TABLE 3.6.26 OPTIMIZATION STUDY OF TAMUR NO.1 SCHEME (CASE II)

(23 of 31)

Item	Maximum Discharge (m^3/s)		80	120	170	250	(390)	630
Cost								
Total Construction Cost	Ct	$x10^6$US$	101	116	133	161	202	268
Annual Cost	C=0.169xCt	"	17.1	19.6	22.5	27.2	34.1	45.3
Benefit								
Maximum Output	P	MW	32	48	68	99.4	155	250
Annual Energy Output	W	$x10^6$kwh	243.9	323.8	405.1	513.7	683.1	876.0
Benefit	B=Px191.8(US$/kw) +Wx0.043(US$/kwh)	$x10^6$US$	16.6	23.1	30.5	41.2	59.1	85.6
B / C	-	-	0.97	1.18	1.36	1.51	1.73	1.89
B - C	-	$x10^6$US$	-0.4	3.5	8.0	13.9	25.0	40.3
Construction Cost								
Per kw	Ct/P	US$	3,156	2,417	1,956	1,620	1,303	1,072
Per kw	Ct/W	US$	0.414	0.358	0.328	0.313	0.296	0.306
Energy Cost		¢	7.00	6.05	5.55	5.30	5.00	5.17
Plant Factor		%	87	77	68	59	50	40
River Water Factor		%	22	30	37	47	63	83
Remarks		-	-	-	-	-	Adopted	-

TABLE 3.6.26
(24 of 31)

OPTIMIZATION OF TAMUR NO.2 SCHEME (CASE II)

Item	Maximum Discharge (m^3/s)		60	100	140	220	(340)	570
Cost								
Total Construction Cost	Ct	$x10^6$US$	63.5	75.9	87.3	111.3	144	203
Annual Cost	C=0.169xCt	"	10.7	12.8	14.8	18.8	24.3	34.3
Benefit								
Maximum Output	P	MW	21	35	49	78	120	202
Annual Energy Output	W	$x10^6$kwh	167.4	239.1	296.2	402.1	527.2	691.0
Benefit	B=Px191.8(US$/kW) +Wx0.043(US$/kWh)	$x10^6$US$	11.2	17.0	22.1	32.3	45.7	68.5
B / C	-	-	1.05	1.32	1.50	1.71	1.88	2.00
B - C	-	$x10^6$US$	0.5	4.2	7.4	13.4	21.3	34.1
Construction Cost								
Per kW	Ct/P	US$	3,024	2,169	1,782	1,427	1,200	1,005
Per kWh	Ct/W	US$	0.379	0.317	0.295	0.277	0.273	0.294
Energy Cost		¢	6.41	5.36	4.98	4.68	4.62	4.96
Plant Factor		%	91	78	69	59	50	39
River Water Factor		%	20	30	37	49	66	84
Remarks		-	-	-	-	-	Adopted	-

TABLE 3.6.26
(25 of 31)

OPTIMIZATION OF TAMUR NO.3 SCHEME (CASE II)

Item	Maximum Discharge (m^3/s)		50	80	120	180	(310)	460
Cost								
Total Construction Cost	Ct	$x10^6$US$	129	161	204	267	410	555
Annual Cost	C=0.169xCt	"	21.8	27.2	34.5	45.1	69.3	93.8
Benefit								
Maximum Output	P	MW	46	74	111	166	287	426
Annual Energy Output	W	$x10^6$kwh	370.7	525.1	690.4	887.0	1,258	1,567
Benefit	B=Px191.8(US$/kw) +Wx0.043(US$/kwh)	$x10^6$US$	24.8	36.8	51.0	70.0	109.1	149.1
B / C	-	-	1.14	1.35	1.48	1.55	1.58	1.59
B - C	-	$x10^6$US$	3.0	9.6	16.5	24.9	39.9	55.3
Construction Cost								
Per kw	Ct/P	US$	2,804	2,176	1,838	1,608	1,429	1,303
Per kwh	Ct/W	US$	0.348	0.307	0.295	0.301	0.326	0.354
Energy Cost		¢	5.88	5.18	4.99	5.09	5.51	5.99
Plant Factor		%	92	81	71	61	50	42
River Water Factor		%	20	28	37	49	68	84
Remarks		-	-	-	-	-	Adopted	-

TABLE 3.6.26
(26 of 31)

OPTIMIZATION STUDY OF TAMUR No.4 SCHEME

Item	Maximum Discharge (m^3/s)		31	46	(67)	97	153
Cost							
Total Construction Cost	Ct	$x10^6$US$	53.2	68.9	90.3	120	173
Annual Cost	C=0.169xCt	"	8.99	11.64	15.3	20.3	29.2
Benefit							
Maximum Output	P	MW	24	35	51	74	116
Annual Energy Output	W	$x10^6$kWh	199.8	272.5	356.1	453.1	606.3
Benefit	B=Px191.8(US$/kW) +Wx0.043(US$/kWh)	$x10^6$US$	13.2	18.4	25.1	33.7	48.3
B / C	-	-	1.47	1.58	1.64	1.66	1.65
B - C	-	$x10^6$US$	4.20	6.79	9.8	13.4	19.1
Construction Cost							
Per kW	Ct/P	US$	2,217	1,969	1,771	1,622	1,491
Per kWh	Ct/W	US$	0.266	0.253	0.254	0.265	0.285
Energy Cost		¢	4.50	4.27	4.29	4.48	4.82
Plant Factor		%	95	89	80	70	60
River Water Factor		%	16	21	28	36	48
Remarks		-	-	-	Adopted	-	-

TABLE 3.6.26
(27 of 31)

ECONOMIC EVALUATION OF ARUN No.1 SCHEME (Case I)

Item	Maximum Discharge (m^3/s)		140	160	180	230	300	430	610	(180) (Restudy)
Cost										
Total Construction Cost	Ct	$x10^6$US$	184	206	230	291	370	511	707	254
Annual Cost	C=0.169xCt	"	31.1	34.8	38.9	49.2	62.5	86.4	119.6	42.9
Benefit										
Maximum Output	P	MW	101	115	129	165	215	309	438	146
Annual Energy Output	W	$x10^6$kwh	863	956	1,030	1,201	1,415	1,731	2,034	1,166
Benefit	B=Px191.8(US$/kW) +Wx0.043(US$/kWh)	x 10^6US$		56	63	69	102	134	171	78.1
B / C	-	-	1.80	1.81	1.77	1.69	1.63	1.55	1.44	1.82
B - C	-	$x10^6$US$	24.9	28.2	30.1	33.8	39.5	47.6	52.0	35.2
Construction Cost										
Per kW	Ct/P	US$	1,822	1,791	1,783	1,764	1,721	1,654	1,614	1,740
Per kWh	Ct/W	"	0.213	0.215	0.223	0.242	0.261	0.295	0.348	0.218
Energy Cost	-	¢	3.60	3.64	3.78	4.10	4.42	4.99	5.85	3.68
Plant Factor		%	98	95	91	83	75	64	53	91
River Water Factor		%	33	37	41	48	55	67	81	41
Remarks		-			Preliminary Comparison					Adopted

TABLE 3.6.26
(28 of 31)

OPTIMIZATION STUDY OF ARUN NO.1 SCHEME (CASE II)

Item	Maximum Discharge (m^3/s)		140	160	180	230	300	430	610	930	1,200
Cost											
Total Construction Cost	Ct	$x10^6$US$	269	297	331	405	512	657	908	1,314	1,698
Annual Cost	C=0.169xCt	"	45.5	50.2	55.9	68.4	86.5	111	153	222	287
Benefit											
Maximum Output	P	MW	98.4	112	127	162	211	302	429	654	844
Annual Energy Output	W	$x10^6$KWH	845	936	1,009	1,176	1,386	1,695	1,991	2,348	2,439
Benefit	B=Px191.8(US$/KW) +Wx0.043(US$/KWH)	x 10^6US$	55.2	61.7	67.7	81.6	99.3	131	168	226	
B / C -		-	1.21	1.23	1.21	1.19	1.15	1.18	1.10	1.02	0.93
B - C -		$x10^6$US$	9.7	11.5	11.8	13.2	12.8	20	15	4	-20
Construction Cost											
Per kw	Ct/P	US$	2,734	2,652	2,606	2,500	2,427	2,175	2,117	2,009	2,012
Per kwh	Ct/W	US$	0.318	0.317	0.328	0.344	0.369	0.388	0.456	0.560	0.696
Energy Cost		¢	5.38	5.36	5.54	5.82	6.24	6.55	7.68	9.45	11.8
Plant Factor		%	98	95	91	83	75	64	53	41	33
River Water Factor		%	33	37	41	48	55	67	81	95	
Remarks		-	-	-	Adopted	-	-	-	-	-	-

TABLE 3.6.26 OPTIMIZATION OF SAPT KOSI HIGHDAM (H=239m)
(29 of 31)

Item	Maximum Discharge (m^3/s)		1,500	1,850	2,000	(2,500)	3,000	3,500
Cost								
Total Construction Cost	Ct	$x10^6$US$	2,208	2,357	2,420	2,721	3,205	3,570
Annual Cost	C=0.169xCt	"	373.2	398.3	409.0	459.8	541.6	603.3
Benefit								
Maximum Output	P	MW	2,093	2,582	2,791	3,489	4,186	4,884
Annual Energy Output	W	$x10^6$kwh	13,018	14,476	14,914	16,810	18,335	19,253
Benefit	B=Px191.8(US$/kw) +Wx0.043(US$/kwh)	$x10^6$US$	961	1,118	1,177	1,392	1,591	1,765
B / C	-	-	2.58	2.81	2.88	3.03	2.94	2.93
B - C	-	$x10^6$US$	558	720	768	932	1,049	1,162
Construction Cost								
Per kw	Ct/P	US$	1,055	913	867	780	766	731
Per kwh	Ct/W	US$	0.170	0.163	0.162	0.162	0.175	0.185
Energy Cost		¢	2.87	2.75	2.74	2.74	2.95	3.13
Plant Factor		%	71	64	61	55	50	45
River Water Factor		%	65	73	75	84	91	96
Remarks		-	-	-	-	Adopted	-	-

TABLE 3.6.26 OPTIMIZATION OF SAPT KOSI HIGH DAM (H=269m)
(30 of 31)

Item	Maximum Discharge (m^3/s)		1,500	1,850	2,000	2,500	3,000	3,500
Cost								
Total Construction Cost	Ct	$x10^6$US$	2,845	2,998	3,075	3,400	3,921	4,317
Annual Cost	C=0.169xCt	"	480.8	506.7	519.7	574.6	662.6	729.6
Benefit								
Maximum Output	P	MW	2,338	2,884	3,118	3,897	4,676	5,455
Annual Energy Output	W	$x10^6$kwh	16,590	18,215	18,846	20,483	21,300	21,981
Benefit	B=Px191.8(US$/kw) +Wx0.043(US$/kwh)	$x10^6$US$	1,162	1,336	1,408	1,628	1,813	1,991
B / C	-	-	2.42	2.64	2.71	2.83	2.74	2.73
B - C	-	$x10^6$US$	681	829	888	1,053	1,150	1,261
Construction Cost								
Per kw	Ct/P	US$	1,217	1,040	986	872	839	791
Per kw	Ct/W	US$	0.171	0.165	0.163	0.166	0.184	0.196
Energy Cost		¢	2.90	2.78	2.76	2.81	3.11	3.32
Plant Factor		%	81	72	69	60	52	46
River Water Factor		%	75	82	84	92	96	98
Remarks		-	-	-	-	Adopted	-	-

TABLE 3.6.26 OPTIMIZATION OF STUDY OF SAPT KOSI HIGH DAM (H=299m)

(31 of 31)

Item	Maximum Discharge (m^3/s)		1,500	1,850	2,000	2,500	3,000	3,500
Cost								
Total Construction Cost	Ct	$x10^6$US$	3,628	3,825	3,872	4,220	4,795	5,219
Annual Cost	C=0.169xCt	"	613.1	646.4	654.4	713.2	810.4	882.0
Benefit								
Maximum Output	P	MW	2,584	3,187	3,445	4,307	5,168	6,030
Annual Energy Output	W	$x10^6$kwh	21,051	22,334	22,935	24,147	24,447	24,827
Benefit	B=Px191.8(US$/kw) +Wx0.043(US$/kwh)	$x10^6$US$	1,401	1,572	1,647	1,864	2,042	2,224
B / C	-	-	2.29	2.43	2.52	2.61	2.52	2.52
B - C	-	$x10^6$US$	788	926	993	1,151	1,232	1,342
Construction Cost								
Per kw	Ct/P	US$	1,404	1,200	1,124	980	928	866
Per kw	Ct/W	US$	0.172	0.171	0.169	0.175	0.196	0.210
Energy Cost		¢	2.91	2.89	2.85	2.95	3.31	3.55
Plant Factor		%	93	80	76	64	54	47
River Water Factor		%	85	91	93	98	99	100
Remarks		-	-	-	-	Adopted	-	-

TABLE 3.6.27
(1 of 8)

ECONOMIC EVALUATION OF HYDROELECTRIC POWER SCHEME

Item		Unit	Sun Kosi River					DUDH KOSI RIVER	
			No .1	No .2	No .3	No .4	Total	No .1	No .2
Maximum Discharge	Qmax	m^3/s	1,400	1,050	570	53	-	300	50
Cost									
Power Station			1,001	992	576	114	2,683	394	105
Access Road	Ct	$x10^6$US$	32	35	6	3	(50)	55	61
Total Construction Cost			1,033	1,027	582	117	2,733	449	166
Annual Cost	C=0.169xCt	"	175	174	98	201	462	76	28
Benefit									
Maximum Output	P	MW	1,357	1,110	536	26	3,029	228	87
Annual Energy Output	W	$x10^6$kwh	4,640	4,760	2,070	181	11,651	978	690
Benefit	B*	$x10^6$US$	460	418	192	13	1,082	86	46
B - C	-	-	2.63	2.41	1.95	0.65	2.34	1.13	1.65
B - C	-	$x10^6$US$	285	244	93	-7	620	10	18
Construction Cost									
Per KW	Ct/P	US$/KW	737	925	1,086	4,500	902	1,969	1,908
Per kWH	Ct/W	US$/KWh	0.222	0.216	0.281	0.646	0.235	0.459	0.241
Energy Cost	-	cent/KWh	3.76	3.65	4.75	10.92	3.96	7.76	4.07

TABLE 3.6.27
(2 of 8)

ECONOMIC EVALUATION OF HYDROELECTRIC POWER SCHEME

Item		Unit	Dudh Kosi River								
			No.3	No.4	No.5	No.6	No.7	No.8	No.9	No.10	Total
Maximum Discharge	Qmax	m^3/s	45	32	30	30	29	26	26	25	-
Cost											
Power Station			66	58	72	49	74	67	66	47	998
Access Road	Ct	$x10^6$US$	63	65	68	70	72	73	75	77	(77)
Total Construction Cost			129	123	140	119	146	140	141	124	(1,075)
Annual Cost	C=0.169xCt	"	22	21	24	20	25	24	24	21	(182)
Benefit											
Maximum Output	P	MW	48	46	73	36	89	93	63	49	812
Annual Energy Output	W	$x10^6$kwh	381	367	580	286	704	740	501	388	5,615
Benefit	B*	$x10^6$US$	26	25	39	19	47	50	34	26	397
B / C	-	-	1.17	1.18	1.65	0.95	1.92	2.10	1.41	1.24	2.19
B - C	-	$x10^6$US$	4	4	15	-1	23	26	10	5	216
Construction Cost											
Per kw	Ct/P	US$	2,688	2,674	1,918	3,306	1,640	1,505	2,238	2,531	1,324
Per kwh	Ct/W	"	0.339	0.335	0.241	0.416	0.207	0.189	0.281	0.320	0.191
Energy Cost	-	¢	5.72	5.66	4.08	7.03	3.50	3.20	4.76	5.40	3.24

TABLE 3.6.27 ECONOMIC EVALUATION OF HYDROELECTRIC POWER SCHEME
(3 of 8)

Item		Unit	Likhu Khola					Maulung Khola
			No.1	No.2	No.3	No.4	Total	-
Maximum Discharge	Qmax	m^3/s	23	21	19	17	-	9
Cost								
Power Station			45	39	44	29	157	31
Access Road	Ct	$x10^6$US$	39	42	44	46	(46)	48
Total Construction Cost			84	81	88	75	(203)	79
Annual Cost	C=0.169xCt	"	14	14	15	13	(34)	13
Benefit								
Maximum Output	P	MW	21	17	31	25	94	13
Annual Energy Output	W	$x10^6$kwh	145	118	213	176	652	91.5
Benefit	B*	$x10^6$US$	10.3	8.3	15	12	46	6.4
B / C	-	-	0.72	0.61	1.02	0.98	1.34	0.48
B - C	-	$x10^6$US$	-3.9	-5.4	0	0	12	-6.9
Construction Cost								
Per kw	Ct/P	US$	4,000	4,765	2,839	3,000	2,160	6,077
Per kwh	Ct/W	"	0.579	0.686	0.413	0.426	0.311	0.86
Energy Cost	-	¢	9.79	11.60	6.98	7.20	5.26	14.6

TABLE 3.6.27 ECONOMIC EVALUATION OF HYDROELECTRIC POWER SCHEME
(4 of 8)

Item		Unit	Tama Kosi River						Khimte Khola		
			No.2	No.3	No.4	No.5	No.6	Total	No.1	No.2	Total
Maximum Discharge	Qmax	m^3/s	150	150	140	60	58	-	10	9	-
Cost											
Power Station			240	204	258	105	102	909	58	24	82
Access Road	Ct	$x10^6$US$	5	2	5	9	11	(11)	8	9	(9)
Total Construction Cost			245	206	263	114	113	(920)	66	33	(91)
Annual Cost	C=0.169xCt	"	41	35	44	19	19	(155)	11.2	5.6	(15)
Benefit											
Maximum Output	P	MW	196	123	126	102	113	660	49	22	71
Annual Energy Output	W	$x10^6$kWh	1,013	603	624	615	686	3,514	344	154	498
Benefit	B*	$x10^6$US$	81	50	51	46	51	279	24	11	35
B / C	-	-	1.98	1.42	1.15	2.39	2.68	1.80	2.14	1.94	2.33
B - C	-	$x10^6$US$	40	15	7	27	32	124	12.8	5.3	20
Construction Cost											
Per kw	Ct/P	US$	1,250	1,675	2,087	1,118	1,000	1,394	1,347	1,500	1,282
Per kwh	Ct/W	"	0.241	0.342	0.421	0.185	0.165	0.260	0.192	0.214	0.183
Energy Cost	-	¢	4.05	5.77	7.12	3.13	2.78	4.38	3.26	3.62	3.01

TABLE 3.6.27
(5 of 8)

ECONOMIC EVALUATION OF HYDROELECTRIC POWER SCHEME

Item		Unit	Bhote Kosi River			Balephi Khola	Rosi Khola				
			No.1	No.2	Total	-	No.1	No.2	No.3	No.4	Total
Maximum Discharge	Qmax	m^3/s	34	32	-	17	13	11	7	5	-
Cost											
Power Station			89	93	182	62	40	38	36	22	136
Access Road	Ct	$x10^6$US$	0	0	0	7	2	5	8	9	(9)
Total Construction Cost			89	93	(182)	69	42	43	44	31	(145)
Annual Cost	C=0.169xCt	"	15	16	(31)	11.7	7.1	7.3	7.4	5.2	(25)
Benefit											
Maximum Output	P	MW	64	69	133	34	16	13	12	10	51
Annual Energy Output	W	$x10^6$kwh	444	480	924	233	97	76	73	61	307
Benefit	B*	$x10^6$US$	31	34	65	17	7.2	5.8	5.4	4.5	23
B / C	-	-	2.09	2.16	2.10	1.42	1.02	0.79	0.73	0.87	0.94
B - C	-	$x10^6$US$	16	18	34	4.9	0.1	-1.5	-2.0	-0.7	-1.5
Construction Cost											
Per kw	Ct/P	US$	1,388	1,348	1,368	2.029	2,625	3,308	3,667	3,100	2,843
Per kwh	Ct/W	"	0.200	0.194	0.197	0.296	0.433	0.566	0.603	0.508	0.472
Energy Cost	-	¢	3.38	3.27	3.35	5.00	7.32	9.56	10.19	8.59	7.98

TABLE 3.6.27 ECONOMIC EVALUATION OF HYDROELECTRIC POWER SCHEME

(6 of 8)

Item		Unit	Indrawati River				Kabeli Nadi			
			No.1	No.2	No.3	Total	No.1	No.2	NO.3	Total
Maximum Discharge	Qmax	m^3/s	110	23	12	-	12	7	4	-
Cost										
Power Station			158	67	34	259	38	32	18	88
Access Road	Ct	$x10^6$US$	3	7	8	(8)	33	36	38	(38)
Total Construction Cost			161	74	42	(267)	71	68	56	(126)
Annual Cost	C=0.169xCt	"	27	13	7.1	(45)	12.0	11.5	9.5	(21)
Benefit										
Maximum Output	P	MW	58	33	25	116	15	15	12	42
Annual Energy Output	W	$x10^6$kWh	249	234	172	655	109	105	81	295
Benefit	B*	$x10^6$US$	22	16	12	50	7.6	7.4	5.8	21
B / C	-	-	0.80	1.31	1.72	1.12	0.63	0.64	0.61	0.97
B - C	-	$x10^6$US$	31	81	86	24	67	83	401	932
Construction Cost										
Per kW	Ct/P	US$	-5	4	5.1	5	-4.4	-4.1	-3.7	-1
Per kWh	Ct/W	"	0.647	0.316	0.24	0.408	0.651	0.648	0.691	0.42
Energy Cost	-	¢	10.93	5.34	4.13	6.89	11.01	10.94	11.68	7.22

TABLE 3.6.27
(7 of 8)

ECONOMIC EVALUATION OF HYDROELECTRIC POWER SCHEME

Item		Unit	Tamur River										
			No.1 Case-I	No.1 Case-II	No.2 Case-II	No.3 Case-I	No.3 Case-II	No.4	No.5	No.6	No.7	Total Case-I	Total Case-II
Maximum Discharge	qmax	m^3/s	650	390	340	310	310	67	55	53	52	-	-
Cost			838	202	144	166	410	90	95	91	100	1,380	1,132
Access Road	Ct	$x10^6$US$	8	8	20	28	28	32	34	36	38	(38)	(38)
Total Construction Cost			846	210	164	194	438	122	129	127	138	(1,418)	(1,170)
Annual Cost	C=0.169xCt	"	143	35	28	33	74	21	22	21	23	(240)	(198)
Benefit													
Maximum Output	P	MW	696	155	120	186	287	51	70	76	101	1,180	860
Annual Energy Output	W	$x10^6$kWh	2,750	683	527	812	1,258	356	489	535	705	5,647	4,553
Benefit	B*	$x10^6$US$	252	59	46	71	109	25	34	38	50	469	361
B/C	-	-	1.76	1.67	1.65	2.15	1.47	1.22	1.58	1.75	2.13	1.96	1.82
B-C	-	$x10^6$US$	109	24	18	38	36	4	13	16	26	230	163
Construction Cost													
Per kW	Ct/P	US$	1,216	1,355	1,367	1,043	1,526	2,392	1,843	1,671	1366	1,202	1,360
Per kWh	Ct/W	"	0.308	0.307	0.311	0.239	0.348	0.343	0.264	0.237	0.196	0.251	0.257
Energy Cost	-	¢	5.20	5.20	5.26	4.04	5.88	5.79	4.46	4.01	3.31	4.24	4.34

TABLE 3.6.27 ECONOMIC EVALUATION OF HYDROELECTRIC POWER SCHEME
(8 of 8)

Item		Unit	Arun River							Sapt Kosi
			No.1	No.2	No.3	No.4	No.5	No.6	Total	-
Maximum Discharge	Qmax	m^3/s	180	160	156	154	153	151	-	2,500
Cost										
Power Station			254	261	234	263	207	210	1,369	2,721
Access Road	Ct	$x10^6$US$	23	31	34.5	41	48	55	(55)	-
Total Construction Cost			277	292	268.5	244	255	265	(1,424)	2,721
Annual Cost	C=0.169xCt	"	47	49	45	41	43	45	(241)	460
Benefit										
Maximum Output	P	MW	146	239	240	120	202	238	1,185	3,489
Annual Energy Output	W	$x10^6$kWh	1,166	1,967	1,965	982	1,650	1,914	9,644	16,810
Benefit	B*	$x10^6$US$	78	130	131	65	110	128	642	1,392
B / C	-	-	1.66	2.65	2.91	1.59	2.56	2.84	2.66	3.03
B - C	-	$x10^6$US$	31	81	86	24	67	83	401	932
Construction Cost										
Per kW	Ct/P	US$	1,897	1,222	1,119	2,033	1,262	1,113	1,202	780
Per kWh	Ct/W	"	0.238	0.148	0.137	0.248	0.555	0.138	0.148	0.162
Energy Cost	-	¢	4.03	2.49	2.29	4.18	2.61	2.35	2.50	2.74

TABLE 3.6.28 ACCESS ROAD PLANNING FOR EACH SCHEME
(1 of 5)

Site	Existing Road From / Via	Dis-tance (km)	Access Road Via	Dis-tance (km)	Construc-tion Cost (10^6 US$)	Remarks
SUN KOSI RIVER						
Sun Kosi						
No. 1	Kathmandu / Sindhuli	51	Sun Kosi No. 2, 3	70	32.0	
No. 2	Kathmandu / Dhulikhel	51	Sun Kosi No. 3	107	33.2	
No. 3	Kathmandu / Dhulikhel	51		20	6.2	
No. 4	Kathmandu / Dhulikhel	65		9	2.8	51+14=65km
DUDH KOSI RIVER						
Dudh Kosi						
No. 1	Kathmandu / Dhulikhel	51	Sun Kosi No. 2, 3	177 (28)	54.9	Figures in ( ) show the distance from the confluence of the Sun Kosi and Dudh Kosi rivers to each site.
No. 2	Kathmandu / Dhulikhel	51	Sun Kosi No. 2, 3	197 (48)	61.1	
No. 3	Kathmandu / Dhulikhel	51	Sun Kosi No. 2, 3	203 (54)	62.9	
No. 4	Kathmandu / Dhulikhel	51	Sun Kosi No. 2, 3	209 (60)	64.8	
No. 5	Kathmandu / Dhulikhel	51	Sun Kosi No. 2, 3	220 (21)	68.2	
No. 6	Kathmandu / Dhulikhel	51	Sun Kosi No. 2, 3	226 (77)	70.1	
No. 7	Kathmandu / Dhulikhel	51	Sun Kosi No. 2, 3	231 (82)	71.6	
No. 8	Kathmandu / Dhulikhel	51	Sun Kosi No. 2, 3	236 (87)	73.2	
No. 9	Kathmandu / Dhulikhel	51	Sun Kosi No. 2, 3	243 (94)	75.3	
No. 10	Kathmandu / Dhulikhel	51	Sun Kosi No. 2, 3	248 (98)	76.9	

TABLE 3.6.28 (2 of 5) ACCESS ROAD PLANNING FOR EACH SCHEME

Site	Existing Road: From / Via	Existing Road: Distance (km)	Access Road: Via	Access Road: Distance (km)	Construction Cost (10^6 US$)	Remarks
UKHU KHOLA						
Likhu Khola						
No. 1	Kathmandu / Dhulikhel	51	Sun Kosi / No. 2, 3	126 (13)	39.1	Figures in ( ) show the distance from the confluence of the Sun Kosi and Likhu rivers to each site.
No. 2	Kathmandu / Dhulikhel	51	Sun Kosi / No. 2, 3	135 (22)	41.9	
No. 3	Kathmandu / Dhulikhel	51	Sun Kosi / No. 2, 3	143 (30)	44.3	
No. 4	Kathmandu / Dhulikhel	51	Sun Kosi / No. 2, 3	147 (34)	45.6	
MAULUNG KHOLA						
Maulung Khola	Kathumandu / Dhulikhel	51	Sun Kosi / No. 2, 3	154 (15)	47.7	Same as above
TAMA KOSI RIVER						
Tama Kosi						
No. 1	Kathmandu / Dhulkhel / Charikot	133	Tama Kosi / No. 2, 3	21	6.5	
No. 2	Kathmandu / Dhulkhel / Charikot	133	Tama Kosi / No. 2	15	4.7	
No. 3	Kathmandu / Dhulkhel / Charikot	133	4+1=5	6	1.9	
No. 4	Kathmandu / Dhulkhel / Charikot	127		15	4.7	
No. 5	Kathmandu / Dhulkhel / Charikot	127	Tama Kosi / No. 4	30	9.3	
No. 6	Kathmandu / Dhulkhel / Charikot	127	Tama Kosi / No. 4, 5	36	11.2	

TABLE 3.6.28 ACCESS ROAD PLANNING FOR EACH SCHEME
(3 of 5)

Site	Existing Road From / Via	Dis-tance (km)	Access Road Via	Dis-tance (km)	Construc-tion Cost (10^6 US$)	Remarks
KHIMTE KHOLA						
Khimte Khola						
No. 1	Kathmandu Dhulikhel Charikot	133	Tama Kosi No. 2, 3	25 (10)	7.8	Figures in ( ) show the distance from the confluence of the Sun Kosi and Likhu rivers to each site.
No. 2	Kathmandu Dhulikhel Charikot			30 (15)	9.3	
BHOTE KOSI RIVER						
Bhote Kosi						
No. 1	Kathmandu Dhulikhel		Camosangu	0	0	
No. 2	Kathmandu Dhulikhel		Camosangu	0	0	
BALEPHI KHOLA						
Balephi	Kathmandu Dhulikhel	65	Sun Kosi No. 4	24 (15)	7.4	

TABLE 3.6.28 (4 of 5)

ACCESS ROAD PLANNING FOR EACH SCHEME

Site	Existing Road From	Via	Dis-tance (km)	Access Road Via	Dis-tance (km)	Construc-tion Cost (10^6 US$)	Remarks
ROSI KHOLA							
Rosi Khola							
No. 1	Kathmandu	Panauti	51	Sun Kosi No. 2	6	1.9	
No. 2	Kathmandu	Panauti	35	Rosi Khola No. 3, 4	16	5.0	
No. 3	Kathmandu	Panauti	35	Rosi Khola No. 4	27	8.4	
No. 4	Kathmandu	Panauti	35		28	8.7	
INDRAWATI RIVER							
Indrawati							
No. 1	Kathmandu	Dhulikhel	43	Indrawati No. 1, 2	20	3.2	
No. 2	Kathmandu	Dhulikhel	43	Indrawati No. 1	43	6.9	
No. 2	Kathmandu	Dhulikhel	43		51	8.2	
TAMUR RIVER							
Tamur No. 1	Dharan	Dhankuta	7		25	7.8	
No. 2	Dharan	Dhankuta	7	Tamur No. 1	65	20.2	
No. 3	Dharan	Dhankuta	7	Tamur No. 2	89	27.6	
No. 4	Dharan	Dhankuta	7	Tamur No. 3	103	31.9	
No. 5	Dharan	Dhankuta	7	Tamur No. 4	109	33.8	
No. 6	Dharan	Dhankuta	7	Tamur No. 5	116	36.0	
Tamur No. 7	Dharan	Dhankuta	7		122	37.8	

TABLE 3.6.28 ACCESS ROAD PLANNING FOR EACH SCHEME
(5 of 5)

Site		Existing Road From	Via	Dis-tance (km)	Access Road Via	Dis-tance (km)	Construc-tion Cost (10^6 US$)	Remarks
KABELI NADI								
Kabeli Nadi								
	No. 1	Dharan	Dhankuta Tamur	7	Tamur No. 3	105 (16)	32.6	Figures in ( ) show distance from the confluence of the Tamur and Kabeli rivers to each site.
	No. 2	Dharan	Dhankuta Tamur	7	Tamur No. 3	115 (26)	35.7	
	No. 3	Dharan	Dhankuta Tamur	7	Tamur No. 3	122 (33)	37.8	
ARUN RIVER								
Arun	No. 1	Dharan	Dhankuta	0		72	23	
	No. 2	Dharan	Dhankuta	0	Arun No. 1	85	31	
	No. 3	Dharan	Dhankuta	0	Arun No. 2	99	34.5	
	No. 4	Dharan	Dhankuta	0	Arun No. 3	115	41	
	No. 5	Dharan	Dhankuta	0	Arun No. 4	135	48	
	No. 6	Dharan	Dhankuta	0		151	55	

TABLE 3.6.29 (1 of 6)

PRIORITY EVALUATION TABLE
KOSI MASTER PLAN STUDY

Reservoir Type / Name of River / Evaluated Items	Sapt Kosi	Sun Kosi SU-1	Sun Kosi SU-2	Sun Kosi SU-3
I. Economic Viability				
1.1 Unit Cost of Power	50	40	40	40
1.2 B/C Ratio	50	40	30	20
1.3 Compliance to National Need (Size of Project)	18	18	18	18
1.4 Employment Opportunities (Long Term Basis)	15	15	15	15
1.5 Multiplier Effects	15	15	15	15
II. Infrastructure for Construction				
2.1 Accessibility	25	5	10	25
2.2 Logistics	15	9	9	9
2.3 Construction Period	21	21	21	21
2.4 Transmission Line	3	3	3	3
2.5 Construction Camp	10	6	6	2
2.6 Permanent Community	5	1	1	3
III. Resettlement				
3.1 Existing Population and Land Use to be Effected	3	3	3	3
3.2 Compensation or Resettlement Site Selection	3	3	3	3
IV. Effects on Downstream Reaches				
4.1 Flood Control	5	3	5	3
4.2 Soil Conservation Effect	15	15	15	15
4.3 Sedimentation	30	30	30	30
4.4 Fisheries Resources (Negative Effect)	3	3	3	3
V. Innundation Effects				
5.1 Agricultural Capabilities (Negative Effect)	5	5	5	5
5.2 Contribution to Fisheries Development	15	15	15	15
5.3 Water Quality				
VI. Development Impacts				
6.1 Effects on the Basin (land Use & Transportation)	25	25	25	25
6.2 Reservoir Resources Potential (Multipurpose Efects Including Irrigation Development)	15	15	15	15
6.3 Regional Resources Potential	25	25	25	25
(TOTAL)	371	315	312	313

TABLE 3.6.29
(2 of 6)

Tamur TM-1	PRR Type Dudh Kosi DD-1	Tama TA-3	Kosi TA-4	Indrawati ID-1	Tamur TM-3
30	20	30	20	10	40
20	20	20	20	10	30
18	30	30	30	24	30
15	15	9	9	9	9
15	15	9	9	9	9
25	5	25	25	25	15
9	9	15	9	9	3
21	21	21	21	21	21
3	3	9	3	9	3
2	10	10	2	6	2
1	1	5	3	3	1
3	9	9	9	9	9
3	9	9	9	9	9
3	3	1	1	1	1
15	15	9	9	9	9
30	18	18	18	18	18
3	9	9	9	9	9
5	15	15	15	15	15
15	9	9	9	9	9
25	25	15	15	15	15
15	9	9	9	9	9
25	25	15	15	15	15
301	295	301	269	253	281

TABLE 3.6.29
(3 of 6)

Sun Kosi SU-4	Dudh Kosi DD-2	DD-3	DD-4	DD-5	DD-6	DD-7	DD-8	DD-9	DD-10	LK-1
10	40	30	30	40	20	40	40	40	30	10
10	20	20	20	20	10	20	30	20	20	10
18	24	18	18	24	18	24	24	24	18	18
9	9	9	9	9	9	9	9	9	9	3
3	9	9	9	9	9	9	9	9	9	3
25	5	5	5	5	5	5	5	5	5	5
15	3	3	3	3	3	3	3	3	3	3
21	7	7	7	7	7	7	7	7	7	7
9	3	3	3	3	3	3	3	3	3	3
10	2	2	2	2	2	2	2	2	2	6
5	1	1	1	1	1	1	1	1	1	5
15	15	15	15	15	15	15	15	15	15	15
15	15	15	15	15	15	15	15	15	15	15
1	1	1	1	1	1	1	1	1	1	1
3	3	3	3	3	3	3	3	3	3	3
6	6	6	6	6	6	6	6	6	6	6
15	15	15	15	15	15	15	15	15	15	15
25	25	25	25	25	25	25	25	25	25	25
3	3	3	3	3	3	3	3	3	3	3
5	15	15	15	15	15	15	15	15	15	15
3	3	3	3	3	3	3	3	3	3	3
5	5	5	5	5	5	5	5	5	5	5
231	229	213	223	229	193	229	239	229	213	179

TABLE 3.6.29
(4 of 6)

Likhu Khola			Maulung Khola	Tama Kosi			Khimte Khola		
LK-2	LK-3	LK-4	"	TA-2	TA-5	TA-6	KM-1	KM-2	BH-1
10	20	20	10	40	40	50	40	40	40
10	20	10	10	20	30	30	30	20	30
18	18	18	18	30	30	30	24	18	24
3	3	3	3	9	9	9	9	3	9
3	3	3	3	9	3	3	9	3	3
5	5	5	5	25	25	25	25	25	25
3	3	3	3	9	3	3	15	9	15
7	7	7	7	21	21	21	21	21	21
3	3	3	3	9	3	3	3	3	9
6	2	2	2	6	2	2	2	2	10
3	1	1	1	5	3	1	5	1	5
15	15	15	15	15	15	15	15	15	15
15	15	15	15	15	15	15	15	15	15
1	1	1	1	1	1	1	1	1	1
3	3	3	3	3	3	3	3	3	3
6	6	6	6	6	6	6	6	6	6
15	15	15	15	15	15	15	15	15	15
25	25	25	25	25	25	25	25	25	25
3	3	3	3	3	3	3	3	3	3
15	15	15	15	15	15	15	15	5	15
3	3	3	3	3	3	3	3	3	3
5	5	5	5	15	15	15	15	5	15
177	191	181	171	299	285	293	299	241	307

TABLE 3.6.29
(5 of 6)

SSR Type									
Bhote Kosi	Balephi	Rosi Khola				Indrawati			
BH-2	BA	RS-1	RS-2	RS-3	RS-4	ID-2	ID-3	TM-4	TM-5
40	30	20	10	10	10	30	40	30	40
30	20	20	10	10	10	20	20	20	20
24	18	18	18	18	18	18	18	24	24
9	3	3	3	3	3	3	9	9	9
3	3	3	3	3	3	3	3	9	9
25	25	25	25	25	25	25	20	10	10
9	9	9	9	9	9	9	9	3	3
21	21	21	21	21	21	21	21	21	21
9		15	9	9	9	9	9	3	3
2	6	6	2	2	2	6	2	2	2
3	1	5	3	1	1	3	1	1	1
15	15	15	15	15	15	15	15	15	15
15	15	15	15	15	15	15	15	15	15
1	1	1	1	1	1	1	1	1	1
3	3	3	3	3	3	3	3	3	3
6	6	6	6	6	6	6	6	6	6
15	15	15	15	15	15	15	15	15	15
25	25	25	25	25	25	25	25	25	25
3	3	3	3	3	3	3	3	3	3
15	5	5	5	5	5	5	5	15	15
3	3	3	3	3	3	3	3	3	3
15	5	5	5	5	5	5	5	15	5
291	241	247	209	207	207	243	242	248	248

TABLE 3.6.29
(6 of 6)

Tamur		Kabeli Nadi			Arun					
TM-6	TM-7	KB-1	KB-2	KB-3	AR-1	AR-2	AR-3	AR-4	AR-5	AR-6
40	40	10	10	10	40	50	50	50	50	50
20	30	10	10	10	20	40	40	20	30	40
24	30	18	18	18	30	30	30	30	30	30
9	9	3	3	3	9	9	9	9	9	9
9	9	3	3	3	9	9	9	3	3	3
5	5	10	5	5	15	15	10	5	5	5
3	3	3	3	3	9	9	9	3	3	3
21	21	21	21	21	21	21	21	21	7	7
3	3	3	3	3	9	3	3	3	3	3
2	2	2	2	2	6	6	6	2	2	2
1	1	1	1	1	3	3	3	1	1	1
15	15	15	15	15	15	15	15	15	15	15
15	15	15	15	15	15	15	15	15	15	15
1	1	1	1	1	1	1	1	1	1	1
3	3	3	3	3	3	3	3	3	3	3
6	6	6	6	6	6	6	6	6	6	6
15	15	15	15	15	15	15	15	15	15	15
25	25	25	25	25	25	25	25	25	25	25
3	3	3	3	3	3	3	3	3	3	3
15	15	5	5	5	25	25	25	25	25	25
3	3	3	3	3	3	3	3	3	3	3
5	5	5	5	5	25	25	25	25	25	25
243	259	180	175	175	307	331	336	283	279	289

TABLE 3.6.31 FEATURE OF 13 HIGH PRIORITY SCHEMES

	Item	Unit	SAPT KOSI HIGH DAM	ARUN NO.3	ARUN NO.2	SUN KOSI NO.1	SUN KOSI NO.3	SUN KOSI NO.2	ARUN NO.1	BHOTE KOSI NO.1	TAMA KOSI NO.3	TAMUR NO.1	TAMA KOSI NO.2	KHIMTE KHOLA NO.1	DUDH KOSI NO.1
Type of Scheme		—	Reservoir	SRR	SRR	Reservoir	Reservoir	Reservoir	SRR	SRR	PRR	Reservoir	SRR	SRR	PRR
River		—	Sapt Kosi	Arun	Arun	Sun Kosi	Sun Kosi	Sun Kosi	Arun	Bhote Kosi	Tama Kosi	Tamur	Tama Kosi	Khimte	Dudh Kosi
Reservoir	Catchment Area	Km^2	61,000	32,332	32,881	16,200	5,520	10,396	32,998	2,320	2,753	5,085	3,010	360	4,100
	High Water Level	EL m	304.8	—	—	424.6	700.0	575.0	—	—	883.9	487.6	—	—	524.2
	Low Water Level	"	259.0	—	—	423.0	674.0	516.0	—	—	873.9	460.0	—	—	514.2
	Gross Storage Capacity	$Mill.m^3$	8,500	—	—	1,500	1,220	4,370	—	—	24	1,890	—	—	162
	Avilable Storage Capacity	"	4,420	—	—	40	550	3,040	—	—	—	760	—	—	—
	Average Runoff	m^3/s	1,633	365	398	657	280	547	405	74	154	308	168	31	227
	90% Dependable Flow	"	750	114	122	143	100	298	123	16	25	115	25	5.4	39
Dam	Type	—	Concrete Gravity	Intake Weir	Intake Weir	Concrete Gravity	Concrete Gravity	Concrete Gravity	Intake Weir	Intake Weir	Concrete Gravity	Concrete Gravity	Intake Weir	Intake Weir	Concrete Gravity
	Height	m	239	23	18	147	140	166	20	24	60	153	20	20	104
	Length	"	640	120	100	500	470	530	150	80	200	600	150	50	300
	Volume	m^3	$7,677x10^3$	$74x10^3$	$37x10^3$	$2,269x10^3$	$1,935x10^3$	$3.067x10^3$	$91x10^3$	$53x10^3$	$151x10^3$	$2,950x10^3$	$69x10^3$	$41x10^3$	$681x10^3$
	Design Flood Discharge	m^3/s	42,400			22,500	11,600	17,300			7,600	11,100			9,800
Hydropower	Intake Water Level	EL m	289.8	810.0	616.0	424.6	691.3	555.3	420.0	1,066.8	880.9	476.0	773.0	1,200.0	521.2
	Tail Water Level	"	119.3	616.0	420.0	304.8	575.0	424.6	311.0	827.0	773.0	344.4	597.0	597.0	424.6
	Gross Head	m	170.5	194.0	196.0	119.8	116.3	130.7	109.0	239.8	107.9	131.6	176.0	603.0	96.6
	Design Discharge	m^3/s	2,500	156	160	1,400	570	1,050	180	34	150	650	150	10	300
	Firm Discharge	"	2,500	114	122	572	400	1,050	123	15.8	99	460	99	5.4	38.5
	Installed Capacity	MW	3,489	240	239	1,357	536	1,110	146	64	123	696	196	49	228
	Firm Capacity	"	3,489	176	185	555	376	1,110	100	29	82	493	130	26	118
	Generated Energy	GWH	16,810	1,965	1,967	4,640	2,070	4,760	1,166	444	603	2,750	1,013	344	978
	Firm	"	9,064	1,526	1,612	1,206	820	2,761	670	257	179	1,078	295	227	259
	Seasonal	"	7,746	-	-	1,742	876	1,999	-	-	286	1,217	471	-	407
	Secondary	"	0	439	355	1,692	374	0	296	187	138	455	248	117	312
Capital Cost	Capital Cost	10^6US$	2,773	307	326	1,093	622	1,085	294	97	219	890	278	77	478
	Hydropower Station	"	2,721	234	261	1,001	576	992	254	89	204	838	240	58	394
	Transmission/Substation	"	52	39	34	60	40	58	17	8	13	45	33	11	29
	Access Roads	"	- (-)	34(99km)	31(85km)	32(70km)	6(20km)	35(107km)	23(72km)	-(-)	2(6km)	7(25km)	5(15km)	8(25km)	55(177km)
Cost per KW		US$/KW	795	1,279	1,364	805	1,160	977	2,014	1,516	1,780	1,279	1,418	1,571	2,096
Energy Cost		Cent/KWH	2.78	2.65	2.80	3.99	5.07	3.84	4.29	3.60	6.14	5.45	4.64	3.78	8.28
Economic Evaluation	Annual Cost	10^6US$	468	52	55	185	105	183	50	16	37	150	47	13	81
	I. Consideration of Potential Energy														
	Annual Benefit	10^6US$	1,392	131	130	460	192	418	78	31	50	252	81	24	86
	Benefit/Cost Ratio	-	2.97	2.52	2.36	2.49	1.83	2.28	1.56	1.94	1.35	1.68	1.72	1.85	1.06
	Annual(Benefit-Cost)	10^6US$	924	79	75	275	87	235	28	15	13	102	34	11	5
	II. Consideration of Firm and Secondary Energy														
	Annual Benefit	10^6US$	1,276	111	115	254	142	388	65	22	35	188	59	18	54
	Benefit/Cost Ratio	-	2.73	2.13	2.09	1.37	1.35	2.12	1.30	1.38	0.95	1.25	1.26	1.38	0.67
	Annual(Bcefit-Cost)	10^6US$	808	59	60	69	37	205	15	6	-2	38	12	5	-12

TABLE 3.6.32 COSTS OF STRUCTURES OF 13 PRIORITY SCHEMES

Unit : 10^6US$

ITEM	SAPT KOSI HIGH DAM	ARUN NO.3	ARUN NO.2	SUN KOSI NO.1	SUN KOSI NO.3	SUN KOSI NO.2	ARUN NO.1	BHOTE KOSI NO.1	TAMA KOSI NO.3	TAMUR NO.1	TAMA KOSI NO.2	KHIMTE KHOLA NO.1	DUDH KOSI NO.2	REMARKS
1. Compensation and Land Acquisition	127	6	6	47	27	46	6	2	5	39	6	1	18	
2. Power house	434	15	22	148	49	107	17	5	11	81	18	3	26	
3. Dam (or Weir)	812 ($7,677 \times 10^3$)	13 (74×10^3)	5 (37×10^3)	251 ($2,269 \times 10^3$)	209 ($1,935 \times 10^3$)	329 ($3,067 \times 10^3$)	12 (91×10^3)	7 (53×10^3)	23 (151×10^3)	314 ($2,950 \times 10^3$)	10 (69×10^3)	6 (41×10^3)	79 (681×10^3)	Dam Concrete (M^3)
4. Intake Structure	38	20	10	15	9	18	12	2	2	11	10	1	4	
5. Waterway	78	62	85	47	22	37	89	28	85	23	76	10	90	
6. Penstock	113	7	13	36	16	34	5	6	4	17	10	13	10	
7. Miscellaneous Works	89	9	10	29	20	35	11	4	9	29	9	2	15	
8. Electric Equipment	404	50	50	202	92	159	44	15	20	132	46	9	61	
9. Temporary Facilities	154	12	14	52	32	55	14	5	13	47	13	3	22	
10. Administrative and Engineering Cost	225	19	22	83	48	82	21	7	17	69	20	5	33	
11. Contingency	247	21	24	91	52	90	23	8	15	76	22	5	36	
12. Access Road	0	34	31	50	6	35	23	0	2	8	5	8	55	
TOTAL	2,721	268	292	1,051	582	1,027	277	89	206	846	245	66	449	

TABLE 3.6.33 COMPARISON OF FEASIBILITY AND MASTER PLAN STUDIES FOR SAPT KOSI HIGH DAM SCHEMES

		FEASIBILITY STUDY		MASTER PLAN STUDY
Dam				
- Height	m	269	-	239
- Length	"	710.5	-	640
Reservoir				
- H.W.L.	EL m	335.28	-	304.80
- L.W.L.	"	259.00	-	259.00
- Gross Storage Capacity	Mill.m^3	13,450	-	8,500
- Available Storage Capacity	"	9,370	-	4,420
Hydropower		(HIGH DAM)	(CANAL)	
- Installed Capacity	MW	3,000	300	3,489
- Generated Energy	GWH			
Primary		13,140	-	16,810
Secondary		2,590	-	0
(Total)		15,700	1,875	16,810
Irrigation				
- Area	ha			
Nepal		546,000	-	-
India		976,000	-	-
(Total)		1,522,000	-	-
- Barrage	m	-	969.9	-
- Canal	km	-	45	-
Construction Cost				
- Power (Dam and Power house	Mill.US¢	2,677		2,721
- Irrigation	"	1,347		-
- Watershed Management	"	50		-
(Total)	"	4,074		2,721
Economic Viability				
- Cost per KW	US¢/KW	900		780
- Energy Cost	Cent/KWH	1.89		2.74
- Irrigation (B/C)	-	1.54		-

Note: Price levels are 1981 and 1983 levels each in Feasibility and Master Plan Studies.

TABLE 3-6-34 INCREMENTAL BENEFIT/COST ANALYSIS OF SAPT KOSI HIGH DAM

Dam Hight (m)	Maximum Discharge (m^3/S)	Installed Capacity P(MW)	Generated Energy E(GWH)	Construction Cost C (Mill.US$)	Cost per KW C/P (US$/KW)	Benefit Cost	Energy Cost (Cent/KWH)	Increment					
								Installed Capacity P(MW)	Generated Energy E(GWH)	Construction Cost C (Mill.US$)	Cost per KW C/ P (US$/KW)	Benefit Cost	Energy Cost
239	2,500	3,489	16,810	2,721	780	3.03	2.74						
								408	3,673	679	1,664	2.06	3.13
269	2,500	3,897	20,483	3,400	872	2.83	2.81						
								410	3,664	820	2,000	1.70	3.78
299	2,500	4,307	24,147	4,220	980	2.61	2.95						

TABLE 3.6.35 CUMULATIVE SEDIMENT LOAD OF SUN KOSI NO. 1 DAM (Case 1-1)
(1 of 4)

Year	Sediment Inflow ($10^6 m^3$)	Capacity of Reservoir:Vg ($10^6 m^3$)	Vg/Qin	Rate of Silting (%)	Sediment Deposit ($10^6 m^3$)	Cumulative Sediment Deposit ($10^6 m^3$)
0		1,500.00				
1- 5	226.80	1,314.02	0.0707	82	185.98	18.98
6-10	226.80	1,132.58	0.0619	80	181.44	367.42
11-15	226.80	955.68	0.0534	78	176.90	544.32
16-20	226.80	785.58	0.0450	75	170.10	714.42
21-25	226.80	624.55	0.0370	71	161.03	875.45
26-30	226.80	472.59	0.0294	67	151.96	1,027.41
31-35	226.80	325.17	0.0223	65	147.42	1,174.83
36-40	226.80	184.55	0.0153	62	140.62	1,315.45
41-45	226.80	64.35	0.0087	53	120.20	1,435.65
46-50	226.80	43.94	0.0030	9	20.41	1,456.06

Total amount of sediment deposited in 50 years = 1,456.06 x 10^6 (m^3)

Design sediment rate = $\frac{1,456.06 \times 10^6}{50 \times 16,200}$ = 1,800m^3/km^2/year

Note: rate of silting; corresponding percentage of sediment deposited as read from Brune's curve.

Average sediment inflow for five years: Vs = 2,800m^3/km^2/year x 16,200km^2 x 5 year = 226.80 x 10^6 (m^3)

Average annual inflow of water into reservoir: Qin = 673.166m^3/s x 60 x 60 x 24 x 365 = 21,228.90 x 10^6 (m^3)

TABLE 3.6.35 (2 of 4) CUMULATIVE SEDIMENT LOAD OF SUN KOSI NO. 2 DAM (Case 2-3)

Year	Sediment Inflow ($10^6 m^3$)	Capacity of Reservoir:Vg ($10^6 m^3$)	Vg/Qin	Rate of Silting (%)	Sediment Deposit ($10^6 m^3$)	Cumulative Sediment Deposit ($10^6 m^3$)
0		4,370.00				
1- 5	145.54	4,234.65	0.261	93	135.35	135.35
6-10	145.54	4,099.30	0.253	93	135.35	270.70
11-15	145.54	3,965.40	0.245	92	133.90	404.60
16-20	145.54	3,831.50	0.237	92	133.90	538.50
21-25	145.54	3,699.06	0.229	91	132.44	670.94
26-30	145.54	3,566.62	0.221	91	132.44	803.38
31-35	145.54	3,435.63	0.213	90	130.99	934.37
36-40	145.54	3,304.64	0.205	90	130.99	1,065.36
41-45	145.54	3,173.65	0.197	90	130.99	1,196.35
46-50	145.54	3,042.66	0.190	90	130.99	1,327.34

Total amount of sediment deposited in 50 years = $1,327.34 \times 10^6$ (m^3)

Design sediment rate = $\frac{1,327.34 \times 10^6}{50 \times 10,396} = 2,600 m^3/km^2/year$

Note: rate of silting; corresponding percentage of sediment deposited as read from Brune's curve.

Average sediment inflow for five years: Vs = $2,800 m^3/km^2/year \times 10,396 km^2 \times 5$ year = 145.54×10^6 (m^3)

Average annual inflow of water into reservoir: Qin = $530,734 m^3/s \times 60 \times 60 \times 24 \times 365 = 16,737.2 \times 10^6$ (m^3)

TABLE 3.6.35 (3 of 4) CUMULATIVE SEDIMENT LOAD OF SUN KOSI NO. 3 DAM (Case 3-5)

Year	Sediment Inflow ($10^6 m^3$)	Capacity of Reservoir:Vg ($10^6 m^3$)	Vg/Qin	Rate of Silting (%)	Sediment Deposit ($10^6 m^3$)	Cumulative Sediment Deposit ($10^6 m^3$)
0		1,220.00				
1- 5	77.28	1,151.22	0.138	89	68.78	68.78
6-10	77.28	1,082.44	0.130	89	68.78	137.56
11-15	77.28	1,014.43	0.123	88	68.01	205.57
16-20	77.28	947.20	0.115	87	67.23	272.80
21-25	77.28	879.97	0.107	87	67.23	340.03
26-30	77.28	813.51	0.100	86	66.46	406.49
31-35	77.28	747.05	0.0922	86	66.46	472.95
36-40	77.28	681.36	0.0847	85	65.69	538.64
41-45	77.28	617.22	0.0772	83	64.14	602.78
46-50	77.28	554.62	0.0700	81	62.60	665.38

Total amount of sediment deposited in 50 years = 665.38×10^6 (m^3)

Design sediment rate = $\frac{665.38 \times 10^6}{50 \times 5,520}$ = 2,400m^3/km^2/year

Note: rate of silting; corresponding percentage of sediment deposited as read from Brune's curve.

Average sediment inflow for five years: Vs = 2,800m^3/km^2/year x 5,520km^2 x 5 year = 77.28×10^6 (m^3)

Average annual inflow of water into reservoir: Qin = 279,770m^3/s x 60 x 60 x 24 x 365 = $8,822.82 \times 10^6$ (m^3)

TABLE 3.6.35 CUMULATIVE SEDIMENT LOAD OF TAMUR NO. 1 DAM
(4 of 4)

Year	Sediment Inflow ($10^6 m^3$)	Capacity of Reservoir:Vg ($10^6 m^3$)	Vg/Qin	Rate of Silting (%)	Sediment Deposit ($10^6 m^3$)	Cumulative Sediment Deposit ($10^6 m^3$)
0		1,890.00				
1- 5	127.13	1,774.31	0.194	91	115.69	115.69
6-10	127.13	1,658.62	0.182	91	115.69	231.38
11-15	127.13	1,544.20	0.170	90	114.42	345.80
16-20	127.13	1,429.78	0.159	90	114.42	460.22
21-25	127.13	1,316.63	0.147	89	113.15	573.37
26-30	127.13	1,203.48	0.135	89	113.15	686.52
31-35	127.13	1,091.61	0.124	88	111.87	798.39
36-40	127.13	981.01	0.112	87	110.60	908.99
41-45	127.13	871.68	0.101	86	109.33	1,018.32
46-50	127.13	763.62	0.0896	85	108.06	1,216.38

Total amount of sediment deposited in 50 years = $1,126.38 \times 10^6$ (m^3)

Design sediment rate = $\frac{1,126.38 \times 10^6}{50 \times 5,085}$ = $4,400 m^3/km^2/year$

Note: rate of silting; corresponding percentage of sediment deposited as read from Brune's curve.

Average sediment inflow for five years: Vs = $5,000 m^3/km^2/year \times 5,085 km^2 \times 5$ year = 127.13×10^6 (m^3)

Average annual inflow of water into reservoir: Qin = $308,632 m^3/s \times 60 \times 60 \times 24 \times 365 = 9,733.01 \times 10^6$ (m^3)

TABLE 3-6-36 ALTERNATIVE IMPLEMENTATION SCHEDULE

Alternative	Scheme	Installed Capacity (MW)	Firm Capacity (MW)	Generated Energy (GWh/Yr)	Construction Power Stations	Access Road	Sabstation/ Transmission	Cost Total	Remarks
1.	Arun No.3	240	176	1,965	234	34	39	307	
	Arun No.2	239	185	1,967	261	-	17	278	
	Arun No.1	146	100	1,166	254	-	5	259	
	TA - No.3	123	82	603	204	2	13	219	
	SU - Diver-	61	58	511	-	-	-	94	
	sion	32	8	57	-	-	-	43	
	(Total)	841	609	6,269	-	-	-	1,200	Annual Load Factor, 85%
2.	Arun No.3	240	176	1,965	234	34	39	307	
	Arun No.2	239	185	1,967	261	-	17	278	
	TA - No.3	123	82	603	204	2	30	236	
	TA - No.2	196	135	1,013	240	3	3	246	
	SU - Diver-	61	58	511	-	-	-	94	
	sion	32	8	57	-	-	-	43	
	(Total)	891	644	6,116	-	-	-	1,204	Annual Load Factor, 78%
3.	Arun No.3	240	176	1,965	234	34	39	307	
	TA - No.3	123	82	603	204	2	30	236	
	TA - No.2	196	135	1,013	240	3	3	246	
	Arun No.2	239	185	1,967	261	-	-	278	
	SU - Dover-	61	58	511	-	-	-	94	
	sion	32	8	57	-	-	-	43	
	(Total)	891	644	6,116	-	-	-	1,204	Annual Load Factor, 78%
4.	Arun No.3	240	176	1,965	234	34	39	307	
	SU - No.3	536	376	2,070	576	6	39	621	
	SU - Diver-	61	58	511	-	-	-	94	
	sion	32	8	57	-	-	-	43	
	(Total)	869	618	4,603	-	-	-	1,065	Annual Load Factor, 60%

Note; 1) TA: Tama Kosi, SU:Sun Kosi

2) • In Alternative 1 and 2, the costs of transmission/ substation for AR-2 and/or AR-1 are estimated as additional costs.

• In Alternative 2 and 3, the transmission cost for TA-2 is counted in TA-3.

TABLE 3-6-37 COST DISBURSEMENT OF ALTERNATIVES

Alternative		1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	(Total)
1	Arun No.3	14	14	16	41	62	73	51	16	10	10							307
	Arun No,2							12	35	64	78	52	20	17				278
	Arun No.1										25	52	76	81	25			259
	TA No.3											21	44	67	67	20		219
	(Total)	14	14	16	41	62	73	63	51	74	113	125	140	165	92	20		1,063
2	Arun No.3	14	14	16	41	62	73	51	16	10	10							307
	Arun No.2							12	35	64	78	52	20	17				278
	TA No.3										21	51	72	72	20			236
	TA No.2											24	49	73	76	24		246
	(Total)	14	14	16	41	62	73	63	51	74	109	127	141	162	96	24		1,067
3	Arun No.3	14	14	16	41	62	73	51	16	10	10							307
	TA No.3							10	31	62	72	51	10					236
	TA No.2								10	32	54	64	43	29	14			246
	Arun No.2										12	35	64	78	52	20	17	278
	(Total)	14	14	16	41	62	73	61	57	104	148	150	117	107	66	20	17	1,067
4	Arun No.3	14	14	16	41	62	73	51	16	10	10							307
	SU No.3							25	88	140	166	114	34	15	15	15	9	621
	(Total)	14	14	16	41	62	73	76	104	150	176	114	34	15	14	15	9	928

Note: 1) Cost includes access roads and Transmission/substations

2) TA; Tama Kosi, SU; Sun Kosi