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HILL AREAS LAND AND WATER DEVELOPMENT PROJECT

ANALYSIS OF RECURRENT COSTS AND STATE BUDGET

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SUMMARY OF OBSERVATIONS

OBSERVATIONS:

- I. Based upon review of the old State sector Lift.Irrigation Schemes (LIS), State budget and cost records, it can be concluded that the GOHP will have sufficient resources to support the recurrent costs of LIS (head not to exceed 150 meters) for another 8-10 years. After 8-10 years GOHP will have to face a huge liability for replacement of Pump & Machinery. The conclusion for sufficient State resources is based upon the trend of actual expenditures vis-a-vis budget provisions since 1983-84.(Refer para 4.0)
- II The energy charges per hectare for LIS increase substantially beyond a head of 150 meters for lift irrigation schemes. (Refer para 3.2.1)
- III Energy charges stand out to be the major cost parameter of the recurrent cost. Energy costs account for 70% of the average recurrent costs (including depreciation) and 78% of the average recurrent costs if depreciation is excluded. (Refer para 3.2.1)
- IV The maintenance and operation costs of schemes are budgeted under the "Non Plan" budget. The state budgeting is not based on the maintenance cost of irrigation schemes but on the actual expenditure incurred in the previous year adjusted for inflation and the additional area brought under irrigation.
- V Over the last four years the cumulative actual expenditure of maintenance and repairs for minor irrigation schemes has exceeded the budget estimates by only 0.6%. (Refer para 4.1)
- VI The budgeted amount for repair and maintenance for the year 1987-88 falls short of the anticipated actual by only 7% (Refer para 4.2)
- VII As against the original budget estimate of Rs 29 million for repair and maintenance in the year 1988-89 the actual expenditure is expected to be Rs37.5 Million. However, as has been happening in the past the budget estimates will be revised (in Sept-Oct'88) to take care of the shortfall.(Refer para 4.2)

SUGGESTIONS:

- I IRR should not be the sole criteria for the selection of lift irrigation schemes. It is suggested that additional criteria like a) capital cost per hectare should not exceed Rs32,000 and (b) the projected recurrent cost should not exceed Rs3,600 (excluding depreciation) per hectare, should be incorporated for AID-financed schemes. (Refer para 3.2.2)
- II The minimum coverage of CCA under the LIS and FIS should be prescribed.
- III LIS's with a head of more than a 100 meters should have a greater coverage to offset the higher recurrent costs.

1. PURPOSE:

In the evaluation of the HALWD Project carried out in March, 1988 it was observed that the IRR of many of the schemes was questionable particularly in the case of high lift irrigation scheme. It was also observed that given the low water charges and the high recurrent cost the project investment will become increasingly burdensome.

This study has been undertaken for the following specific purposes in light of the above observation in the evaluation report.

- 1.1 Recurrent Cost Analysis: To analyse the recurrent costs for the operation and maintenance of the lift irrigation schemes categorized by their head and suggest additional indicators other than the IRR that in used, as a criteria for the selection of scheme.
- 1.2 State Budget Analysis: To review the non-plan budget of the Irrigation and Public Health Department to determine the provisions made for meeting the recurrent costs of the lift irrigation schemes under the HALWD Project and also to forecast the budget provisions required for meeting these costs in the future.

2. BACKGROUND:

As a result of the hilly terrain of almost the entire state of Himachal Pradesh the lift irrigation system is one of the important means of irrigation. Although the flow irrigation (FI) system has an economic advantage over the LI, it cannot be put to use at places where the source of water is at a lower elevation than the area to be irrigated.

As a result of the topography of the area a significant man-made effort goes in for the building up of a system by which water is pumped up to a higher elevation and made to run down through a well determined path to irrigate agricultural fields.

Lift irrigation is being used in the state for quite a few years. The head of the system depends on the terrain of the area and also the area to be covered under the scheme. The State Government, after the HALWD project was taken up, have stopped taking up LI schemes from the state budget. All new schemes that are coming up are under the Project.

Pumping water up an elevation of a hundred meters or more is no doubt a very expensive proposition with an equally expensive operation and maintenance costs. But, the fact that emerges is that in view of the limited scope of the not so expensive means of irrigation, such as the flow irrigation, and the topography of the state, the Government have little choice other than to go in for LIS. This is a major policy issue and is beyond the scope of this review. What is of primary concern here is that as the Government is providing irrigation water at a nominal price, and this price has no relevance to the recurrent cost incurred, it becomes necessary to clearly set forth the parameters that should guide in the selection of the schemes. The other area of concern is the review of the budgetary provisions for the recurrent cost of the schemes under the project.

A field trip was undertaken by the authors of the report to look into the various costs, both estimated as well as actual, to arrive at the recurrent costs for the schemes of different levels of head.. Based on this an analysis was carried out to determine the total operational and maintenance budget for the AID financed schemes. ,

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3. RECURRENT COST ANALYSIS :

3.1 Cost Parameters:

3.1.1 After extensive discussions with Mr. S.K.Gautam, Chief Engineer and Mr. G.C.Gupta, Superintending Engineer in the Project Cell of the Irrigation Department (ID) the following cost parameters of recurrent costs were agreed to:

- a) Establishment Cost: To include only the wages of the daily wagers who directly work for the maintenance and operation of the irrigation equipment and civil works of the scheme.
- b) Energy Charges: There are two dimensions to this cost parameter. First is the variable charge of approximately 55 paise per unit and the second is a fixed charge called the "annual demand charge" on the idle machinery. However, there is information that the State Electricity Board has stopped taking the annual demand charges after protracted representations by the Irrigation Department.
- c) Maintenance Charges/Depreciation: Most of the USAID supported irrigation schemes are new and thus the actual data does not reflect the true picture of repair cost borne by the schemes. Therefore, it was agreed that combined effect of repairs and depreciation will be reflected in the recurrent cost analysis at the following rates:

- Civil Works	@ 2.0%
- Rising Main	@ 3.5%
- Pump & Machinery	@ 6.5%

- d) Indirect salaries: Salaries paid at the Division/Circle level to the Irrigation Department staff.

Theoretically, the interest on the capital costs should also be a cost parameter for recurrent costs, but as the funds are provided by the State Government without charging any interest, this cost parameter has been neglected.

- 3.1.2 It is a good commercial practice to provide for depreciation on the fixed assets and it was also necessary for the purposes of "recurrent cost analysis" to assess the recurrent costs of the selected schemes, with depreciation as a cost parameter. However, it would be appreciated that the GOI and state budgeting is expenditure based and thus does not allow any reserves or provisions to be created for expenditure in future. In other words the amount budgeted should be disbursed (not accrued or expended) in the same budgeting year. Thus, the state budget rightly excludes depreciation as part of the "Non Plan" budget. GOHP budget will face a huge liability for repairs and replacement of machinery after about 10-12 years as most of the pumps and machinery installed in the state sector and USAID schemes from 1986 thru 1988 will then fall due for replacement. As of now, GOHP has faced negligible liability in terms of replacement of machinery because most of the state sector schemes were also initiated in 1979-80.

However, the GOHP liability for recurrent costs upto the PACD will be nominal and this would mostly pertain to energy charges and very low percentage of repairs element. Thus, for the purpose of assessing the GOHP provision for recurrent costs of Lift Irrigation Schemes (existing and proposed), the depreciation as a recurrent cost parameter has also been excluded. Instead of depreciation, repairs have been taken into account at the following rates:

- Civil Works	@ 1.0 %
- Rising Main	@ 0.25%
- Pump & Machinery	@ 2.5 %

The above mentioned rates for repairs have been prescribed by GOI under their circular# C.E-PW-PII-Maintenance/87-7423-32 dated August 1,1987 (rates prescribed for water supply schemes).

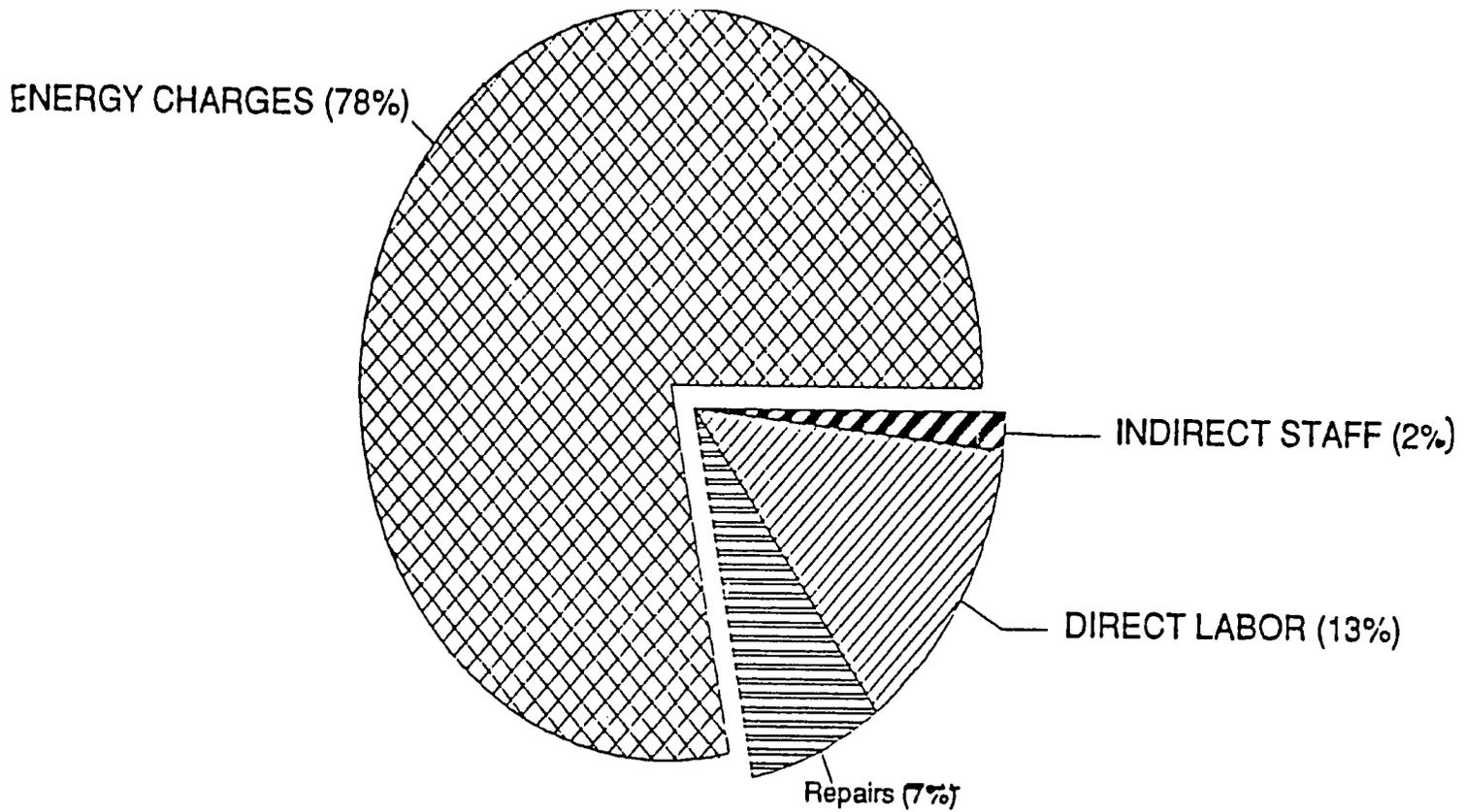
3.1.3 No depreciation has been provided on the cost of power line. The initial investment in the powerline is borne by the ID. It is the responsibility of the State Electricity Board (SEB) to provide for maintenance and replacement of the powerlines. The ID is not required to pay any amount for maintenance of the power lines, although it might be included in the energy charges, which are paid to SEB at the commercial rates (no subsidy by SEB to ID).

3.1.4 Salaries of the Project Cell and the IPH HQ at Shimla have not been apportioned to the maintenance and operation cost of the schemes. After discussions with the staff of Project Cell, it was concluded that their staff along with IPH staff were involved only upto the construction part of the irrigation schemes. The maintenance of irrigation schemes is being exclusively handled at the Circle and Division levels of the Irrigation Department.

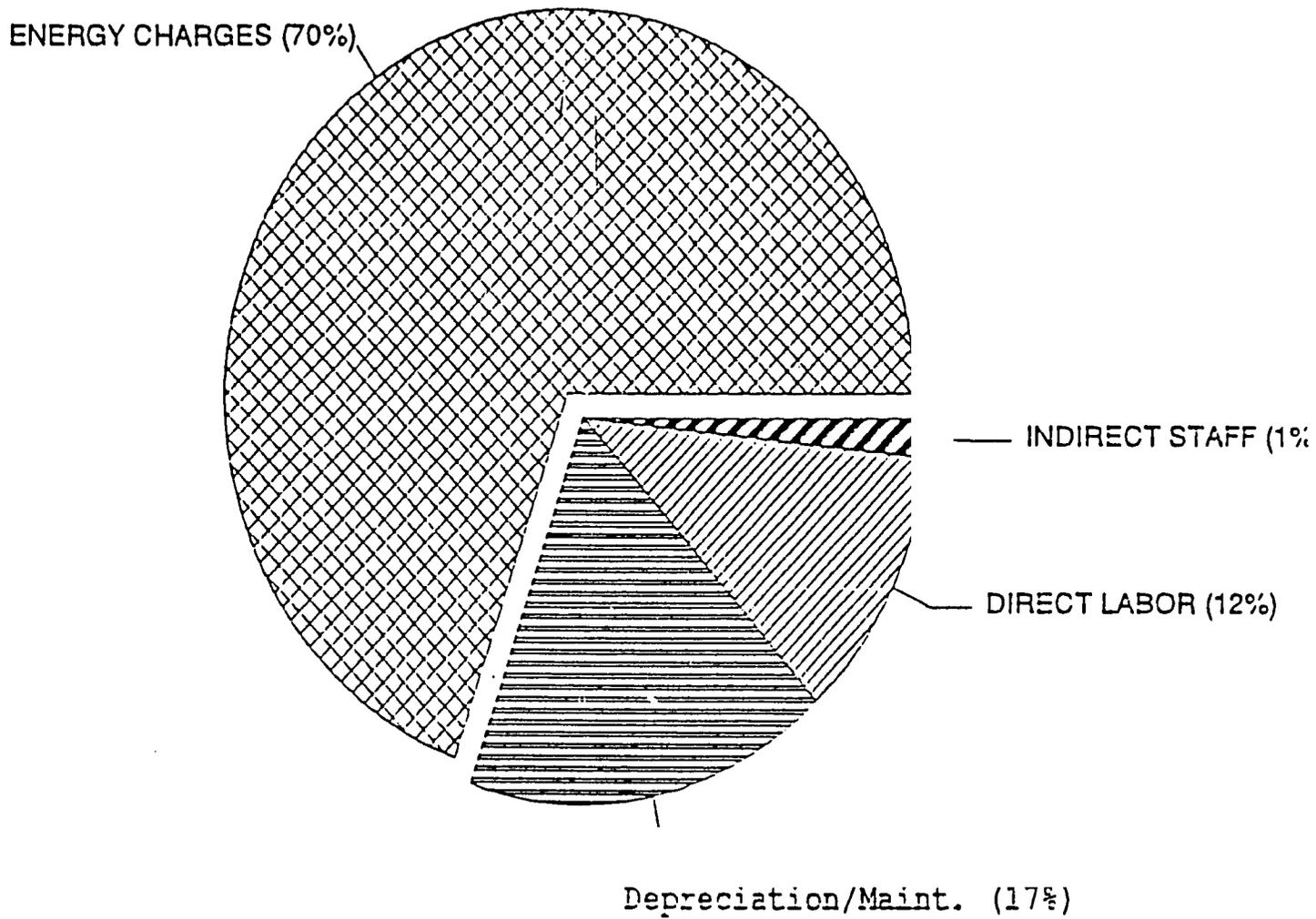
3.2 OBSERVATIONS/CONCLUSIONS:

3.2.1 Attachment 'A' summarizes the recurrent cost analysis of the eight schemes selected (4 LIS and 4 TW) for the purpose of this analysis. The observations in the attachment are summarized as follows:

RECURRENT COST PARAMETERS EXCLUDING DEPRECIATION



RECURRENT COST PARAMETERS INCLUDING DEPRECIATION



Cost Parameters	Cost per Hectare-Rs	% (incl Depri.)	% (excl Depri.)
<u>A. Capital Cost</u>	<u>27,149</u>	<u>-</u>	<u>-</u>
<u>B. Recurrent Costs</u>			
Energy Charges	2,817	69.96%	78.46%
Depreciation/Maint.	687	17.06%	-
Direct Labor	466	11.58%	12.99%
Indirect Staff	57	1.40%	1.58%
Total Recurrent Cost (Including Depreciation)	4,027	100.00%	-
Repairs/Maintenance	250		6.97%
Total Recurrent Cost (Excluding Depreciation)	3,590		100.00%

Energy charges clearly stand out to be the major cost parameter of the recurrent cost. The effect of the head of lift irrigation schemes on the energy charges can be analyzed as follows:

Scheme	Head	Energy Charges Per Hectare (Rs)	Capital Cost Per Hectare (Rs)
Basal Basola	42.25 meters	1,410	23,597
Sai Bhardvan	62.57 meters	2,685	27,812
Ghatti Nagchela	I-24.02 meters II-52.31 mts	2,097	27,323
Neri Jamli	I - 10.87 mts II-237.89 mts	4,769	26,510

It may be noted from the above mentioned cost details that the energy charges take a big leap for the Lift Irrigation Schemes which are above 150 meters. (there are only few completed LIS under HALWD and further the limited availability of time restricted the sample size). There is only one LIS approved by USAID, which has a lift of more than 155 meters i.e.; Neri Jamli and there are 3 schemes with a lift between 150 and 155 meters. Not much variation was observed for the capital cost per hectare among the 8 schemes reviewed with head ranging from 42.25 meters to 237.89 meters.

Prima facie it seems that high lift schemes (i.e., substantially over 150 meters) are motivated more by the social objective rather than the economic returns. In one of the state sector LIS, it was observed that State had spent almost Rs 55,929 per hectare (excluding chak development costs, which is approx. Rs.14,437 per hectare in addition to the capital cost) with current CCA of only 32 hectares. The actual recurrent cost of the scheme (including depreciation) worked out to Rs. 8,568 per hectare per year. (Ref: Panesh Kanda LIS, Shimla Division, Head-285 meters). Total collection from farmers under this scheme during the year 1987-88 was approx. Rs. 350/- and even this meagre collection goes into the State treasury and not to the irrigation department.

3.2.2 IRR, although a very good indicator of financial viability of any activity has its limitations in terms of unrealistic assumptions, inflated benefits etc. IRR is better suited for prioritizing 2 or 3 options worked out on the same set of assumptions. The sole criteria for selection of an irrigation scheme under HALWD project that is IRR greater than 12%, it is suggested that efforts be made to negotiate additional criteria for LIS like:

a) Capital cost per hectare not to exceed Rs. 32,000/- per hectare.

b) Projected recurrent costs per hectare not to exceed Rs.3600 (excluding depreciation) per hectare per year.

The above limitations will probably keep the maximum lift below 150 meters and will also ensure that the schemes are cost effective in terms of capital invested and future recurring liability.

3.2.3 Although the scheme at Badhera has an IRR as high as 20.72 % and even the head is only 73.72 meters, but this scheme will have recurrent cost as high as Rs.5,503 per hectare as against the scheme of Ghatti Nagchela with a head of 152.31 meters and having a recurrent cost liability of only Rs.3,262 per hectare. The reason for this difference is that the Badhera scheme is catering to only 15 hectares. Thus, even lower coverage in terms of CCA can be a cause for high recurrent costs. Therefore, it is suggested that the following steps may be considered with regard to coverage:

- a) Prescribe minimum coverage under lift and flow irrigation schemes; and
- b) Link lift schemes over 100 meters with higher coverage to offset the effect of higher recurrent costs of such schemes.

3.2.4 The recurrent costs of LIS stand no comparison with FIS, because the gravitational force in the latter substitutes expensive energy charges and further even the element of repairs is negligible. Thus, the cost parameters for operating flow irrigation schemes are a) direct labor (approx. 50% of LIS labor costs); and b) Depreciation and repairs on civil works and distribution system. The recurrent cost of a flow irrigation schemes will average approx. Rs.700-800 per hectare (includes depreciation) against an average recurrent costs of Rs 4,000 per hectare (includes depreciation) for lift irrigation schemes. The capital cost of flow irrigation scheme may average Rs. 20,000 (includes chak development) against Rs. 30,000 for lift irrigation schemes.

4.0 STATE BUDGET ANALYSIS:

4.1 The maintenance and operation cost of the irrigation schemes are budgeted under "Non-Plan" budget with a very negligible amount under "Plan" portion. The "Plan" budget usually comprises of the

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capital costs for irrigation schemes. Upto 1987-88 GOHP had also included certain maintenance costs in the "Plan" budget, however effective 1988-89 GOI has clearly instructed GOHP to exclude maintenance costs from the "Plan" budget. The State budgeting of maintenance costs is not based upon the number of operational irrigation schemes but is based upon the past year actuals adjusted for inflation and additional area brought under irrigation. GOHP budgeting norms for maintenance of irrigation schemes are very low. IPH recommendation to the ninth finance commission for maintenance costs are Rs. 289 per hectare for gravity schemes and Rs. 1,023 per hectare for lift irrigation schemes. The ID meets its higher maintenance cost as against the lower budget provisions, the reply was that they make use of other budget line items like repairs of irrigation schemes due to natural calamities etc. Detailed in attachment 'B' is a comparison of the budget provisions and the actual expenditure incurred by the irrigation department since 1983-84 under "Non-Plan" for operations and maintenance of minor irrigation schemes.

The budget v/s actual comparison can be summarized as follows:

Year	Budget Amount	Actual Expend.	Shortfall/Excess Provision
	(Rs in millions)		
1983-84	12.500	12.336	1.3%
1984-85	13.085	14.546	-11.2%
1985-86	19.839	19.260	2.9%
1986-87	24.330	23.998	1.4%
TOTAL	69.754	70.140	- 0.6%

It may be noted that in the past four years the actual expenditure for maintenance and repairs have exceeded the budget estimates by only 0.6%. However, the Irrigation Department has a practice of submitting a revised budget estimate in the latter half of the

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fiscal year, and which is usually accepted by GOHP subject to fund availability. The revised budget estimates incorporate the additional fund requirements due to unforeseen circumstances.

- 4.2 The budget estimates for 1987-88 and 1988-89 under "Non-Plan" budget for maintenance and operation of minor irrigation schemes are as follows:

Type of Scheme	Original Estimate 1987-88	Revised Estimate 1987-88	Difference	Original Estimate 1988-89
------(Rs in millions)-----				
Lift Irr. Scheme	13.487	15.087	11.9%	14.162
Flow Irr. Scheme	6.176	6.676	8.1%	8.748
Tube Well	5.823	6.423	10.3%	6.114
TOTAL	25.486	28.186	10.6%	29.024

The revised budget estimate for 1988-89 is due in September-October 1988. The actual expenditure during the year 1986-87 was Rs 24 million and another 1,686 ha of CCA was irrigated during the same year. Breakdown of 1,686 ha into FIS and LIS is not available, thus using 2:1 PP ratio and average maintenance cost of recurrent cost analysis above (i.e., Rs 3,600 per hectare for LIS and Rs 230 for FIS), the combined average recurrent cost of LIS and FIS works out to Rs. 2,476 per hectare. Thus, additional requirement for 1987-88 is Rs 4.2 million, (i.e., Rs 2,476*1686 ha) adding an escalation of 7%, the actual expenditure during 1987-88 will be approx. Rs 30.2 million. The budgeted figure during 1987-88 is short by only 7% i.e., just the value of the escalation. However, as stated in para 4.1 above, the GOHP has been able to meet the cost overruns and, leaving unforeseen circumstances, should be able to do so in the future also.

ATTACHMENT A

SUMMARY STATEMENT FOR RECURRENT COST ANALYSIS FOR LIS/TH

DISTRICT	SCHEME	HECTARAGE	HEAD	ESTIMATED COST (Rs)	ACTUAL COST (Rs)	ENERGY CHARGES (Rs)	DEPRECIATION/ MAINTENANCE (Rs)	DIRECT LABOR (Rs)	INDIRECT STAFF (Rs)	RECURRENT COST (Rs) (INCL DEPR)	RETARDS (Rs)	PERMANENT COST (Rs) (INCL DEPR)
Bilaspur	Heri Janli LIS	105	1-10.07 meters	2,700,000	2,703,500	500,724	92,059	30,600	15,000	638,383	30,450	574,714
			11-237.07 meters									
			Civil works	(1,129,725)								
			R/Main	(671,050)								
			Pump & Mach	(706,925)								
Power Line	(275,000)											
Mandi	Sai Dhardwan LIS	227	62.57 meters	5,770,400	6,313,260	607,546	148,588	47,800	4,700	810,634	57,570	712,474
			Civil works	(4,055,721)								
			R/Main	(702,005)								
			Pump & Mach	(263,071)								
Power Line	(212,363)											
Mandi	Ghalli Nagchala LIS	124	1-24.02 meters	3,075,000	3,300,000	260,073	84,173	57,677	2,600	404,525	29,054	377,119
			11-152.31 meters									
			Civil works	(1,777,414)								
			R/Main	(760,527)								
			Pump & Mach	(333,632)								
Power Line	(506,425)											
Una	Basal Basola LIS	30	42.25 meters	731,270	707,905	42,300	16,540	32,670	2,405	93,915	7,244	64,117
			Civil works	(507,012)								
			R/Main	(43,500)								
			Pump & Mach	(47,776)								
Power Line	(25,577)											

DISTRICT	SCHEME	HECTARE	PLAD	ESTIMATED COST (Rs)	ACTUAL COST (Rs)	ENERGY CHARGES (Rs)	DEPRECIATION/ MAINTENANCE (Rs)	DIRECT LABOR (Rs)	INDIRECT STAFF (Rs)	RECURRENT COST (Rs) (INCL DEPR)	REPAIRS (Rs)	EQUIPMENT COST (Rs) (INCL DEPR)
Una	Badhera	15 73.72	acres	420,460	417,320	43,792	10,827	26,730	1,202	82,553	3,895	75,557
				Civil works	(237,306)							
				R/Main	(82,797)							
				Pump & Mach	(47,099)							
				Power Line	(40,217)							
Una	Harroh	31 71.04	acres	746,370	707,000	75,168	16,116	26,730	2,485	120,477	5,377	110,300
				Civil works	(454,047)							
				R/Main	(77,326)							
				Pump & Mach	(66,609)							
				Power Line	(107,025)							
Una	Sannal	32 72.64	acres	860,300	869,369	77,305	21,571	32,670	2,565	134,131	6,815	117,774
				Civil works	(447,137)							
				R/Main	(239,335)							
				Pump & Mach	(67,946)							
				Power Line	(119,949)							
Una	Daluhi	37.60 74.06	acres	1,216,350	1,211,027	91,799	24,727	26,730	3,181	146,429	19,542	152,500
				Civil works	(884,632)							
				R/Main	(79,309)							
				Pump & Mach	(57,599)							
				Power Line	(177,305)							
TOTAL		603.60			Rs. 16,387,172	Rs. 1,709,678	Rs. 414,623	Rs. 281,607	Rs. 34,138	Rs. 2,431,068	Rs. 151,177	Rs. 2,142,707
PER HECTARE COST					Rs. 27,147	Rs. 2,817	Rs. 687	Rs. 466	Rs. 57	Rs. 4,027	Rs. 250	Rs. 3,501

Attachment B

BUDGETED AND ACTUAL EXPENDITURE UNDER "NON-PLAN"
FOR MAINTAINENCE ON MINOR IRRIGATION SCHEMES

(Rs in Millions)

	1983-84			1984-85			1985-86			1986-87		
	Budget	Actual	Diff	Budget	Actual	Diff	Budget	Actual	Diff	Budget	Actual	Diff
LIS	7.2	6.578	0.86%	7.485	8.090	- 8.08%	10.859	10.654	1.88%	12.902	12.689	1.65%
FIS	2.9	2.942	-1.44%	3.000	3.111	- 3.70%	4.650	4.115	11.50%	5.882	5.050	14.14%
TW	2.4	2.816	-17.33%	2.600	3.345	-28.65%	4.330	4.491	-3.72%	5.546	6.259	-12.85%
	12.5	12.336	1.31%	13.085	14.546	-11.16%	19.839	19.260	2.92%	24.330	23.998	1.36%

ATTACHMENT C

YEAR	HECTARAGE		RATE PER HECTARE		EXPENDITURE			RECURRENT COST	
	ID	CD	ID	CD	ID	CD	TOTAL	RATE PER HECTARE	RECURRENT COST
			(RS 000,000)		(RS 000,000)			(RS 000,000)	(RS 000,000)
ACTUALS =====									
1985-86	.25	105					10.521		
1986-87	1.150	2.001					41.453		
1987-88	1.800	1.650					65.546	0.00248 *	
PROJECTIONS =====									
1988-89	2.000	2.000	0.02053 **	0.00880 ***	41.066	17.600	58.666	0.00272	14
1989-90	2.500	5.000	0.02259	0.00960	56.466	48.400	104.866	0.00300	22
1990-91	2,500	5,000	0.02484	0.01065	62.112	53.240	115.352	0.00330	33
1991-92	2,500	6,000	0.02733	0.01171	68.324	70.277	138.600	0.00363	45
1992-93	2,525	6,000	0.03006	0.01288	75.907	77.304	153.212	0.00399	60
1993-94 (6 MONTHS)	0	3,244	0.03157	0.01353	0.000	43.086	43.086	0.00417	67
TOTAL (Rs)	15,000	31,000			303.075	310.707	732.102		236.661
							ESTIMATED CAPITAL COST		
							\$52.293		
							CAPITAL COST PLANNED IN THE FF		
							\$45.620		

NOTE: See attached notes

NOTES:

- i) COMF had planned the project targets with a premise that a two year extension will be approved by USAID. As the targets are not available for HALKO without extension, it is presumed that the targets will not be accelerated.
- ii) Inflation factor @ 10% has been used for calculating rate per hectare.
- iii) In the first three years of the project the majority of schemes completed are LIS. As of the day of the visit only 2-3 flow irrigation schemes were completed as against +30 of LIS. Thus, the fourth year is expected to give a mix of schemes more skewed towards FIS to achieve the PP ratio of 2:1 for LIS & FIS.
- * 10,000 ha for LIS @ Rs.3,600 per hectare (Average Recurrent Cost)
5,000 ha for FIS @ Rs.230 per hectare (Average Recurrent Cost)
Total Cost = Rs.37.2 million
Cost per hectare = Rs.2,476 per hectare i.e., 37.2 million/15,000 ha
- ** Estimated average capital cost rate as of 1987-88 is:
a) Irrigation Schemes:
LIS - Rs.22,000 (Excluding Chak Development)
FIS - Rs.12,000 (Excluding Chak Development)
- Total Project Capital Costs:
LIS 10,000 * Rs.22,000 = Rs 220 million
FIS 5,000 * 12,000 = Rs 60 million
- TOTAL Rs 280 million
- Cost per hectare Rs 18,667
Inflation @ 10% (1988-89) Rs.20,533
- *** b) Chak Development
Cost of chak development is approx.
Rs.8,000 per hectare for 1987-88
Using inflation factor @ 10% Cost of chak development = Rs.8,800 per hectare.