackled and the support the initiative needs in order to succeed.

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1. The Background

In the context of the Lift Irrigation Schemes (LIS) coming up in the Krishna River basin Dr. Madhav Godbole, Ex Chairman of Maharashtra State Electricity Board (MSEB) and Chairperson of the government appointed committee to review the power sector in Maharashtra, wrote in January 2002: "In some schemes the electricity charges themselves will prove to be the death-knell of the schemes. If these schemes are completed, the recovery of the water charges will be negligible and the state government will have to incur the recurring burden of subsidy running into several thousand crores of rupees each year in perpetuity. It will not be wrong to say that it will be another `Enron' but in the irrigation sector". (Economic and Political Weekly, January 12, 2002). Dr. Godbole also goes on to demand that the state government should order an inquiry by setting up an expert committee to examine all such lift irrigation schemes and till the inquiry is completed the government should suspend the work on these schemes.

Cut to Atpadi, a small town, the Taluka headquarter of Atpadi Taluka. On July 26, 2002 about 70,000 men and women from 13 drought-prone talukas of Satara, Sangli and Solapur districts converged on Atpadi town under the banner of Shetmajoor Kashtakari Shetkari Sanghatana (SKSS) to demand the opposite of what Godbole was advocating -- asking for equitable access to water and the speedy implementation of the Tembu and other lift irrigation schemes. They also decided to communicate to the government that they were ready to pay water charges in advance and were also ready to take over the entire Tembu Lift Irrigation Scheme (TLIS) and manage it. The 2002 Atpadi Samanyayi Pani Vatap Parishad (Equitable Water Distribution Conference) was not a one-time event. The drought-prone people from these 13 Talukas gather in large numbers every year since 1993 on July 26, the birthday of the erstwhile ruler and social reformer Shahu Maharaj of Kolhapur, to pursue their demands in respect of equitable access to water and a fair share of the Krishna waters.

These two sharply contrasting responses indicate the range of not so black and white, complex viewpoints of the different stakeholders, all putting forward legitimate concerns that need to be taken into account. The present study is an inquiry into possible ways to make the TLIS affordable, economically viable and also sustainable from the point of view of energy and the responses and viewpoints of different stakeholders. Thus, the study explores two important questions that generally come up in the context of high conveyance lifts, characteristically those above 120 m: Can they become economically affordable and sustainable from the point of energy?

As part of this study we attempted to interact with different direct and indirect stakeholders – the farmers from Atpadi taluka, the activists of Shetmajoor Kashtakari Shetkari Sanghatana (SKSS) – the organisation spearheading their movement for equitable water distribution, officials of the Irrigation Department and the Maharashtra Krishna Valley Development Corporation (MKVDC), the Maharashtra State Electricity Board (MSEB), the Maharashtra Energy Development Agency (MEDA), the Maharashtra Electricity Regulatory Commission (MERC), and independent experts and NGOs working in the field of energy and water like PRAYAS, SARMET, etc.

To elicit the responses of the farmers from the Atpadi Taluka, we held focussed group discussions (FGDs) in 10 selected villages from the Taluka. After the FGD was over, the farmers present were invited to individually fill in a simple questionnaire and 102 farmers responded to the questionnaires. The main focus of the FGDs and the questionnaires was to gauge their readiness to accept the restructuring of the TLIS as proposed by SKSS, their awareness about the implications of equitable water distribution and the consequential costs – both monetary and energy, their willingness to pay the costs, their willingness to abide by certain conditions, and their willingness to participate in the co-management of water and energy by forming Water and Energy Users' Associations (WEAUs).

We also organised two one-day stakeholders' meetings to understand the perceptions and viewpoints of different stakeholders and to bring about a dialogue between them. At the first stakeholders' meeting we circulated a Marathi note detailing the financial and energy implications of the TLIS as it stands today and also what could be the possible approach to make this scheme affordable and sustainable. About 25 persons, drawn from MKVDC, SKSS, PRAYAS, SARMET, Centre for Environment Education (CEE), Social Forestry and SOPPECOM, participated in the discussions. Nobody from the MSEB could participate in this stakeholder meeting, though the Chief Engineer of Kolhapur Zone (most of Krishna valley falls under this zone) had confirmed his participation. Similarly, though officials from MEDA had confirmed, they also could not attend the meeting. Independent expert Shri Madhav Godbole could not attend due to previous engagements. MERC expressed its regret at being unable to attend the meeting.

All the participants felt that the discussions were useful and also expressed the desire to continue this consultative process and stressed the need to have such a forum for the stakeholders to come together, interact, exchange views and iron out issues. Since some of the stakeholders could not be present, another stakeholder meeting was arranged. This time, a senior official from MSEB Kolhapur Zone attended the meeting, and the MEDA Director General made time to attend the deliberations for some time. The paper presented at the Delhi IWMI meeting was circulated for discussion before this meeting. Shri Madhav Godbole, unfortunately, could not attend the meeting because of a medical problem that needed attention. No one from MERC could attend either. The present paper is based on all these interactions.

2. The Region

The Krishna basin in Maharashtra

The total area of the Maharashtra part of Krishna basin comes to 69.42 lakh ha which is 22.6% of the total area of Maharashtra. The basin extends from longitude 73^{o}30' E to 76^{o}30' E and latitude 15^{o}44' N to 19^{o}15' N. Elevation in the basin ranges from about 400 m to about 1000 m. The total population in the basin as per 1991 census comes to 1.86 crores and the estimated population for 2001, taking into account a decennial growth rate in the basin of about 25%, would be 2.33 crores. The basin consists mainly of Pune, Satara, Sangli, Kolhapur and Solapur districts and parts of Usmanabad and Ahmednagar districts.

The rainfall regime in the Krishna basin in Maharashtra ranges from an annual average of 500 mm to above 3000 mm (in the mountaintops it may reach 5000 mm). According to the Chitale Commision Report (*Report of the Maharashtra Water and Irrigation Commission under the Chairmanship of Dr. Madhav Chitale),* the total water available in the basin at 75% dependability is estimated to be 28,371 MCM per year, the average availability to be 34,032 MCM and the availability per capita and per ha of culturable area in 1991 has been estimated to be about 1,800 m^3 and 6,000 m^3 respectively. By 2001, the per capita availability is expected to reduce to about 1,400 m^3. The Bachhawat award for Maharashtra is close but somewhat lower: the water available for Maharashtra in the Award has been estimated to be around 27,250 MCM and 30,350 MCM at 75 and 50% dependability respectively. This would imply a per capita availability in 2001 of around 1,170 m^3 and 1,300 m^3 at 75% and 50% dependability respectively. This is the order of water available in the basin.

Uneven availability of water within the basin – a case for intra-basin transfers

In Maharashtra, the Krishna basin comprises Southern Maharashtra and is conventionally known as the more `developed' amongst the different regions in Maharashtra. However, a closer look at the basin shows that it is an interesting case of uneven development and uneven availability of water. In terms of the rainfall regime, there is a sharp contrast between the Western portion of the Krishna basin in Maharashtra, which has a much more assured and high rainfall, and the Eastern portion, which is severely drought prone. Huge investments have been made on irrigation – most of the major projects in Maharashtra are concentrated in this region – but the benefits have been confined to a narrow stretch on either side of the river. More than two-thirds of the area in the basin remains severely drought prone. We thus have two contrasting pictures – there are large tracts of area affected by waterlogging and salinisation because of over-irrigation and other factors; and there is the other, much larger area where irrigation is scarce and the people have to depend on water tankers to meet their drinking and domestic water needs, especially, in the summer months.

Despite the many weaknesses in defining concepts of water-surplus and water-deficit areas, Table 1 below which gives the sub-basinwise details of population, culturable area, and availability of water clearly brings out the sharp variation in the availability of water amongst the different sub-basins. At the bottom of the heap we have the Yerala sub-basin with an estimated per capita water availability of 83 m^3 for the year 2001 and at the top we have the West-South sub-basin of Upper Krisha with a corresponding per capita availability of above 4,900 m^3, almost 60 *times*! The variation between the average and dependable (at 75% dependability) availability is also much wider in the Eastern sub-basins. The ratio between the availability at 50 and 75 percent for the Upper Krishna (West) sub-basin is 1.31, while for the upper Krishna (East) sub-basin it is as high as 8.68. This serves to bring out the unpredictable nature and fluctuations in the rainfall regimes in the Eastern sub-basins.

It has to be noted that most major projects in the Krishna basin therefore – and many of the major lift irrigation schemes planned and being implemented in the basin by MKVDC, including the TLIS -- are schemes that are in effect, intra-basin water transfers, carrying water from the water-surplus Western portion to the water-starved Eastern portion of the river basin. In the debate amongst farmers, politicians, experts and environmentalists about the necessity of such transfers, their economic viability, their environmental sustainability or the sustainability of their energy costs, we should not lose sight of the character of the region to which the water is being carried. Furthermore, it should also be noted that there are no convenient storage sites from which Krishna water could be conveyed to some of these portions, the command of the TLIS is one such area, and the decision to provide water to these areas through high lift systems has also to be seen in this light.

***Table 1*: Sub-basin wise details of Krishna basin**

Sub-basins	Population ('000) #	Culturable area ('000 ha)	Water availability at 75% dependability (MCM)	Annual average availability (MCM)	Annual average per capita availability (m^3)	Annual average availability per ha culturable area (m^3)
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6) = (5)/(2)**	**(7) = (5)/(3)**
Upper Krishna (West)						
a. West-north	4,253 (5,316)	988	15,877	18,097	4,255 (3,404)	18,317
b. West-south	522 (653)	124	2,942	3,227	6,177 (4,942)	26,024
Upper Krishna (East)						
a. Yerala	1,258 (1,573)	320	20	130	103 (83)	406
b. Agarni	260 (325)	110	5	87	335 (268)	791
Upper Bhima						
Up to Ujani dam	5,263 (6,579)	1,122	6,293	7,594	1,443 (1,154)	6,768
Rest of Bhima						
a. Nira	1,387 (1,734)	531	2,241	2,812	2,027 (1,622)	5,296
b. Downstream of Ujani dam	1,954 (2,443)	915	319	469	240 (192)	513
Sina-Bori-Benetura						
a. Sina	3,068 (3,835)	1,160	478	1,110	362 (289)	957
b. Bori-Benetura	666 (833)	357	196	506	760 (607)	1,417
Krishna basin as a whole	**18,632 (23,290)**	**5,627**	**28,371**	**34,032**	**1,827 (1,461)**	**6,048**

Source: Maharashtra water and Irrigation Commission Report

: Based on 1991 Census population, figures in paranthesis are based on population estimates for 2000.

In fact this issue of an intra-basin transfer from water-surplus to water-scarce areas is the backdrop to the present study of the setting up of high lifts in the Krishna basin. Thus, if the intra-basin transfers involved here take the form of providing certain basic irrigation service equitably and widely to water scarce areas – a big if, considering the highly inequitable nature of major projects so far – then it is a service directly linked to assuring the livelihoods of the poor in the region. In short, it could be reasonably argued that the provision of such service forms part of their right to assured livelihoods. This is an important aspect to be kept in mind as we approach the more substantive issues related to the viability and sustainability of such schemes.

Increasing trend in agricultural energy consumption

However, the decision for putting up high lifts on the Krishna river to convey water to the upper reaches of the Eastern portion is more of a piece with the trend towards an increasing use of pumping energy. At the time of independence agricultural energy consumption was low. Over the years there has been a steady increase in the demand for pumping energy leading to an overall increase in energy consumption. In the earlier days, pumping energy was mainly used in lifting water from groundwater sources -- open wells, bore wells, etc. -- and the investment was primarily private investment. Since then, lifts from flowing streams have also been on the rise. Recently, in Maharashtra, the state itself has taken the initiative in installing massive lift irrigation schemes to divert water from surface storages to drought-prone regions, especially in the Krishna river basin.

Three factors of relatively recent origin have contributed to this trend. The first is the so-called compulsion of the Bachhawat Award to utilise Krishna waters as quickly as possible. The Bachhawat Tribunal was set up to decide on the sharing of waters from the Krishna river between Maharashtra, Karnataka and Andhra Pradesh. It has stipulated in its Award that each state should utilise its specified share by June 2000 after which date the unutilised share of each of the states would become part of a pool available for further negotiation and re-distribution between the states. During the latter half of the 90s the state government took a series of measures aimed at speedy utilisation of its share of water: one was the setting up of a separate corporation (Maharashtra Krishna Valley Development Corporation -- MKVDC) primarily with the idea of raising funds from the public; and second was the sanctioning of massive lift irrigation schemes and building storages with an idea of `utilising’ as much of its share as possible by June 2000.

The second factor is an increasingly powerful demand by people from the upper reaches of the valley for their fair share of Krishna waters. The benefits of the Krishna waters have been enjoyed by the farmers in the narrow strip of alluvial plains on either side of the river while most of the upper reaches of the valley, especially the Eastern portion have remained severely drought prone areas. During the last decade there has been a massive movement spearheaded by the Shetmajoor Kashtakari Shetkari Sanghatana (SKSS) in the drought prone upper reaches of the valley, basically in the 13 drought-prone Talukas of Sangli, Satara and Solapur Districts, calling for the equitable distribution of the Krishna waters between and within regions.

The third factor is the new emerging government practice in Maharashtra, especially in respect of new irrigation schemes. The emphasis is simply on developing the source and not building the canal system at all. The practice is to build a dam, and instead of the canal system, construct a series of pick up weirs (basically Kolhapur type of weirs) downstream, release regulated flows into the river and have the users lift the water from the pick up weirs. This simple device greatly simplifies matters for the government and allows it to reduce expenditure by shedding its responsibility for regulating distribution. The result is that, on the one hand, use of unregulated amounts of water becomes the privilege of those who have the resources to invest in lifting devices (who also tend to become water-lords extracting rent for their ownership over water) and on the other, water necessarily has to be lifted, resulting in sharply increasing energy consumption.

The need to address energy issues

It is becoming increasingly evident that ensuring equity and sustainability would involve costs, including an energy cost, and conversely that a refusal to pay those costs is tantamount to a refusal to ensure equity and sustainability. Equitable access to water, like integration of different kinds of sources (for example, local and exogenous sources, surface and ground water sources), is an important component of SOPPECOM’s approach to water sector restructuring and all of these involve additional costs. None of them is a free good. We have to pay certain costs for equity -- both economic costs and energy costs.

Slowly, but surely, we have all come to the realisation that energy is an important, crucial issue in the context of water management and the sustainability of the system demands that both energy and water are managed together. The question is how. The answer throws up a wide range of options and suggestions. At one end of the spectrum are those who believe there should be no big dams and no big lifts, period. That, in their opinion, cuts through the Gordian knot. At the other end are those who see the increasing energy consumption as essential and inevitable and look to Foreign Direct Investment (FDI) and large external investments in energy as the solution. Somewhat away from both, novel approaches to local energy generation facilities based on mass utilisation of renewable sources including small hydro also emerging. Another current emphasises biomass as a resource and points out that the biomass we produce with the water is also energy, and if we manage it well and as SOPPECOM has argued, if we ensure that part of this biomass energy goes to meet energy needs, it may be sufficient to pay for the lifts involved.

There are many issues that lie on the way. What would be the increase in energy demand like when all such schemes on the Krishna are commissioned? How would the picture change, if at all it does, with equitable access built in? How does the present generation and pattern of energy use compare with the additional demands in the form of Lift Schemes? How do we price the water? Will it be economically affordable and also sustainable? What are the avenues for water users' participation in energy generation? What are the policy implications? And as importantly, what do the different stakeholders, direct and indirect, feel about all these issues, these options and their role? The paper aims at exploring many of these issues in the context of the Atpadi taluka and the Tembu Lift Irrigation Scheme, though as part of a continuing and hopefully evolving debate. Before we turn to the issues, we should have a look at the relevant details of the TLIS itself.

3. The Scheme

The Tembu Lift Irrigation Scheme and SKSS proposal for Atpadi Taluka

Atpadi taluka and the Tembu Lift Irrigation Scheme form the context of the study for definite reasons. The reasons relate to the nature of the Tembu Lift Irrigation Scheme (TLIS) and the intervention of the local organisation Shetmajoor Kashtakari Shetkari Sanghatana (SKSS) in respect of the coverage in Atpadi Taluka. Here SKSS has submitted a proposal to take up equitable water distribution and cover, in principle, all families in the Taluka, instead of the limited number that would have been covered by the departmental scheme. The leadership is also aware of co-management needs, and has also touched upon the issue of energy generation, especially in respect of the additional burden due to changes necessitated by the requirements of equitable distribution. The MKVDC has agreed in principle to take up this proposal on a pilot project basis and the details of operationalising it are still awaiting discussion following the submission of the joint proposal.

The Tembu Lift Irrigation Scheme

The Tembu Lift Irrigation Scheme, would utilise about 22 TMC of water annually from the Krishna river as part of a wider plan to utilise Maharashtra state's share of the Krishna waters. The Krishna Water Distribution Tribunal, known as the Bachhawat Award, has stipulated in its Award that the concerned states -- Maharashtra, Karnataka and Andhra Pradesh -- should utilise their share of water awarded to them by June 2000, failing which the unutilised share would be pooled together and would be open for negotiations and re-distribution.

The massive Krishna-Koyna Lift Irrigation Scheme (KKLIS) was the first scheme to be sanctioned as part of the drive to utilise the state's share of Krishna waters. It went some way towards meeting the demand of the people in the drought prone outlying regions of the Krishna basin in Maharashtra. However, the scheme could only cover portions in the basin in Sangli district up to about RL 2100 feet (640 m). Since it was not possible to provide water to the substantial portion beyond RL 640 m that remained unserviced by KKLIS, sanction was next sought and obtained for another massive scheme, the Tembu Lift Irrigation Scheme, that was proposed to serve these areas. Under this scheme it is proposed to lift water in five different stages and provide irrigation up to a level of 2750 feet (838 m). In its present form, this scheme plans to irrigate about 79,600 ha area in 173 villages in six talukas -- Karad, Khanapur, Atpadi, Kavathe Mahankal and Sangola -- of the three districts of Satara, Sangli and Solapur. The details of the TLIS are presented in Tables 2 and 3 below.

Table 2: ***Salient features of TLIS***

1) Name of the scheme:	Tembu Lift Irrigation Scheme, Taluka Karad, District Satara	
2) Administrative approval	G. R. No. Tembhu 1095/1427/(361/95) dated 19/2/96	
3) Estimated cost	Rs. 1416.59 crores	
4) Proposed water use	22.00 TMC (623 Mm^3) per annum	
5) Planned storages of required water:		
	1) Koyna dam	17.27 TMC
	2) Proposed Wang Dam	0.93 TMC
	3) Proposed Tarli dam	1.70 TMC
	4) Proposed Solshi	3.00 TMC
	Total:	**22.90 TMC**
5) Command area (ICA)	79,600 ha	
6) No. of villages in the command area	176	
7) Per ha cost of the project	Rs. 1.78 lakh	
8) Benefit-cost ratio	1.56	

Table 3: ***Details of irrigation area and water use according to different talukas***

Taluka	No. of villa-ges	Total area (ha)	Culturable command area (ha)	Irrigated command area (ha)	Irrigation intensity (%)	Water use	
						TMC	Mm^3
Karad	2	1,150	860	600	69.77	0.16	4.70
Khanapur	86	61,350	49,100	28,300	57.63	7.82	221.63
Tasgaon	15	20,570	15,450	7,700	49.84	2.13	60.30
Atpadi	36	61,568	43,100	16,000	37.12	4.42	125.3
K.Mahankal	13	13,750	10,300	7,000	67.96	1.94	54.82
Sangola	21	36,500	29,200	20,000	68.49	5.53	156.63
Total	**173**	**194,888**	**148,010**	**79,600**	**53.78**	**22.00**	**623.38**

Table 4: ***Technical Information According to Different Stages***

Particulars	**Stage 1**		**Stage 2**	**Stage 3**		**Stage 4**	**Stage 5**	**Total**
	1 A	**1 B**		**3 A**	**3 B**			
No. of pumps (Working + reserve)	30 + 3 = 33	36 + 3 = 39	2 + 1 = 3	20 + 2 = 22	4 + 1 = 5	3 + 1 = 4	4 + 1 = 5	99 + 12 = 111
HP of each pump	1950	2200	1400	1940	1990	1075	1235	
Total HP	58,500	79,200	2,800	38,800	7,960	3,225	4,940	195,425
Required electricity (MW)	51	69	2.50	40.68		2.80	4.30	171.28
Proposed static head (m)	60.83	86.61	57.98	63.67	30.67	37.47	68.33	316.91
The flow of water to be lifted (m^3/second	57.37	57.37	2.88	35.32	14.91	5.00	4.32	
Length of the canal (km)	--	45	39	150	106	42	25	407
Command area taluka-wise (ha):								
Karad	--	--	600	--	--	--	--	600
Khanapur	--	1,280 4,645	3,400	--	12,975	831 3,139	2,000	28,300
Tasgaon	--	--	--	--	7,700	--	--	7,700
Kavate Mahankal	--	--	--	7,000	--	--	--	7,000
Atpadi	--	--	--	3,652 12,348	--	--	--	16,000
Sangola	--	--	---	20,000	--	--	--	20,000
Total	**--**	**5,925**	**4,000**	**43,000**	**20,675**	**4,000**	**2,000**	**79,600**

<u>Source:</u> MKVDC documents

The present status of TLIS is that a major portion of the civil work (of the baseline canal) and major structures would be completed over the next couple of years and they would be able to run the main canal. However it would take much more time to complete the distribution network. The details are given in Tables 5 and 6 below.

Table 5: ***Year-wise breakup of expenditure***

Year	Provision made (Rs. crores)	Expenditure incurred (Rs. crores)
1996-97	10.86	10.86
1997-98	104.09	104.09
1998-99	65.51	65.80
1999-00	119.99	145.80
2000-01	120.35	146.10
Total:		**472.36**

Source: MKVDC documents

Table 6: ***Year-wise requirements of funds to complete the project by June 2005***

Year	Requirement of funds (Rs. in crores)	Expected area to be brought under irrigation (ha)
2001-02	322.00	3,700
2002-03	210.00	4,310
2003-04	111.00	22,790
2004-05	51.00	24,980
2005-beyond	248.22	23,880
Total:	942.22	79,660*

* The total comes to 79,660 ha which is 60 ha more than the figure given in the salient features of the project.

Source: MKVDC documents

The proposed pilot project in Atpadi taluka

According to the present plans of the government to utilise Maharashtra's share of Krishna waters, even after all the projects proposed and under construction become operational, a majority of the people in the drought-prone regions of Krishna basin would not have access to Krishna water and would continue to be affected by the frequent droughts. Arguing that there is sufficient water to provide a minimum access to everyone if the water is distributed equitably, the SKSS has been organising the people of 13 drought-prone talukas of Southern Maharashtra on the issue of equitable distribution of Krishna waters for the last 6 to 7 years. As a result of the various agitations and a series of negotiations it carried out with MKVDC and the Government, MKVDC has now shown willingness to take up equitable water distribution on a household basis as a pilot project for Atpadi taluka. As can be seen from Table 4, only about 16,000 ha in the taluka would be irrigated by Tembu Lift Irrigation Scheme (TLIS). Many of the villages, which are at a still higher elevation, have been left out of the project. It has been argued by SKSS that within the 4.4 TMC quota allocated for Atpadi from Tembu scheme, it is possible to give sizeable water service to *all* the rural households of Atapdi taluka on the principle of equitable water distribution: according to the SKSS estimates, it is possible to provide about 5,000 m^3 per household for *all* rural households in the taluka. After a preliminary study, MKVDC has agreed that it is possible and has been engaged in drawing up a joint proposal to be submitted to the government by the MKVDC and the SKSS.

***Table 7:* Details of the proposed pilot project**

1.	Total geographical area in the taluka:	90,186 ha
2.	Area under village settlements, streams, rivers, etc.:	6,368 ha
3.	Forests and others	8,768 ha
4.	Culturable area	74,784 ha

Out of this, area irrigated or planned to be irrigated:

	CCA (ha)	ICA (ha)
Area under Tembu scheme	41,000	16,000
K. T. Weirs	2,345	138
Minor irrigation projects	12,435	4,170
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Total:	55,780	20,308
	=====	=====

Thus the area which is not included comes to: 74,784 ha - 55,780 ha = 19,004, say 19,000 ha (CCA).

A calculation of the area left out of the original TLIS is presented in Table 7. MKVDC has suggested certain measures to cover areas not presently covered by either Tembu or other schemes in the taluka. Out of the 19,000 ha, about 5,400 ha is on the left bank of Man river, and another area of about 13,600 ha. It is suggested that the left bank area on the Man river could be covered by constructing a series of 6 pick-up weirs on the river and then lifting the water from these weirs. For the other area, the option is to lift water from the Tembu canal itself for a part of the area or to store the water in nearby minor irrigation tanks and lift it from there. This means additional lifts over and above the Tembu lift and the study estimates an additional maximum lift of between 40 to 50 m. The additional cost has been estimated as Rs. 100 crores in the plan submitted jointly by the MKVDC and the SKSS to the Government.

4. Summary of TLIS costs

The costs of the original TLIS

From here on, we move on to the discussion that gradually takes us to some of the substantive issues involved: affordability and sustainability.

First we need to have a look at the various components of the of the TLIS cost in the context of the Atpadi Taluka. We shall restrict ourselves to the Atpadi taluka since the alternative proposal has been worked out in some detail for that area. To summarise the information given earlier, the original TLIS proposed by MKVDC (hereafter original TLIS) irrigates an area of 16,000 ha in Atpadi Taluka, provides 4.4 TMC or about 125 Mm^3 of water and involves a lift of 280 m for that portion.

The total financial investment on the scheme is estimated at 178,000 Rs/ha. The Vaidyanathan Committee (1992) on the pricing of irrigation water has recommended a minimum of 3% of the total outlay as the price of the basic service. On this count the service would attract a charge of Rs. 5,340 Rs/ha.

The pump efficiency for the heavy duty dedicated pumps used by TLIS is taken as 80% on an average. The energy per ha required for lifting may then be calculated as

(125 x 10^6 m3 x 280 m) / (360 T-m x 0.8 x 16,000 ha)

= 7,595 kWh/ha

At present, the MSEB has a rule in force where all large and HT pump installations are charged at industrial rates, and there has been a running dispute on this between the MSEB and the MKVDC. On that basis, at an industrial minimum rate of 3.15 Rs/kWh the electricity bill comes to

7,595 x 3.15 = 23, 926 Rs/ha say 24,000 Rs/ha

Should the MSEB agree to apply concessional rates for farmers, we assume a rate of about 1.05 Rs/kWh. Since agricultural consumption is unmetered, it is difficult to estimate the actual concessional rate that prevail, though most estimates would put it around 0.70 Rs/kWh. Our rate here is based more on what from our discussions seems to be an acceptable rate for the SKSS leadership.

7,595 x 1.05 = 7,975 Rs/ha say 8,000 Rs/ha

The costs of the restructured TLIS

The original TLIS proposal was sought to be modified by the SKSS and after discussion, the new proposal jointly forwarded to the government by the MKVDC and the SKSS (hereafter the restructured TLIS) agrees that the allocation of 4.4 TMC or 125 Mm^3 is sufficient to provide 5000 m^3 per household (hh) to all the 22,000 rural households in Atpadi Taluka and that the TLIS is proposed to be modified so as to provide a basic service of 5000 m^3 to every family in the area.

The costs of the original TLIS would carry over to the restructured TLIS, except that they would now be assessed in terms of costs per hh, since it is the household allocation of 5000 m^3 that is the constant reference.

The costs would then change as follows: Pumping energy: 5,523 kWh/hh; Energy cost at industrial price: about 17,500 Rs/hh; at concessional price: about 5,800 Rs/ha; and Water service charge: 3,883 Rs/hh.

Additional costs

However, the restructuring would also imply a rise in the pumping cost as well as in the investment outlays since the water now has to be conveyed to a larger area and has to be pumped. These are estimated in the following manner.

For pumping energy, it is estimated that the restructuring may at most involve lifting half of the water allocation through an average of at most 50 m (providing roughly for lifts of up to 75 m). Thus the additional energy burden per hh on this count may be estimated as

(2500 m^3 x 50 m) / (360 T-m x 0.50)

= 694 kWh/hh   say 700 kWh/hh

The issue of the type of works that the restructuring involves has been discussed elsewhere (Paranjape and Joy, 1995) and it is shown there that most of the work is labour intensive and can be handled locally so that the labour and local material component may be treated as part of the government's employment assistance programme that generates productive assets, and only the cost of external materials needs to be charged to the project cost. In that case, at current prices we need not add more than 20,000 Rs/hh to the project cost, and consequently, 600 Rs/hh to the water charge.

A comparison of costs and components

The various components of cost are compared in Table 8 below.

***Table 8*: Comparison of Original and Restructured TLIS**

Item	Original TLIS		Restructured TLIS	
	Industrial tariff	Concessional tariff	Industrial tariff	Concessional tariff
Project cost	178,000 Rs/ha		149,000 Rs/hh	
Water service charge	5,340 Rs/ha		3,883 Rs/hh	
Pumping energy	7,595 kWh/ha		6,223 kWh/hh	
Energy Tariff	23,924 Rs/ha	7,975 Rs/ha	19,602 Rs/hh	6,534 Rs/hh
Total charge	29,264 Rs/ha	13,315 Rs/ha	23,485 Rs/hh	10,417 Rs/hh

5. A Basin-wide Analysis

Is the energy burden too high?

As the table shows, the TLIS involves an annual energy burden of more than 7,500 kWh/ha for conveying water to the region, and one of the main criticisms of the scheme has been that this burden is too high. Any such judgement involves a norm in relation to which it is `too high' and the norm is not apparent. There are two issues here. One, should we be looking at Tembu in isolation, and two, how high is too high?

What is the basis: basin or project?

The need for a deeper analysis is not apparent in the first instance. The question, should we look at Tembu in isolation does not make much sense. Tembu costs are Tembu costs. The need to go deeper into a basin-wide analysis only appears on certain assumptions. And that assumption is that at least a certain minimum provision of water is a basic service, and equitable access to it is a right for all, irrespective of their social, economic or, what is here important, their geographical position. This is a rights framework, and in this section what we attempt is to carry the logic through to the basin level.

Here, we first need to take into consideration the fact that the TLIS serves the most drought-prone region in Maharashtra. Second, we need to take into consideration, that there are no prospects of any other water being conveyed to this region. Thus this is not a case of extra water service being provided to a region that already receives sufficient water for its basic needs. And the restructured TLIS proposes to serve all households in the Taluka with a minimum basic water service of 5000 m^3 per hh. Together, these mean that TLIS water is a minimum assurance of a basic service and needs to be addressed in those terms.

As we have said earlier, we start with the assumption that water is a basic service, and equitable access to it is a right for all, irrespective of their social, economic or, what is here important, their geographical position. This right obviously is circumscribed by livelihood needs; it cannot pertain to access to any arbitrary amount of water simply because it is available – it pertains to the minimum water that is required to fulfil basic needs and to earn one’s livelihood. In other words, we could say that we need to treat this minimum basic service as a public good to be supplied to all. A service of 5000 m^3 at source would probably translate into an at-field water use of less than 2500 m^3, and we assume that it is of an order to qualify for being called a minimum basic service.

Continuing our analogy, let us see how geographic position affects water conveyance costs. Obviously, there are differences in conveying water to different regions; some regions are more favourably placed and water can be conveyed to these regions at little cost, some regions are unfavourably placed and it may cost much more to convey water to these regions. But the principle of equitable access implies that, so far as basic service is concerned, access should be equal, in terms of costs and burdens. The principle of equitable access implies that the total burden needs to be related to the total service and that this burden is equitably divided and it is to this principle that we shall return later.

Basinwide estimates

The full impact of the large lift schemes on the Krishna and elsewhere will become apparent only after they are commissioned and are in full operation. We shall therefore estimate the impact for a date when the schemes are likely to be completed. A convenient date for this is the year 2030 by which time one may reasonably expect the schemes to be complete. It is also the date for which the Maharashtra Water and Irrigation Commission (2001) under the chairmanship of Dr. Chitale (hence forward, the Chitale Commission) has worked out estimates. The Chitale Commission also estimates the total energy consumption in agriculture in 2030.

We may divide the Chitale Commission's 2030 energy consumption estimate into three parts for our purpose:

a) The energy consumption involved in the high lift schemes that will become operational by then. These are basically state operated lift schemes.

b) The current energy consumption in agriculture that anyway would continue.

c) The estimated additional pumping energy needed by that time.

Energy consumption of the high lift schemes

The state operated high lift schemes in the Krishna basin in Maharashtra would have an installed capacity of 765 MW. We assume operation of these lifts at an average load factor of 0.67 since kharif demands would be low and late summer supplies would, on an average, be low. In fact, an analysis of Tembu indicates a load factor of 0.61. So we may estimate the energy consumption as follows

765 MW x 8760 hrs/yr x 0.67 / 1000 MWh/MU

= 4490 MU   say 4500 MU

Energy consumption at present levels

The reported level of agricultural energy consumption was of the order of 15,000 MU for Maharashtra as a whole (Chitale Commission). However, there have been many questions raised about these figures. Under the direction of the MERC, the MSEB has been re-evaluating these figures and the latest figures for 2001-2002 show a consumption of about 12,187 MU. Of this, The Kolhapur zone -- which may be taken as roughly representing the Krishna basin for the purpose of our estimation -- accounts for 3,532 MU or about 28.9 % of the total consumption. For our estimate, therefore we assume that this consumption of 3,532 MU continues.

Estimated additional energy consumption

The Chitale Commission estimates that by 2030 the agricultural energy consumption in Maharashtra may rise by as much as 60,000 MU including the state operated high lifts. However, we need to have another look at these figures.

The Commission's estimate, excluding the high lift component, may be divided into two parts. Firstly, it estimates an additional 66 lakh hectares of irrigated area to be added from all sources outside the command areas -- the list of these sources is quite exhaustive and includes re-circulation as well. Secondly, it then estimates the energy requirements on the basis of an estimated energy use requirement of 1 MW and a capacity of 6 MW per 1,000 ha.

An excessive estimate

There is reason to believe that the energy use per ha assumed by the Commission is excessive. The energy norm used by the Commission is equivalent to an energy consumption of 8,760 kWh per ha. If we assume that on an *average* 1,000 mm of water is applied to this area, then even at a pump efficiency of 50%, this provides sufficient energy to lift the water through an *average* height of about 160 m, or more than 500 ft. As an average lift this is excessive. In fact, even departmental lifts are generally subject to a *maximum* limit of 120 m, and it is extremely unlikely that the average lift will exceed this value.

A more reasonable estimate

We need to make more reasonable assumptions about this norm. It has been observed that water obtained from lift schemes or individual lifts from wells is applied more carefully and sparingly than canal water and also, there is generally comparatively less water available. For these reasons, in the following estimate it is assumed that on an *average* about 750 to 800 mm of water is applied. An *average* lift of 50 m is assumed for purposes of estimation (this allows a wide range of variation, of up to 75 m). On this basis we then have a revised energy consumption norm of 1 MW energy use and 6 MW capacity on 4,000 ha.

So, even on the basis of the Commission's estimate of 6.6 Mha increase in irrigation, the additional energy consumption would be equivalent to an energy use of 14,454 MU. Assuming that this is distributed in proportion to the geographical area of the different basins since the increase is not dependent on basin specific features, the Krishna basin component of this increase may be taken to be 14,454 x 0.226 = 3266 MU.

Estimated population of Krishna basin and per hh costs

The population of Maharashtra may be taken to be around 10 crores and a uniformly decreasing decennial rate from 25 to 20 % would give us a population of about 18.375 crores in 2030. It is expected by then that 50% of Maharashtra's population would be urban, so the rural population would be around 9.19 crores or 18.38 million standard households. Assuming a distribution of rural population corresponding to the basin areas, the Krishna basin would then comprise 4.15 million households.

On the basis of this estimated population, the energy burden of the state-operated lifts would be 1084 kWh/hh and the energy burden corresponding to the non-state component would be 1638 kWh/hh.

6. Back to the issues

Providing equitable access

We may now resume our discussion of issues on the basis of these figures. From the point of view of equitable access, there are areas in which we may be able to provide access without pumping energy and there are areas where water may have to be conveyed through high lifts. However, the principle then implies that the cost then is pooled at a basin level and distributed uniformly between all regions. If this is not done, then we are penalising disadvantaged regions for their very disadvantage! And if, the high energy cost of conveying water to individual regions is to become an argument for not conveying water to those regions, we are also perpetuating their disadvantage.

What would the price of basic service look like?

The question that we need to ask is whether the total energy cost of conveyance within *a basin* is disproportionately large, unsustainable, unaffordable. We need to reformulate the question on these terms. If we do so, then we have a cost of about 4,500 MU to convey water to 4.15 million households, i.e., an energy cost of 1084 kWh/hh. The SKSS has been demanding a basic service of 3000 m^3 per household for the basin and, at least in principle, has committed itself to pay the basic recurring costs on that service, i.e., the O&M and other recurring costs. This is tantamount to a recurring energy cost of 360 kWh/1000m^3. What the *price* of that energy should be is another issue. If this is charged at our assumed concessional rate of 1.05 Rs/kWh, we have a charge of about 375 Rs/1000m^3.

Current investments on large systems are of the order of Rs. 100,000/ha, and water allocations are typically of the order of 600 mm, that is 6000 m^3, so that we may consider an average investment of 16,000 Rs/m^3. Charging basic service at the minimum slab recommended by the Vaidyanathan Committee at 3% of investment, we have a corresponding charge of about 500 Rs/1000m^3.

On these terms, the price of the basic service of water provided would become 875 Rs/1000m^3.

Potential for savings

One of the measures related to the co-management of power and water is to increase the efficiency of power use within agriculture. Sant and Dixit have shown that two such measures in respect of agricultural pumpsets have a great energy saving potential. They have shown that upward revision of BIS standards and optimally higher sized pipes would result in an energy saving of 15 and 20 % respectively. They have also estimated that the cost to benefit ratio of the additional investment is less than 9. If we succeed in implementing these measures in half of the additional area being brought under irrigation by 2030, this itself would imply a saving 572 MU or about 140 kWh/hh.

Similarly, another simple measure could save energy in older lift schemes. Older lift schemes, and even many of the later ones as well, are essentially single stage lifts in which *all* the water allocation is carried to the highest point and is then released into the command area by gravity flow. Alternatively, these could be restructured into multistage systems in which the service area is divided into a few convenient portions lying at different elevations and only the allocations corresponding to those portions are carried to those elevations. This has the potential of substantial energy savings, typically 25% or more. If we assume that, in the Krishna basin, about 40% of the present energy consumption corresponds to such lift schemes on the banks of the Krishna and its tributaries, the potential energy saving is of the order of 353 MU or about 85 kWH/hh. The additional cost of such a restructuring however needs further study.

Electricity tariff: philosophies and policy

The question of affordability depends on how we price the electricity. This is not a question that has a natural answer. On the one hand we have a pool of electrical energy produced at different costs and at the other end we have an assemblage of uses. There are many ways of matching the two.

The conventional answer is based on the concept of differential tariff or cross subsidy. Users are generally classified according to their capacity to pay, their level of consumption and to some extent on the quality of service. Those who have a higher consumption and a higher capacity to pay are viewed as subsidising those who do not. Over the years, we are now approaching a point where the extent of cross subsidy has raised the price of electricity for the high tariff, high end consumer to a point where it is on par with captive power generation and there is the danger of this segment falling out of the net, and thus negating the possibility of cross subsidy.

Prioritising costs rather than cross subsidy

There is a different way of tackling the problem, a way that is being suggested for the last many years by our senior colleague K. R. Datye. In the system he suggests, he advocates setting up a priority set of uses and matching it with the costwise pool of power available in order to arrive at a pricing strategy. Thus the highest priority uses are matched to the lowest cost of power. The advantage of this method is that it has the potential to curb the arbitrariness that is involved in the capacity-to-pay based cross subsidy model. By matching segmentwise uses with segment wise costs, we free the interdependence of an arbitrarily high price for one sector being the condition for an arbitrary subsidy for the other.

In this system, the *price* for each segment is determined, and a subsidy, whether cross subsidy or otherwise, would have to be added as an *explicit* overlay. The politics then is restricted to how we order the priorities of use. This need not imply that the low cost pool of power would be sufficient to sustain the current low rates of power for various sectors, and it may well turn out, as suggested at the stakeholders' meeting, that it would still mean a `tariff shock' for subsidy privileged sections.

In the following, we try to carry out an illustrative exercise based on the costs presented by MSEB to the MERC in its 2001 application seeking revision of electricity tariffs. However, it should be emphasised that the analysis here is meant to be illustrative and depends on a series of simplifying but explicitly stated assumptions. These assumptions are detailed below.

The optimistic BAU

The costs are divided into what the MSEB chooses to call Generation costs (which fall somewhere in a grey area between variable costs and fuel costs and may even include some other costs) and a category called Other costs that lumps together all other costs reported by MSEB. Further it is assumed that the Other costs are divided between different plants or slabs of power supplied by different plants in the following manner: Half of the other costs are distributed in proportion to the generation cost of the slab and the other half is distributed in proportion to the MUs generated. At present T&D losses account for a high proportion of almost 40% and it is assumed that they are controlled to within 20%, a long term objective anyway. Other costs are similarly assumed to be net of bad debts and a tightening of 15% is assumed. These assumptions are meant to reflect what is considered to be desirable and practicable, though not necessarily achievable in the present set up. Further, we consider that the addition of the extra 15,000 MU projected by the Chitale Commission takes place at a cost double that of present hydro costs. All other additions are assumed to take place at costs higher than the maximum cost worked out here, so that we may take the following table excluding the higher cost purchases as representing the lower cost segment – or in Chinese terminology, Track 1 power. Beyond that it is a business as usual (BAU) scenario.

Source	Net MU Generated	Net MU Available	Generation Cost (Rs. crores)	Other costs (Rs. crores)	Generation cost Rs/kWh	Other cost Rs/kWh	Total cost Rs/kWh
MSEB Hydro	3,716	2,972	0	107	0.00	0.36	0.36
New Hydro	15,000	12,000	0	864	0.00	0.72	0.72
Uran +WHR	3,389	2,711	226	161	0.83	0.59	1.43
Chandrapur	14,368	11,494	1,076	717	0.94	0.62	1.56
Khaperkheda	2,638	2,111	226	140	1.07	0.66	1.73
Koradi	5,380	4,304	538	307	1.25	0.71	1.96
Bhusawal	2,616	2,092	270	151	1.29	0.72	2.01
Paras	345	276	38	21	1.36	0.74	2.11
Nasik	5,320	4,256	638	333	1.50	0.78	2.28
Parli	4,104	3,283	506	261	1.54	0.79	2.34
Purchases	16,283	13,027	4,026	1,600	3.09	1.23	4.32
Total	**73,158**	**58,527**	**7,544**	**4,661**	**1.29**	**0.80**	**2.09**

Based on 2001 MSEB submissions to the MERC regarding tariff revision.

As we had said earlier, the politics now lies in ordering the different uses according to their priority. It is customary to assume the minimum lighting needs of poor households as a first charge in both the rural and urban areas. A consumption of 30 kWh/month or 360 kWh per year is conventionally considered sufficient to satisfy the lighting needs of small tenements and is therefore 360 kWh/hh for the entire population is considered as first charge on the low cost pool. The 2030 population of Maharashtra has been earlier estimated to be about 18.38 million households. On this basis, the first charge on the pool is 6617 MU.

We may consider the provision of basic water service conveyance as the next charge on the low cost pool. The total energy consumption on account of high lifts in all basins in Maharashtra works out to 8364 MU.

The costs for those slabs would then be as follows:

First 360 kWh/hh household consumption = 6617 MU at 369 Rs crores, Unit cost = Rs 0.56/kWh

Basic water service conveyance = 8734 MU at Rs 656 Rs crores, Unit cost = Rs 0.75/kWh

The not-so-optimistic BAU

The major difference in the optimistic and not so-optimistic scenario is the availability of the additional hydro potential as estimated by the Chitale Commission. If, the projects do not materialise or if their costs turn out to be excessively high as with the Sardar Sarovar project, the low cost pool shrinks dramatically, and an inevitable tariff shock would follow. The recalculation with a smaller addition of low power hydro of half the amount would then modify the costs as follows:

First 360 kWh/hh household consumption = 6617 MU at 369 Rs crores, Unit cost = Rs 0.56/kWh

Basic water service conveyance = 8734 MU at Rs 1,096 crores, Unit cost = Rs 1.25/kWh

And in a truly pessimistic BAU scenario with no new hydro added we would have the following costs:

First 360 kWh/hh household consumption = 6617 MU at 640 Rs crores, Unit cost = Rs 0.97/kWh

Basic water service conveyance = 8734 MU at Rs 1,363 Rs crores, Unit cost = Rs 1.56/kWh

End use philosophy and end use planning

Another such change in approach that is needed is end use planning, or to use a popular term that comes close, demand side management. Though it is not strictly part of co-management of water and energy, the philosophy of end use planning is common to both. End use planning involves generation as part of the overall approach, and not as a separate supply side. Demand management is a component of this and a table borrowed from Sant, Dixit and Wagle may demonstrate its power. The table estimates energy use and power savings possible from a range of end uses.

***Table 9*: Potential of major end use options in Maharashtra by year 2002**

End use option	Estimated Peak Power Saving MW	Estimated Energy Saving MU	Annualized Lifecycle Cost (Rs/kWh/yr)
Compact Fluorescent Lamp	680	1670	1,866
Solar Water Heaters	250	950	8,196
Refrigerator Efficiency Improvements	35	335	6,424
Commercial sector	170	540	6,114
Irrigation Pump Set	390	2790	3,855
LT industry	165	900	2,793
HT industry	310	3300	2,793
T&D loss reduction	175	1400	3,368
Industrial Load Shifting	250	0	2,156
Total	2425	11885	

Adapted from Sant, Dixit and Wagle, 1995.

If we are to take seriously the maxim being propagated by the MSEB that one kWh saved is one kWh generated, we should include these among the possible ways of meeting rising electrical energy demand.

Similarly, they also point out that dispersed generation options need to be considered as seriously as centralised generation plants. Their estimate given below is that almost 1300 MW capacity could be immediately added in the form of dispersed generation plants.

***Table 10*: Potential of dispersed generation option for Maharashtra, 2002**

Option	Installed Capacity MW	Lifecycle Cost Rs./kW/yr
Sugar Co-generation	500	10,046
Co-generation (other industries)	500	13,964
Small Hydel Plants	200	6,889
Producer Gas	100	13,518

Adapted from Sant, Dixit and Wagle, 1995.

This estimate would acquire even greater significance when we take biomass based generation options into consideration.

Agriculture and biomass end use

The most important aspect of the co-management of energy and water is to realise the importance of agriculture as biomass production and, according to the end use philosophy, of the end use of biomass. In fact we are looking at agriculture in the wider sense of biomass production, a sense that includes all biomass production that may supplement or be analogous to agriculture, for example, horticulture, silviculture, farm forestry, etc.

The first important thing is that biomass is energy. So, if extracting and harvesting it, conveying it, distributing it and applying it costs energy, when it is used for biomass production, it also *produces* energy. The simple matter is that in most cases, the water used for biomass production *should be able to pay its way in terms of energy*, provided, of course that the actual end use of that portion of the biomass is an energy producing or energy replacing use.

How much energy does a m^3 of water produce?

We have estimated elsewhere that if it is well utilised, one m^3 of water is capable of producing on an average more than 3 kg of biomass (dry weight -- all weights hereafter are dry weights, unless explicitly specified otherwise), and as part of an intensive cultivation module may produce up to double that value (Paranjape and Joy 1995 and Datye 1997). However, how much usable energy the biomass may represent depends on what end use it is put to.

For example, if we directly burn the biomass and think of the heat as replacing that of coal in the power sector, one kg of biomass represents about 0.7 kWh of energy or 0.7 kg of coal (for upper bound estimates, we assume a less than average quality of coal). At a pump efficiency of 50%, 0.7 kWh represents a lifting energy of more than 120 T-m. Considering that *one* m^3 *of water* produces 3 kg of biomass, it *produces energy sufficient to lift itself through 360 m*.

However, burning biomass is an end use that gives the least energy benefit. If we use it to replace steel in structural composites, it replaces an equivalent weight of steel, and therefore each kg has an energy replacement value of about 2 kg of coal or 2 kWh, that is, given this end use, *one* m^3 *of water saves sufficient energy to lift itself through 1080 m*. Similarly, if we use it to replace energy intensive materials like petroleum derived polymers or resins, the energy benefit may rise to 5 kg of coal per kg of biomass use.

The point is this, if users are aware of the interdependence of water and energy and are aware of the importance of energy replacing end use of biomass, they can manage their affairs in a way that the water can pay for the energy cost involved in lifting itself. There are many ways in which this can be done.

Biomass as the stabilising element in hybrid renewable energy systems

Biomass has a crucial, stabilising role in development of hybrid renewable energy systems. All renewable sources have limitations that can be overcome if they are combined into a hybrid synergetic system. The availability of all these sources is variable: solar is not dependable in the monsoon and its availability is low in winter, especially in the north; availability of wind is higher generally from March to September but is low otherwise; throughout the Deccan plateau, the availability of hydro is high in the monsoon and post monsoon period but falls off sharply in summer. The potential synergy should also be noted: solar and wind are high when hydro is low, and hydro is high when solar and wind are low.

However, to combine them into a stable, synergetic system, we need a source that can take care of the shortfalls that may unexpectedly arise, since none of the other sources are dependable in their variation. Biomass forms the stabilising element in such a system, because it is a renewable source that, like fossil fuels, is capable of being stored and easily aggregated and can be called into service whenever the others show a shortfall due to their intrinsic variability. It is possible in this kind of system to utilise one kg of biomass to harness an energy more that three times its weight in coal replacement value.

However, we should also note that burning of biomass should be the last of the end use options for biomass, unless we can ensure against overexploitation and overextraction. As a thumb rule, generally, 1/3rd of the biomass produced in any ecosystem should be recycled, and only after ensuring this minimum requirement should any thermal use for biomass be considered. Another way of ensuring this is to follow the biogas route to energy extraction that produces sufficient amount of recyclable material as by-product. The viability of hybrid renewable sources is greatly enhanced if we consider them as cogeneration systems producing electricity as well as process heat.

Re-assessing the energy burden

At this point, we may re-consider the question of the energy burden of pumping energy. Our earlier estimates had shown that the non-state component of the energy burden of about 1500 kWh/hh would not be met from Track 1 energy. If the water users could ensure that a sufficient amount of biomass is utilised in energy producing or replacing applications, they would have produced their own energy. This simply means that water users should set up or find people who would set such enterprises that would produce energy goods from biomass and local, renewable energy sources.

From the earlier discussion of hybrid systems and the use of biomass as structural material or as replacement for petroleum derived products, we may expect an average energy replacement of 3 kg of coal or 3 kWh per kg of biomass use in this manner. So, to ensure the production or replacement of 1500 kWh of energy therefore we need to ensure energy replacing use of 500 kg of biomass per household. Since we are talking about a basic service of 3000 m^3 of water being provided to all the households, assuming that 2000 m^3 of it will be utilised by the plant, we have a biomass production increment of 6 T/hh. Thus we need a co-management strategy that ensures that about 8% of the biomass production is ploughed back into the energy sector to ensure that the water that has been utilised pays for the energy required to make it available.

7. The immediate agenda and co-management

What about Tembu as it stands today?

All this, it may be argued, is for the future, as and when things change, policies change, and so on. What does one do about Tembu as it stands today? How does one go about making it viable, feasible and sustainable even as we debate the larger questions? Or is one simply saying that nothing can be done until the basin wide changes are brought about?

For the time being, it is true; one must meet things as they are. However, we hope that by now, first, that we have made a prima facie case for not rejecting high lifts like Tembu simply on the basis of their high energy costs. Secondly, that it is possible to treat these high lifts as eligible for Track 1 treatment and that they should be so treated. This is important in determining the economic burden that the water users may have to bear if they bear full charges for the energy. This is not to say that the farmers are at present being expected to pay those charges; in fact, by all indications, they are to be charged at standard departmental rates. However, for our purposes, it is essential to reflect on what the scenario may be like if they are asked to pay the energy charges in full, and given the speed with the government's fiscal crisis is developing, it is not an altogether implausible scenario. In this part of the discussion, we concentrate on its relevant implications for the Atpadi Taluka pilot project.

For this purpose then we assume that the Atpadi pilot project has to bear the full energy cost for conveyance. We assume the most pessimistic BAU scenario but where the costs are worked out on the basis described above. This implies a unit cost of Rs. 1.56/kWh. So that the total water charge for the users is 13,540 Rs/hh, or say 13,600 Rs/hh of which 3,900 Rs/hh comprise water charge while 9,700 Rs/hh comprise energy charge.

Interestingly, the leadership of the SKSS has expressed a readiness on part of the farmers to bear this charge, a point that we shall take up for discussion later. However, that they may manage to bear this cost does not mean that they may find it easy to do so and it is important to find ways and means to minimise the cost to the user and to make it more sustainable. Some of the measures that are under discussion in this respect are summarised below.

Eventual reduction of basic service from Tembu

Though Atpadi taluka has always been a semi-arid, drought prone zone, earlier the taluka had substantial tree cover, albeit comprising mainly shrubs and scrub forest. Several streams had small but perennial flows. There is an urgent need for regeneration of the environment, and if part of the water can be used for recharge, greening and environmental regeneration, and if watershed development and soil and water conservation works are properly carried out, it may be possible to eventually reduce the basic service component.

If 5% of the water is reserved for such use, and adequate soil and watershed conservation work is undertaken to cover the Taluka in five years, it may be possible to bring down the basic service quantum from 5000 to 3000 m^3, supplementing 1500 m^3 of local water and a better ecosystem productivity. This would have a double effect. The per household costs would correspondingly come down: the total charge would be down to 8,200 Rs/hh, of which 2,300 would comprise the water charge and 5,900 the energy charge. Secondly, the saved water corresponding to 2000 m3/hh comprising 50 Mm3 would then be a pool available for use in high value, specialised uses at a higher cost, so that it may be possible to cross subsidise the user cost for basic service.

From WUAs to WEUAs

One of the other important implications of the need for energy and water co-management is to move from Water Users Associations (WUAs) to Water and Energy Users Associations (WEUAs). It is essential that there should be a unified management of water and energy. By changing over from the command area as basis to village or region as basis will facilitate this changeover. Just as the WUAs receive water at a given point on a volumetric basis from the department the WEUAs can receive energy and water at selected points on a metered basis and may then decide on how to distribute this cost internally. Since equitable access implies household rather than command area as the basis, and consequently, habitat, village and similar units at higher levels it is easier for them to make the transition from WUAs to WEUAs.

Biomass Energy Enterprises

However, the most crucial aspect of the co-management of energy and water is the setting up of energy enterprises. It is desirable that the WEUAs come together at a convenient regional level of say a Taluka or a well-defined cluster of villages and establish a biomass energy enterprise that concentrates on biomass based energy replacing or producing enterprise. A possible illustrative example of such an enterprise is outlined below. It should be stressed that this is just one of the possibilities and represents a direction. An implementable alternative can only emerge after a discussion.

For example, such an enterprise could enter into an agreement with the WEUAs federation that at the federation level, the WEUAs would earmark, say, 10% of the water they receive for production as specified by the enterprise. It should be emphasised that there is a very large range of products and processes to choose from. For example, in order to produce fuel it is not necessary to think simply of firewood; there is a whole range of options available from tubers like cassava, sugary juices from beet or sweet sorghum, or the ubiquitous sugarcane, or on a longer time horizon, the famous Jatropha that ushered in the Brazilian gasohol. There are also different routes available from the normal fermentation producing alcohol to a `deep' fermentation that produces methane and converts a higher percentage of the product to fuel value. In fact, this would be the most difficult part in the enterprise, the choice of the product mix and the activity mix for the enterprise.

Combining public good with private profits

It is possible for the enterprise and the WEUAs together to combine public good with private profits. For example, say 10% allocation of water earmarked for enterprise production could be combined with wasteland development and greening efforts in a very positive manner. If this allocation were to be used for wasteland development, the 500 m^3 of water use could be combined with another 500 m^3 of utilised rainfall on the wasteland, and could result in the establishment of perennial stands that would become perennial sources of energy replacing biomass use. Soil improvement and soil conservation works could result in the 500 m^3 of water annually `invested' in the first few years resulting in a capability of harvesting an additional 500 m^3 annually. In that case, we would have a per capita production of 3 T/hh annually on the wasteland (there is ample wasteland in the Taluka). The greening could earn the WEUAs clean development credits they could use elsewhere.

At the minimum therefore, with adequate preparation, it should be possible to produce at least 1.5 T/hh of biomass for energy replacing use. This would more than pay for the energy cost of water conveyance.

The importance of added value

It is important to note here that the enterprise we are talking about is a fully commercial venture. Moreover, unlike food products that are perishable and have quick saturation tendencies, the products are industrial, energy replacing products that need not be limited by those tendencies. It should also be remembered that because of the nature of the activity of the enterprise, the enterprise would be able to enjoy or can ask for the concessions that development of renewable energy sources like wind enjoys at the moment. In fact, if it is the WEUAs or their federation that sets up the enterprises, the dividends accruing to them can be put to good use in developing the water and energy infrastructure.

8. Stakeholder perceptions

For the purposes of the study we had organised two one-day stakeholder meetings. At those meeting we had called together a number of people connected with the issue. Those invited included: activists and leaders from the Shetmajoor Kashtakari Shetkari Sanghatana (SKSS), officials from the Maharashtra Krishna Valley Development Corporation (MKVDC), The Irrigation Department, Government of Maharashtra (ID-GoM), The Maharashtra State Electricity Board (MSEB), The Maharashtra Electricity Regulatory Commission (MERC), the Maharashtra Energy Development Authority (MEDA), independent experts Shri Madhav Godbole, energy experts Shri Girish Sant and Shri Shantanu Dixit from PRAYAS and Shri K. R. Datye from the Society for Advancement of Renewable Materials and Energy Technology (SARMET), Ms. Sanskriti Menon and Shri Ulhas Gore from the Centre for Environment Education (CEE), and economist Shri R. K. Patil, Irrigation Experts and ex-oficials Shri S. N. Lele and Shri S. B. Sane, along with the members and support team from SOPPECOM. Besides these two one-day meetings, we also travelled in the Atpadi taluka and held about ten focused group discussions in the villages and one at the taluka level with the SKSS activists. A draft of the paper was also presented at an IWMI organised workshop in Delhi in September.

To prevent clashing appointments and facilitate planning, we had circulated a notice of the stakeholder workshop more than a month in advance and had also taken care to circulate the background material immediately thereafter. For the first meeting, a draft paper in Marathi along the lines of this paper had been prepared and circulated. For the second meeting the draft presented at the Delhi meeting was circulated as discussion material. The discussions were lively and instructive and we take this opportunity to thank all the participants in the process. Their participation has been invaluable in shaping this paper and its contents.

MERC

The MERC response, unfortunately, was lacking. We had expected that someone from the Commission would attend. However, despite circulating the notice and the material well in advance, it was unfortunate that no one from the Commission could attend.

The MKVDC, the ID-GoM and the MSEB

The ideas presented in the paper may be divided into two parts: one, those relating to basin-wide calculations, estimates and recommendations, often including strong policy prescriptions, and two, those relating to making the TLIS more sustainable and affordable. The two sets of ideas found distinctly different reception from the officials who participated in the two meetings.

The first set of ideas, not surprisingly, received a wary and lukewarm response, especially since it involved policy prescriptions that departed radically from prevalent practice. While they were prepared to go to great length in defending and/or explaining present practices and policies, they were quite reluctant to venture into broader policy areas.

Subsidising inefficiency and penalising co-operation!

So far as the second set of ideas is concerned, the response was generally enthusiastic and they offered all help to the farmers organisation if they were to embark on the proposed restructuring. However, there was some difference of opinion between the MSEB and the MKVDC on the matter of the TLIS consumption being charged industrial tariff. According to the present set of rules, whether or not industrial tariff is attracted or not depends solely on the pump rating and on whether the connections are LT of HT. This creates a peculiar problem. For example, if every farmer drew water individually from a stream, they would be charged concessional tariff, but if say 50 of them got together and decided on a common installation, which would be more energy efficient, they would attract industrial tariff! This in effect subsidises inefficiency and penalises co-operation. Senior MSEB staff admitted that this was so, but they could do little about it, since those were the rules in operation, except to keep the matter pending and await a discussion and settlement of the issue at a higher level.

Would the water charges include the full energy charge?

Would the TLIS water charges include the full energy charges? This was an issue that was very important for the future of TLIS. While the MKVDC officials were seriously worried about the impact of the energy bill on the functioning of the TLIS, they were ambiguous, at least initially, on the issue of whether the Corporation would pass on the energy cost to the user. It was at the second meeting that they were asked explicitly about what the water charges would be once the TLIS becomes operational. At that point they made it clear, that as things stand today, they would have to go by the book and supply water according to the schedule of water rates determined by the ID for the different seasons. In effect, this means a water charge, much below the charges we have been discussing.

This again has a peculiar relationship with the proposed method of determining basic service: as argued in this paper, the water rates are uniform all over the state, however, the quantum of service is not limited to any concept of basic service, and the price of the service does not reflect the minimum true or intrinsic pooled cost. In effect it subsidises wholesale all irrigation service without even a concept of some kind of differential tariff. What it therefore does is not to subsidise need but to subsidise use, with the amount subsidy benefit being the greater the greater the use. The present method of energy tariff, unmetered charges based on capacity also do the same.

Where will the energy come from?

The simplest answer to the question of where will the energy come from, was that it has been all taken care of at higher level and already planned. In short, the general increase in generation capacity would take care of the problem. However, there seemed to be little in the way of translating the state level plans into lower level plans. The assumption was that since the state was aware of the energy demand for the water sector, and the state was the one who made the plans for electricity generation as well, that was taken care of. The perspective seemed to be a much more general one, where there were plans for expansion and therefore ipso facto, the water sector, and the various districts would also share in that increase. There seemed to be no active interaction and planning effort between the MSEB and the MKVDC on this count. Privately, some of the officials pointed out to the crisis that had gripped both the organisations and said that they could just manage to stay afloat at this point, that would be great advance, let alone the kind of management that we were demanding from them.

The experts

Madhav Godbole, who has first mooted the question of high lifts openly, was invited, but, unfortunately, could not attend either of the meetings, once, because of prior engagements and the other due to medical reasons.

The first set of questions received much closer attention from the group of experts from the NGO sector, both those within and outside SOPPECOM.

They generally agreed with the principle behind the basin-wide estimates and suggestions. However, they also expressed a need for a more rigorous analysis of a number of things. First, they felt that though the basinwide estimates presented would work as initial hypothesis, there was a need for a more rigorous examination and to corroborate estimates through resource mapping and evaluation in selected areas. Similarly, the need for exogenous water in Atpadi Taluka itself needs to be studied more rigorously.

They also pointed out that the kind of perspective that is being put forward is very dificult to be accepted piecemeal, and that may weigh against it. It is difficult

Dixit and Sant pointed out that even after applying the method as suggested by Datye, it is possible that the low cost pool of power may not turn out to be very large and the tariff determined according to this method could still bea tariff shock. They emphasised the need to take into consideration the possibilities of improvements in the present system, which in their opinion were considerable, along with consideration of new alternatives. Most of them felt the need to take up pre-feasibility and pilot studies in respect of the possibilities and options in biomass based energy generation or energy replacing industrial use on a large scale.

MEDA

MEDA went unrepresented at the first stakeholders meeting. However, the Director General, Shri G. M. Pillai himself attended the second stakeholders meeting. He was most interested in the proposed programme of biomass based energy generation and energy replacing use. He assured that he would seriously consider any detailed proposal on an immediately implementable programme.

The Farmers

But the most remarkable perceptions were from the farmers and the SKSS leadership. This was quite apparent at the focus group discussions as well as at the taluka level discussion. Expectedly, there was a strong advocacy of TLIS and a readiness to take on responsibilities. This was expected since we were talking to people drawn from a constituency formed around those issues. There was also a strong feeling of injustice being done to the drought prone areas. We had refrained from quantifying costs, especially since the talks with the MKVDC did not indicate that the full energy cost would be passed on. The results of the survey of 102 farmers who attended the meetings are as follows:

How many people would be ready for equitable distribution of water?	No. of respondents
<=25%	0
>25% and <=50%	2
>50% and <=75%	9
>75%	64
Yes (unspecified)	26

Will there be any obstacles? No: 92 Yes: 10

Type of obstacles reported (no. of respondents in parantheses):

1) Well owners, would not listen and lift extra water. (1)
2) Making field channels and acquiring land would be difficult. (1)
3) Some people's land is on a higher level. (1)
4) Big farmers will oppose equitable distribution. (5)
5) The landless will not be able to utilise their water share. (2)

Would people be ready to form WUAs and take over? Yes: 100 No: 2

Will there be any obstacles? No: 94 Yes: 8

Type of obstacles reported (no. of respondents in parantheses):

1) WUAs are not impartial. In the interests of the poor farmer government should retain control (1)
2) WUAs do not have sufficient powers or rights. Government should support WUAs. (1)
3) Groupism and politics. (5)
4) Farmers in the head reach will not allow others to take their share. (1)
5) Pinning down responsibility and making people accept it will be difficult. (1)

Will people be ready to struggle for a policy change? Yes: 101 No: 1

Will people be ready to take on the responsibility of watershed development? Yes: 101 No: 1

Will people be ready to pay water charges to the WUA for their wells? Yes: 91 No: 11

At what rate should the wells be charged (as % of canal water rate)?	No. of respondents
<=10%	9
>10% and <=25%	46
>25% and <=50%	27
>75% and <=100%	3
Unspecified	17

How should the surplus water (water left over after providing basic service) be distributed?	No. of respondents
Should be provided according to demand	6
Should be used for public purposes and should increase income.	1
Should be provided according to need.	34
Should be distributed equally	39
Should be given for cash crop	1
Should be provided according to need and demand.	5
Should be provided to those who can aford it	10
Should be provided to those who have more land	10

Should be provided with certain limitations to area	1
Govt. should reserve water and use it for plantation	2
WUA should decide	1

Will people be ready to pay on volumetric basis? Yes: 95 No: 7

Will people be ready to reserve water for energy crops? Yes: 101 No: 1

Will people be ready to form energy enterprises? Yes: 98 No: 4

The viewpoints expressed at the group discussions were similar, except that the discussions were much more vocal. Though there is a strong support for the SKSS stand, there is also an apprehension that there are sections that may not allow the perspective to be fully articulated and implemented. This is especially so in respect of water charges for wells, the differential tariff and equitable distribution including rights for the landless.

The SKSS leadership

Of course, the most remarkable of all the stakeholders was the SKSS leadership. The SKSS leadership agrees fairly closely with the analysis and suggestions presented in the paper and treats them as a starting point. There are a few issues on which it puts forward a somewhat different emphasis, and we shall not deal in detail with those. One is the issue of funds. It feels very strongly that the rural/farm sector is discriminated against and feel that the government and the experts both apply double standards while dealing with these issues. It points to things like the huge amount of debts of industrial houses that were written off, which by the latest reckoning has crossed a hundred thousand crores, and the amount of money spent on ensuring the Mutually Assured destruction of India and Pakistan that again reaches a figure quite close. The same government and the same experts, in their opinion, readily accept the writing off of bad debts, indeed regularise them, but baulk when it comes to expenditure for irrigation. If these debts were recovered, they argue, the costs of irrigation projects and energy generation including energy subsidy would be covered many times over. These are familiar radical arguments that carry much weight. What is remarkable is that, in spite of these reservations, the SKSS leadership supports full charging of O&M costs. The difference is mainly in respect of capital costs.

At a practical level, SKSS has gone even further and has proposed to the government that the farmers are ready to pay their water charges in advance and take over the entire TLIS system, provided the work on TLIS is given precedence and priority over other irrigation schemes and the work is expedited. This is quite an audacious step, especially when the issue of having to pay the full energy cost as part of the water charges looms large. Though it is true, that the MKVDC has said that as things stand, they are bound to apply the standard schedule of water rates for the TLIS. However, what if they decide to charge full O&M and the full energy cost? That Damocles sword hangs above the farmers. And the remarkable thing about the SKSS is that, if it does come to that, the SKSS believes the farmers will be ready and able to pay those charges. We discuss these and some other issues in the following section.

9. Issues

Readiness to pay

Would the farmers be ready to pay 13,600 Rs/hh? And here Dr. Bharat Patankar, who spoke at the stakeholders' meeting on their behalf assured us that they are quite ready to pay this amount. In fact, the SKSS, the farmers organisation has communicated to the government their readiness to take over the *entire* Tembu scheme (not just the Atpadi section) at currently applied minimum *industrial tariff* implying that they are ready to pay a higher charge of possibly up to 23,500 Rs/ha or more for the scheme as a whole. And there were good practical reasons for it, as he assured us.

At present those who want water have to buy it by the tanker, and in spite of that, many enterprising farmers here buy that water for crops like grapes, *because it pays its way.* A tanker, holding about 10 m^3, costs around 300 Rs. So the cost of water comes to around 30 Rs/m^3. Moreover, they have to pay on the principle of *chouthai* or one-fourth of produce for a share of well water they do not own. At 13,600 Rs/hh the water cost comes to about 5 to 8 Rs/m^3 depending on the how much water is delivered at the field. If they use only part of their water for a high value crop like grape already popular in the area, they are confident they can manage to pay this tariff. (It should be noted that the freedom to choose their crop pattern that is assured to them by volumetric deliveries becomes important.)

However, there is a need to exercise some caution here. It is important to keep in mind that what may work for a small proportion of the cultivable area in a region may not work all that well when a substantial portion of the land in an area is involved. For example, it may neither be feasible nor advisable to devote all the area to high value crops, especially, short term perishables susceptible to glut. Subsistence or food needs cannot be totally ignored without compromising self-reliance (it should be emphasised that one is talking about self-reliance, not self sufficiency). Combining the needs of repayments with those of self reliance and sustainability will involve a judicious combination of obligations and freedom. Evolving these mechanisms needs a framework both in terms of information and informed decision making as well as an institutional framework.

Equity, sustainability and eventual reduction in exogenous water for basic service

There are three kinds of issues involved here. The first is simply that of how would an equitable water service be planned. There is now an increasing amount of experience on planning an equitable water service, starting with the Pani Panchayat. The essential thing in this is not to have a hard and fixed notion of a scientifically precise equal amount of water being delivered to all; what we need to work towards is a collectively acceptable and easily administered procedure that ensures a close approximation, but even more importantly, provides a transparency and consensus. An example of this is the method of determining water charges for wells in the command that has been evolved at Ozar and similarly the method by which, in the last few years, *individual* farmers are also charged on a time-cum-volumetric basis. These methods shall be described in detail in the companion study on Ozar.

In short, these and similar methods imply that though the water is received at a single point from the larger project -- here the TLIS -- while part of it may be utilised directly as surface irrigation with methods that may be adapted as closely as possible to reflect volumetric deliveries, some of the farmers may be served out of such water stored and/or lifted. Further, part of that water may be received in local surface and groundwater storages where it may be combined with locally harvested water. In effect, the water from the larger project, here the TLIS is delivered to the *local integrated water system, and not to the individual farmers.*

However, this will need close planning of the local system and how exactly to deal with water delivered from TLIS as well as local water harvested. Prior rights will have to be recognised and residual rights will have to be taken over by the WUAs including the right to increased water including that of wells. All this will need to be done *before* major rights on TLIS and local augmented supplies are established in an unplanned manner. This is one of the biggest institutional challenges before the SKSS.

Needed, A Participative And Scientific Natural Resource Database Management System

The determination of prior rights and the extent of that right, as well as the continuing monitoring of exogenous and local harvested water implies, first, a process of water resource estimation and, secondly, a continuous monitoring of water resource status in the area. Sustainability, in the sense of determining how far water use is sustainable and regulating it in order to ensure sustainability, as well as ensuring that water use is environmentally sustainable and regenerative require a similar process of natural resource mapping and evaluation. A combination of participative and scientific methods is needed in this respect and the BGVS initiated Participative Resource Mapping (PRM) developed and implemented in many regions in India and the later modified methods applied in the Udaipur region in Rajasthan, the Bhusaval region in Maharashtra and the Ratlam region in Madhya Pradesh have given rise to a Natural Resource Database Management System (NRDMS) that adequately combines participative and scientific methods. This methodology needs to be taken up on a sufficient scale so as to test and routinise these processes for the TLIS in Atpadi taluka.

Based on this NRDMS methodology an approach to resource planning centring on water similar to the one adopted by the Kerala Shstriya Sahitya Parishad (KSSP) in Kerala would have to be adopted. This would result in a village wise plan of how the equitable system would be organised, of where and how the TLIS water would be received, how the local water resource would be developed, how they would be integrated, what works it would require, what its costs would be, which would be the wasteland that would receive the water reserved for regeneration would have to be identified, what would be the responsibility of the village in respect of growing energy crops and how those responsibilities would be distributed -- the village plan would have to cover all these aspects and more. In fact, the NRDMS would form a backbone that would tie together the different elements of the programme.

Energy Enterprise: Pre-Feasibility study to DPR

Parallel with this process would be the process of evaluating biomass based energy generation and replacement options. Given the scale on which this would be done, this would have to be done professionally, beginning with a pre-feasibility study and ending in a DPR. The NRDMS and the process of evaluating these options for technical feasibility and economic viability would have to interact periodically and sufficiently well so that the water resource plan and the energy generation and replacement programme are dovetailed. The two together would define the mutual commitments between the village communities and the taluka or regional level enterprise that would come up. These would have to function as guidelines and periodically reviewed and modified through dialogue and consensus, which once arrived at, should become binding on both the parties.

The Independent Importance of Local Natural Resource Development

One of the few drawbacks of the SKSS is its relationship with local resource development, especially, local watershed development. Time and again, though its importance is accepted, however, it tends to be seen as facilitating the use of TLIS water rather than in its own independent right. In the integrated viewpoint that SOPPECOM has been advocating, the relationship starts and depends on the independent development and sustainable enhancement of local water and natural resources. However, in the drought prone tracts, local water and ecosystem resource may only be able to fully assure livelihoods with a sufficient degree of dependability. Exogenous water then enters the system to supplement the local resource at a higher degree of dependability and make up this shortfall.

Though the SKSS leadership understands this relationship and agrees with it, in practice, there are two ways in which there is danger of slipping into a mode that may prove to be counteractive in this respect. One, is the way in which local water resource development is seen to be facilitating and supplementing the use of TLIS water, often mainly as receptacles. Two, is the virtually complete absence of any effort to undertake local watershed and natural resource development activity of any kind. It is the latter that is the more serious. Environmental regeneration is not only a means of utilising exogenous water efficiently, it is also an independent, comprehensive objective. If this is not realised, in thought and in practice, there is a perhaps remote but distinct danger that all talk about local resource development may prove, historically and in effect, empty rhetoric as a means of obtaining exogenous water.

10. Supporting the promise

The Atpadi pilot project of the TLIS is a promising experiment in which the main stakeholders have come together with a different approach. This has been made possible by a continuous dialogue, and struggle, over the years in which both parties have been forced to the negotiation table by their compulsions and aspirations. What is important is that they have been finding common ground and have been able to progressively expand that common ground. The same forces that have brought them to the negotiation table have also seen to it that they see the importance of interlinking equity, productivity and sustainability, including sustainability in economic and energy terms.

The main active force behind this emerging dialogue has been the SKSS. Their leadership is sufficiently seized of the problems and even at the grass roots, at least in Atpadi Taluka there is a much greater awareness of the problems and a readiness to take on responsibilities that accompany the benefits they demand. With the joint submission of the proposal of intent on Atpadi and the SKSS offer to take over the entire Tembu scheme, a new phase has been ushered in. It is incumbent on other stakeholders, including the research establishment and other experts to enter into a constructive dialogue on this issue and support the new initiative in order to realise and fulfil the potential that the situation promises.

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