

Option IV

Basic Parameters	OP4- 405	
Waterway Length		
Headrace Tunnel	m	309.3
Penstock	m	148.5
Tailrace Tunnel	m	1199
	m	1656.8
Sedimentation Level	EL.m	386.2

Specification

Item	Unit	FSL=405									
		1	2	3	4	5	6	7	8	9	10
Qmax	m3/s	65.4	70.2	75	79.8	84.6	89.3	94.1	98.9	103.7	108.5
FSL	EL.m	405	405	405	405	405	405	405	405	405	405
MOL	EL.m	397	397.4	397.6	398	398.2	398.6	399	399.2	399.4	399.8
TWL	EL.m	302.5	302.5	302.6	302.6	302.6	302.7	302.7	302.7	302.7	302.8
Loss	m	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2
Effective Head	m	99.3	99.3	99.2	99.2	99.2	99.1	99.1	99.1	99.1	99
Pmax	MW	58	62	66	71	75	79	83	87	92	96
Primary Energy	GWh	119.48	127.80	130.03	144.59	152.50	159.69	166.78	173.49	180.27	186.31
Pfirm	MW	47.47	51.25	54.84	58.26	60.93	61.97	56.70	51.96	46.30	45.73
Benefit	1000USD	35,785	38,420	39,901	43,551	45,778	47,385	47,076	46,858	46,376	47,291
Cost	1000USD	34,661	35,034	35,350	35,759	36,066	36,426	36,786	37,084	37,417	37,772
B/C		1.03	1.10	1.13	1.22	1.27	1.30	1.28	1.26	1.24	1.25

Civil & Hydromechanical Work Quantity

(1) Dam

Design Flood	m3/s	8,306
Dam Basis EL.	m	293
Non- overflow Width	m	80.2
Spillway Width	m	77
Sand Drain Width	m	16
Intake Width	m	0
Dam Height (Hd)	m	117
Crest Length (L)	m	173.2
Coefficient for Ex	Y=A*X*B	
A		32335
B		0.4384
Coefficient for Conc	Y=C*X*D	
C		0.0015
D		1.3058

Item	Unit	FSL=405									
		1	2	3	4	5	6	7	8	9	10
Excavation	m3	2,498,877	2,498,877	2,498,877	2,498,877	2,498,877	2,498,877	2,498,877	2,498,877	2,498,877	2,498,877
Concrete	m3	316,564	316,564	316,564	316,564	316,564	316,564	316,564	316,564	316,564	316,564
Gate	t	1,827	1,827	1,827	1,827	1,827	1,827	1,827	1,827	1,827	1,827

(2) Intake

Number	-	1									
Design Velocity	m3/s	3.5									
MOL	EL.m	397	397.4	397.6	398	398.2	398.6	399	399.2	399.4	399.8
Waterway Diameter	m	4.9	5.1	5.2	5.4	5.5	5.7	5.9	6	6.1	6.3
Available Height	m	8	7.6	7.4	7	6.8	6.4	6	5.8	5.6	5.2

Item	Unit	FSL=405									
		1	2	3	4	5	6	7	8	9	10
Excavation	m3	4,795	4,930	5,075	5,193	5,326	5,427	5,525	5,640	5,751	5,832
Concrete	m3	3,562	3,685	3,819	3,929	4,052	4,147	4,239	4,348	4,453	4,531
Reinforce Bar	t	142	147	153	157	162	166	170	174	178	181
Intake Gate	t	78	84	89	95	101	106	112	117	123	128
Intake Screen	t	43	47	50	53	56	59	62	65	68	71

(3) Power Tunnel

Tunnel Inner Diameter	m	4.9	5.1	5.2	5.4	5.5	5.7	5.9	6	6.1	6.3
Concrete Thickness	m	0.6									
Tunnel Length	m	309.3									
Number	-	1									

Item	Unit	FSL=405									
		1	2	3	4	5	6	7	8	9	10
Tunnel Excavation	m3	9,207	9,821	10,135	10,778	11,108	11,781	12,473	12,827	13,186	13,919
Lining Concrete	m3	3,375	3,502	3,566	3,695	3,759	3,888	4,017	4,082	4,147	4,277
Reinforce Bar	t	135	140	143	148	150	156	161	163	166	171

(3) Service Adit

Tunnel Length	m	1642.07
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Item	Unit	FSL=405									
		1	2	3	4	5	6	7	8	9	10
Tunnel Excavation	m3	48,881	52,139	53,807	57,223	58,970	62,543	66,221	68,100	70,005	73,893

Tunnel Excavation	3,422	3,650	3,767	4,006	4,128	4,378	4,635	4,767	4,900	5,173
(4)Penstock										
Tunnel Excavation	415	438	461	484	507	529	551	573	596	618
Lining Concrete	174	180	185	190	195	200	204	209	213	218
Reinforce Bar	14	15	15	15	16	16	17	17	17	18
Others	121	127	132	138	144	149	154	160	165	171
(5)Power House										
Excavation	2,966	3,073	3,175	3,275	3,372	3,463	3,555	3,645	3,732	3,816
Concrete	2,135	2,212	2,285	2,357	2,427	2,493	2,559	2,623	2,686	2,747
Reinforce Bar	40	41	42	44	45	46	47	49	50	51
Others	2,570	2,663	2,751	2,838	2,922	3,001	3,081	3,158	3,234	3,307
(6)Tailrace Tunnel										
Tunnel Excavation	2,677	2,855	2,947	3,134	3,229	3,425	3,626	3,729	3,834	4,047
Lining Concrete	2,486	2,580	2,627	2,721	2,769	2,864	2,959	3,007	3,054	3,150
Reinforce Bar	460	478	487	504	513	531	548	557	566	584
Others	1,687	1,774	1,818	1,908	1,953	2,046	2,140	2,188	2,236	2,334
(7)Tailrace										
Excavation	54	57	59	62	64	67	70	72	75	78
Concrete	169	183	194	207	218	232	246	258	269	284
Reinforce Bar	17	18	18	19	20	21	21	22	23	23
Others	60	64	68	72	76	80	84	88	92	96
(8)P/H Access Tunnel										
Tunnel Excavation	5,807	5,807	5,807	5,807	5,807	5,807	5,807	5,807	5,807	5,807
Lining Concrete	2,397	2,397	2,397	2,397	2,397	2,397	2,397	2,397	2,397	2,397
Reinforce Bar	487	487	487	487	487	487	487	487	487	487
Others	1,738	1,738	1,738	1,738	1,738	1,738	1,738	1,738	1,738	1,738
(9)Miscellaneous Works	7,076	7,128	7,163	7,215	7,250	7,302	7,355	7,389	7,424	7,477
Total	148,602	149,695	150,423	151,520	152,244	153,339	154,454	155,176	155,895	157,020

Hydro- mechanical Works

1,000USD

Item	FSL=405									
	1	2	3	4	5	6	7	8	9	10
(1)Dam & Spillway										
Gate	11,878	11,878	11,878	11,878	11,878	11,878	11,878	11,878	11,878	11,878
(2)Intake										
Gate	514	551	588	624	661	697	733	769	806	842
Screen	285	306	326	347	367	387	407	427	448	468
(3)Penstock	927	990	1,052	1,115	1,177	1,238	1,300	1,362	1,425	1,485
(4)Tailrace										
Gate	514	551	588	624	661	697	733	769	806	842
(5)Others	2,823	2,855	2,886	2,917	2,949	2,979	3,010	3,041	3,072	3,103
Total	16,941	17,129	17,318	17,505	17,693	17,874	18,060	18,247	18,434	18,616

Project Cost Summary

1,000USD

Item	FSL=405									
	1	2	3	4	5	6	7	8	9	10
1. Preparation & Compensation	2,972	2,994	3,008	3,030	3,045	3,067	3,089	3,104	3,118	3,140
(1) Access Road										
(2) Compensation										
(3) Others										
2. Environmental Mitigation	26,280	26,280	26,280	26,280	26,280	26,280	26,280	26,280	26,280	26,280
3. Civil Works										
(1) River Treatment	6,053	6,053	6,053	6,053	6,053	6,053	6,053	6,053	6,053	6,053
(2) Dam	103,360	103,360	103,360	103,360	103,360	103,360	103,360	103,360	103,360	103,360
(3) Intake	796	823	852	876	902	923	943	967	989	1,006
(4) Power Tunnel	4,843	5,146	5,301	5,618	5,779	6,110	6,449	6,622	6,797	7,155
(5) Penstock	724	759	794	827	861	894	926	959	991	1,023
(6) Power House	7,710	7,988	8,254	8,514	8,766	9,003	9,242	9,475	9,702	9,921
(7) Tailrace Tunnel	7,310	7,687	7,878	8,267	8,464	8,865	9,274	9,481	9,690	10,114
(8) Tailrace	300	322	339	361	378	400	422	440	458	481
(9)P/S Access Tunnel	10,430	10,430	10,430	10,430	10,430	10,430	10,430	10,430	10,430	10,430
(10) Others	7,076	7,128	7,163	7,215	7,250	7,302	7,355	7,389	7,424	7,477
4. Hydro- Mechanical Works	16,941	17,129	17,318	17,505	17,693	17,874	18,060	18,247	18,434	18,616
5. Electro- Mechanical Works	26,106	27,295	28,469	29,892	31,006	32,112	33,189	34,249	35,551	36,589
6. Transmission Line	10,170	10,170	10,170	10,170	10,170	10,170	10,170	10,170	10,170	10,170
Direct Cost	231,070	233,563	235,667	238,396	240,438	242,842	245,241	247,224	249,447	251,815
7. Administration Fee	34,661	35,034	35,350	35,759	36,066	36,426	36,786	37,084	37,417	37,772
8. Contingency	23,107	23,356	23,567	23,840	24,044	24,284	24,524	24,722	24,945	25,181
9. Interest During Construction	57,768	58,391	58,917	59,599	60,109	60,710	61,310	61,806	62,362	62,954
Total	346,605	350,344	353,501	357,595	360,657	364,262	367,862	370,837	374,171	377,722

Basic Parameters	OP4- 410	
Waterway Length		
Headrace Tunnel	m	309.3
Penstock	m	148.5
Tailrace Tunnel	m	1199
	m	1656.8
Sedimentation Level	EL.m	386.2

Specification

Item	Unit	FSL=410									
		1	2	3	4	5	6	7	8	9	10
Qmax	m ³ /s	73.7	78.2	82.8	87.3	91.9	96.4	101	105.5	110.1	114.6
FSL	EL.m	410	410	410	410	410	410	410	410	410	410
MOL	EL.m	397.6	397.8	398.2	398.4	398.8	399	399.4	399.6	399.8	400.2
TWL	EL.m	302.5	302.6	302.6	302.6	302.7	302.7	302.7	302.8	302.8	302.8
Loss	m	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2
Effective Head	m	104.3	104.2	104.2	104.2	104.1	104.1	104.1	104	104	104
Pmax	MW	69	73	77	81	85	90	94	98	102	106
Primary Energy	GWh	138.78	146.67	154.93	162.66	170.16	177.66	184.89	191.32	197.51	203.09
Pfirm	MW	53.22	56.56	60.21	62.43	65.18	68.59	68.69	61.32	58.33	51.43
Benefit	1000USD	40,989	43,414	45,999	48,058	50,235	52,611	53,942	52,883	53,097	52,026
Cost	1000USD	36,822	37,127	37,486	37,783	38,139	38,469	38,820	39,108	39,394	39,740
B/C		1.11	1.17	1.23	1.27	1.32	1.37	1.39	1.35	1.35	1.31

Civil & Hydromechanical Work Quantity

(1) Dam

Design Flood	m ³ /s	8,306
Dam Basis EL.	m	293
Non- overflow Width	m	80.2
Spillway Width	m	77
Sand Drain Width	m	16
Intake Width	m	0
Dam Height (Hd)	m	122
Crest Length (L)	m	173.2
Coefficient for Ex	Y=A*X*B	
	A	32335
	B	0.4384
Coefficient for Conc	Y=C*X*D	
	C	0.0015
	D	1.3058

Item	Unit	FSL=410									
		1	2	3	4	5	6	7	8	9	10
Excavation	m ³	2,545,144	2,545,144	2,545,144	2,545,144	2,545,144	2,545,144	2,545,144	2,545,144	2,545,144	2,545,144
Concrete	m ³	353,122	353,122	353,122	353,122	353,122	353,122	353,122	353,122	353,122	353,122
Gate	t	1,827	1,827	1,827	1,827	1,827	1,827	1,827	1,827	1,827	1,827

(2) Intake

Number	-	1									
Design Velocity	m ³ /s	3.5									
MOL	EL.m	397.6	397.8	398.2	398.4	398.8	399	399.4	399.6	399.8	400.2
Waterway Diameter	m	5.2	5.3	5.5	5.6	5.8	5.9	6.1	6.2	6.3	6.5
Available Height	m	12.4	12.2	11.8	11.6	11.2	11	10.6	10.4	10.2	9.8

Item	Unit	FSL=410									
		1	2	3	4	5	6	7	8	9	10
Excavation	m ³	5,946	6,108	6,249	6,398	6,526	6,664	6,781	6,909	7,037	7,136
Concrete	m ³	4,640	4,796	4,932	5,077	5,203	5,338	5,454	5,581	5,708	5,807
Reinforce Bar	t	186	192	197	203	208	214	218	223	228	232
Intake Gate	t	91	97	102	108	113	119	124	130	135	141
Intake Screen	t	51	54	57	60	63	66	69	72	75	78

(3) Power Tunnel

Tunnel Inner Diameter	m	5.2	5.3	5.5	5.6	5.8	5.9	6.1	6.2	6.3	6.5
Concrete Thickness	m	0.6									
Tunnel Length	m	309.3									
Number	-	1									

Item	Unit	FSL=410									
		1	2	3	4	5	6	7	8	9	10
Tunnel Excavation	m ³	10,135	10,454	11,108	11,442	12,125	12,473	13,186	13,550	13,919	14,671
Lining Concrete	m ³	3,566	3,631	3,759	3,824	3,953	4,017	4,147	4,212	4,277	4,407
Reinforce Bar	t	143	145	150	153	158	161	166	168	171	176

(3') Service Adit

Tunnel Length	m	1642.07
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Item	Unit	FSL=410									
		1	2	3	4	5	6	7	8	9	10
Tunnel Excavation	m ³	53,807	55,502	58,970	60,743	64,369	66,221	70,005	71,936	73,893	77,887

Tunnel Excavation	3,767	3,885	4,128	4,252	4,506	4,635	4,900	5,036	5,173	5,452
(4)Penstock										
Tunnel Excavation	455	477	498	519	541	562	583	604	625	646
Lining Concrete	183	188	193	198	202	206	211	215	219	223
Reinforce Bar	15	15	16	16	16	17	17	17	18	18
Others	131	136	141	147	152	157	162	167	172	177
(5)Power House										
Excavation	3,201	3,296	3,391	3,482	3,572	3,658	3,744	3,826	3,908	3,987
Concrete	2,303	2,372	2,441	2,506	2,570	2,633	2,695	2,753	2,813	2,870
Reinforce Bar	43	44	45	46	48	49	50	51	52	53
Others	2,773	2,856	2,939	3,017	3,095	3,170	3,244	3,315	3,386	3,455
(6)Tailrace Tunnel										
Tunnel Excavation	2,947	3,039	3,229	3,327	3,525	3,626	3,834	3,939	4,047	4,265
Lining Concrete	2,627	2,674	2,769	2,816	2,911	2,959	3,054	3,102	3,150	3,246
Reinforce Bar	487	495	513	522	539	548	566	575	584	601
Others	1,818	1,863	1,953	1,999	2,093	2,140	2,236	2,285	2,334	2,434
(7)Tailrace										
Excavation	59	61	64	66	69	71	74	76	78	81
Concrete	191	202	215	226	240	250	265	276	287	301
Reinforce Bar	18	19	20	20	21	22	22	23	23	24
Others	67	70	75	78	82	86	90	94	97	102
(8)P/H Access Tunnel										
Tunnel Excavation	5,807	5,807	5,807	5,807	5,807	5,807	5,807	5,807	5,807	5,807
Lining Concrete	2,397	2,397	2,397	2,397	2,397	2,397	2,397	2,397	2,397	2,397
Reinforce Bar	487	487	487	487	487	487	487	487	487	487
Others	1,738	1,738	1,738	1,738	1,738	1,738	1,738	1,738	1,738	1,738
(9)Miscellaneous Works										
Total	7,510	7,544	7,596	7,630	7,683	7,716	7,770	7,803	7,838	7,892
Total	157,703	158,417	159,515	160,228	161,333	162,045	163,165	163,873	164,591	165,722

Hydro- mechanical Works

1,000USD

Item	FSL=410									
	1	2	3	4	5	6	7	8	9	10
(1)Dam & Spillway										
Gate	11,878	11,878	11,878	11,878	11,878	11,878	11,878	11,878	11,878	11,878
(2)Intake										
Gate	599	636	672	708	744	780	817	852	889	924
Screen	333	353	373	393	414	434	454	474	494	513
(3)Penstock	1,080	1,140	1,203	1,265	1,326	1,387	1,450	1,509	1,572	1,632
(4)Tailrace										
Gate	599	636	672	708	744	780	817	852	889	924
(5)Others	2,898	2,928	2,960	2,990	3,021	3,052	3,083	3,113	3,144	3,174
Total	17,387	17,570	17,758	17,942	18,127	18,311	18,497	18,678	18,865	19,045

Project Cost Summary

1,000USD

Item	FSL=410									
	1	2	3	4	5	6	7	8	9	10
1. Preparation & Compensation	3,154	3,168	3,190	3,205	3,227	3,241	3,263	3,277	3,292	3,314
(1) Access Road										
(2) Compensation										
(3) Others										
2. Environmental Mitigation	28,230	28,230	28,230	28,230	28,230	28,230	28,230	28,230	28,230	28,230
3. Civil Works										
(1) River Treatment	6,053	6,053	6,053	6,053	6,053	6,053	6,053	6,053	6,053	6,053
(2) Dam	110,062	110,062	110,062	110,062	110,062	110,062	110,062	110,062	110,062	110,062
(3) Intake	1,030	1,063	1,093	1,124	1,151	1,181	1,205	1,233	1,260	1,281
(4) Power Tunnel	5,301	5,458	5,779	5,943	6,278	6,449	6,797	6,975	7,155	7,521
(5) Penstock	784	816	848	880	911	942	973	1,003	1,034	1,064
(6) Power House	8,320	8,567	8,816	9,052	9,285	9,509	9,733	9,945	10,159	10,365
(7) Tailrace Tunnel	7,878	8,072	8,464	8,664	9,068	9,274	9,690	9,901	10,114	10,547
(8) Tailrace	335	352	373	390	412	429	451	468	485	508
(9)P/S Access Tunnel	10,430	10,430	10,430	10,430	10,430	10,430	10,430	10,430	10,430	10,430
(10) Others	7,510	7,544	7,596	7,630	7,683	7,716	7,770	7,803	7,838	7,892
4. Hydro- Mechanical Works	17,387	17,570	17,758	17,942	18,127	18,311	18,497	18,678	18,865	19,045
5. Electro- Mechanical Works	28,840	29,955	31,042	32,110	33,171	34,462	35,477	36,490	37,479	38,454
6. Transmission Line	10,170	10,170	10,170	10,170	10,170	10,170	10,170	10,170	10,170	10,170
Direct Cost	245,483	247,511	249,905	251,884	254,258	256,458	258,802	260,719	262,626	264,935
7. Administration Fee	36,822	37,127	37,486	37,783	38,139	38,469	38,820	39,108	39,394	39,740
8. Contingency	24,548	24,751	24,990	25,188	25,426	25,646	25,880	26,072	26,263	26,494
9. Interest During Construction	61,371	61,878	62,476	62,971	63,564	64,114	64,700	65,180	65,656	66,234
Total	368,224	371,267	374,857	377,826	381,386	384,687	388,203	391,079	393,938	397,403

Basic Parameters		OP4- 415
Waterway Length		
Headrace Tunnel	m	309.3
Penstock	m	148.5
Tailrace Tunnel	m	1199
	m	1656.8
Sedimentation Level	EL.m	386.2

Specification

Item	Unit	FSL=415									
		1	2	3	4	5	6	7	8	9	10
Qmax	m3/s	82.6	87.3	92.1	96.8	101.6	106.3	111.1	115.8	120.6	125.3
FSL	EL.m	415	415	415	415	415	415	415	415	415	415
MOL	EL.m	398.2	398.4	398.8	399	399.4	399.6	400	400.2	400.4	400.8
TWL	EL.m	302.6	302.6	302.7	302.7	302.7	302.8	302.8	302.8	302.8	302.9
Loss	m	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2
Effective Head	m	109.2	109.2	109.1	109.1	109.1	109	109	109	109	108.9
Pmax	MW	80	85	90	94	99	103	108	113	117	122
Primary Energy	GWh	159.33	168.09	176.67	184.74	193.15	200.21	207.66	214.26	220.50	226.19
Pfirm	MW	59.34	62.88	65.85	67.33	71.12	74.55	77.67	80.27	82.56	84.70
Benefit	1000USD	46,529	49,171	51,608	53,506	56,160	58,462	60,742	63,001	65,208	67,366
Cost	1000USD	39,025	39,363	39,758	40,050	40,440	40,728	41,115	41,433	41,716	42,098
B/C		1.19	1.25	1.30	1.34	1.39	1.44	1.48	1.41	1.40	1.34

Civil & Hydromechanical Work Quantity

(1) Dam

Design Flood	m3/s	8,306
Dam Basis EL.	m	293
Non- overflow Width	m	80.2
Spillway Width	m	77
Sand Drain Width	m	16
Intake Width	m	0
Dam Height (Hd)	m	127
Crest Length (L)	m	173.2
Coefficient for Ex	Y=A*X*B	
A		32335
B		0.4384
Coefficient for Conc	Y=C*X*D	
C		0.0015
D		1.3058

Item	Unit	FSL=415									
		1	2	3	4	5	6	7	8	9	10
Excavation	m3	2,590,358	2,590,358	2,590,358	2,590,358	2,590,358	2,590,358	2,590,358	2,590,358	2,590,358	2,590,358
Concrete	m3	392,176	392,176	392,176	392,176	392,176	392,176	392,176	392,176	392,176	392,176
Gate	t	1,827	1,827	1,827	1,827	1,827	1,827	1,827	1,827	1,827	1,827

(2) Intake

Number	-	1									
Design Velocity	m3/s	3.5									
MOL	EL.m	398.2	398.4	398.8	399	399.4	399.6	400	400.2	400.4	400.8
Waterway Diameter	m	5.5	5.6	5.8	5.9	6.1	6.2	6.4	6.5	6.6	6.8
Available Height	m	16.8	16.6	16.2	16	15.6	15.4	15	14.8	14.6	14.2

Item	Unit	FSL=415									
		1	2	3	4	5	6	7	8	9	10
Excavation	m3	7,086	7,268	7,432	7,602	7,752	7,911	8,050	8,200	8,348	8,469
Concrete	m3	5,757	5,940	6,105	6,277	6,430	6,593	6,735	6,889	7,043	7,169
Reinforce Bar	t	230	238	244	251	257	264	269	276	282	287
Intake Gate	t	105	111	117	123	129	135	141	146	152	158
Intake Screen	t	58	62	65	68	72	75	78	81	85	88

(3) Power Tunnel

Tunnel Inner Diameter	m	5.5	5.6	5.8	5.9	6.1	6.2	6.4	6.5	6.6	6.8
Concrete Thickness	m	0.6									
Tunnel Length	m	309.3									
Number	-	1									

Item	Unit	FSL=415									
		1	2	3	4	5	6	7	8	9	10
Tunnel Excavation	m3	11,108	11,442	12,125	12,473	13,186	13,550	14,292	14,671	15,054	15,836
Lining Concrete	m3	3,759	3,824	3,953	4,017	4,147	4,212	4,342	4,407	4,472	4,603
Reinforce Bar	t	150	153	158	161	166	168	174	176	179	184

(3') Service Adit

Tunnel Length	m	1642.07
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Item	Unit	FSL=415									
		1	2	3	4	5	6	7	8	9	10
Tunnel Excavation	m3	58,970	60,743	64,369	66,221	70,005	71,936	75,877	77,887	79,923	84,074

(4) Penstocks											
Design Velocity 1	m/s	3.5									
Penstock Length 1	m	5									
Design Velocity 2	m/s	5.2									
Penstock Length 2	m	110.2									
Design Velocity 3	m/s	6.08									
Penstock Length 3	m	25.7									
Design Velocity 4	m/s	8.76 2 penstocks									
Penstock Length 4	m	7.6									
Mean Velocity	m/s	5.637079									
Dm	m	4.319346	4.440533	4.560976	4.675905	4.790434	4.899984	5.009392	5.114254	5.219173	5.319901
tm	mm	17.19598	17.62233	18.03179	18.43576	18.83833	19.20806	19.59228	19.96054	20.329	20.6661

Item	Unit	FSL=415									
		1	2	3	4	5	6	7	8	9	10
Tunnel Excavation	m3	3,553	3,711	3,871	4,027	4,185	4,340	4,497	4,650	4,806	4,958
Lining Concrete	m3	1,377	1,411	1,445	1,477	1,509	1,540	1,570	1,600	1,629	1,657
Reinforce Bar	t	17	17	17	18	18	18	19	19	20	20
Penstock	t	329	346	364	382	400	417	435	452	470	487

(5) Powerhouse											
Undergroundtype											
A	m2	868.8155	893.1917	917.1381	940.2484	963.2783	985.0058	1006.999	1028.079	1049.17	1069.091
d	m	30									

Item	Unit	FSL=415									
		1	2	3	4	5	6	7	8	9	10
Excavation	m3	57,342	58,951	60,531	62,056	63,576	65,010	66,462	67,853	69,245	70,580
Concrete	m3	13,032	13,398	13,757	14,104	14,449	14,775	15,105	15,421	15,738	16,036
Reinforce Bar	t	52	54	55	56	58	59	60	62	63	64

(6) Tailrace Tunnel											
Design Velocity	m/s	3.5									
Tunnel Inner Diameter	m	5.5	5.6	5.8	5.9	6.1	6.2	6.4	6.5	6.6	6.8
Concrete Thickness	m	0.6									
Tunnel Length	m	1199									
Number	-	1									

Item	Unit	FSL=415									
		1	2	3	4	5	6	7	8	9	10
Tunnel Excavation	m3	43,058	44,353	47,001	48,353	51,116	52,526	55,403	56,871	58,358	61,389
Lining Concrete	m3	14,572	14,822	15,322	15,573	16,075	16,327	16,832	17,084	17,338	17,845
Reinforce Bar	t	583	593	613	623	643	653	673	683	694	714

(7) Tailrace											
Item	Unit	FSL=415									
		1	2	3	4	5	6	7	8	9	10
Excavation	m3	5,312	5,502	5,741	5,928	6,164	6,348	6,584	6,766	6,949	7,179
Concrete	m3	1,652	1,737	1,846	1,932	2,043	2,131	2,245	2,334	2,425	2,540
Reinforce Bar	t	24	24	25	26	27	28	28	29	30	31

(8) P/H Access Tunnel											
Tunnel Length	m	1844.1									

Item	Unit	FSL=415									
		1	2	3	4	5	6	7	8	9	10
Tunnel Excavation	m3	82,985	82,985	82,985	82,985	82,985	82,985	82,985	82,985	82,985	82,985
Lining Concrete	m3	18,441	18,441	18,441	18,441	18,441	18,441	18,441	18,441	18,441	18,441
Reinforce Bar	t	553	553	553	553	553	553	553	553	553	553

Civil Work Cost 1,000USD

Item	Unit	FSL=415									
		1	2	3	4	5	6	7	8	9	10
(1) Concrete Dam											
(1).1 River Treatment(NEA F/S)		6,053	6,053	6,053	6,053	6,053	6,053	6,053	6,053	6,053	6,053
(1).2 Concrete Dam											
Excavation		46,626	46,626	46,626	46,626	46,626	46,626	46,626	46,626	46,626	46,626
Concrete		50,983	50,983	50,983	50,983	50,983	50,983	50,983	50,983	50,983	50,983
Others		19,522	19,522	19,522	19,522	19,522	19,522	19,522	19,522	19,522	19,522
(2) Intake											
Excavation		135	138	141	144	147	150	153	156	159	161
Concrete		691	713	733	753	772	791	808	827	845	860
Reinforce Bar		191	197	203	208	213	219	224	229	234	238
Others		254	262	269	277	283	290	296	303	309	315
(3) Power Tunnel											
Tunnel Excavation		778	801	849	873	923	948	1,000	1,027	1,054	1,109
Lining Concrete		526	535	553	562	581	590	608	617	626	644
Reinforce Bar		132	135	139	141	146	148	153	155	157	162
Others		215	221	231	237	247	253	264	270	276	287
(3) Service Adit											

Tunnel Excavation	4,128	4,252	4,506	4,635	4,900	5,036	5,311	5,452	5,595	5,885
(4)Penstock										
Tunnel Excavation	497	519	542	564	586	608	630	651	673	694
Lining Concrete	193	198	202	207	211	216	220	224	228	232
Reinforce Bar	16	16	16	17	17	18	18	18	19	19
Others	141	147	152	157	163	168	173	179	184	189
(5)Power House										
Excavation	3,441	3,537	3,632	3,723	3,815	3,901	3,988	4,071	4,155	4,234
Concrete	2,476	2,546	2,614	2,680	2,745	2,807	2,870	2,930	2,990	3,047
Reinforce Bar	46	47	48	50	51	52	53	54	55	56
Others	2,981	3,065	3,147	3,228	3,305	3,380	3,455	3,528	3,600	3,668
(6)Tailrace Tunnel										
Tunnel Excavation	3,229	3,327	3,525	3,626	3,834	3,939	4,155	4,265	4,377	4,604
Lining Concrete	2,769	2,816	2,911	2,959	3,054	3,102	3,198	3,246	3,294	3,391
Reinforce Bar	513	522	539	548	566	575	592	601	610	628
Others	1,953	1,999	2,093	2,140	2,236	2,285	2,384	2,434	2,484	2,587
(7)Tailrace										
Excavation	64	66	69	71	74	76	79	81	83	86
Concrete	215	226	240	251	266	277	292	303	315	330
Reinforce Bar	20	20	21	22	22	23	24	24	25	25
Others	75	78	82	86	90	94	99	102	106	110
(8)P/H Access Tunnel										
Tunnel Excavation	5,807	5,807	5,807	5,807	5,807	5,807	5,807	5,807	5,807	5,807
Lining Concrete	2,397	2,397	2,397	2,397	2,397	2,397	2,397	2,397	2,397	2,397
Reinforce Bar	487	487	487	487	487	487	487	487	487	487
Others	1,738	1,738	1,738	1,738	1,738	1,738	1,738	1,738	1,738	1,738
(9)Miscellaneous Works	7,965	8,000	8,054	8,089	8,143	8,178	8,233	8,268	8,303	8,359
Total	167,257	167,996	169,126	169,862	171,006	171,737	172,894	173,630	174,370	175,536

Hydro- mechanical Works

1,000USD

Item	FSL=415									
	1	2	3	4	5	6	7	8	9	10
(1)Dam & Spillway										
Gate	11,878	11,878	11,878	11,878	11,878	11,878	11,878	11,878	11,878	11,878
(2)Intake										
Gate	690	728	768	807	846	884	923	962	1,001	1,039
Screen	383	405	427	448	470	491	513	534	556	577
(3)Penstock	1,250	1,316	1,384	1,450	1,518	1,583	1,651	1,717	1,785	1,850
(4)Tailrace										
Gate	690	728	768	807	846	884	923	962	1,001	1,039
(5)Others	2,978	3,011	3,045	3,078	3,111	3,144	3,178	3,211	3,244	3,277
Total	17,867	18,067	18,268	18,467	18,668	18,865	19,066	19,264	19,465	19,659

Project Cost Summary

1,000USD

Item	FSL=415									
	1	2	3	4	5	6	7	8	9	10
1. Preparation & Compensation	3,345	3,360	3,383	3,397	3,420	3,435	3,458	3,473	3,487	3,511
(1) Access Road										
(2) Compensation										
(3) Others										
2. Environmental Mitigation	30,180	30,180	30,180	30,180	30,180	30,180	30,180	30,180	30,180	30,180
3. Civil Works										
(1) River Treatment	6,053	6,053	6,053	6,053	6,053	6,053	6,053	6,053	6,053	6,053
(2) Dam	117,131	117,131	117,131	117,131	117,131	117,131	117,131	117,131	117,131	117,131
(3) Intake	1,271	1,310	1,346	1,383	1,415	1,450	1,481	1,514	1,547	1,574
(4) Power Tunnel	5,779	5,943	6,278	6,449	6,797	6,975	7,337	7,521	7,708	8,087
(5) Penstock	847	880	913	945	977	1,009	1,041	1,072	1,103	1,134
(6) Power House	8,944	9,195	9,441	9,679	9,916	10,140	10,366	10,583	10,800	11,005
(7) Tailrace Tunnel	8,464	8,664	9,068	9,274	9,690	9,901	10,329	10,547	10,766	11,210
(8) Tailrace	373	390	412	430	452	470	493	511	529	552
(9)P/S Access Tunnel	10,430	10,430	10,430	10,430	10,430	10,430	10,430	10,430	10,430	10,430
(10) Others	7,965	8,000	8,054	8,089	8,143	8,178	8,233	8,268	8,303	8,359
4. Hydro- Mechanical Works	17,867	18,067	18,268	18,467	18,668	18,865	19,066	19,264	19,465	19,659
5. Electro- Mechanical Works	31,350	32,645	33,926	34,926	36,156	37,137	38,331	39,508	40,436	41,595
6. Transmission Line	10,170	10,170	10,170	10,170	10,170	10,170	10,170	10,170	10,170	10,170
Direct Cost	260,169	262,417	265,052	267,001	269,600	271,523	274,099	276,223	278,109	280,650
7. Administration Fee	39,025	39,363	39,758	40,050	40,440	40,728	41,115	41,433	41,716	42,098
8. Contingency	26,017	26,242	26,505	26,700	26,960	27,152	27,410	27,622	27,811	28,065
9. Interest During Construction	65,042	65,604	66,263	66,750	67,400	67,881	68,525	69,056	69,527	70,163
Total	390,253	393,626	397,578	400,501	404,400	407,285	411,148	414,335	417,163	420,975

Basic Parameters OP4- 420

Waterway Length		
Headrace Tunnel	m	309.3
Penstock	m	148.5
Tailrace Tunnel	m	1199
	m	1656.8
Sedimentation Level	EL.m	386.2

Specification

Item	Unit	FSL=420									
		1	2	3	4	5	6	7	8	9	10
Gmax	m3/s	92.3	97.2	102	106.9	111.7	116.6	121.4	126.3	131.1	136
FSL	EL.m	420	420	420	420	420	420	420	420	420	420
MOL	EL.m	398.8	399	399.4	399.6	400	400.2	400.4	400.8	401	401.2
TWL	EL.m	302.7	302.7	302.7	302.8	302.8	302.8	302.8	302.9	302.9	302.9
Loss	m	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2
Effective Head	m	114.1	114.1	114.1	114	114	114	114	113.9	113.9	113.9
Pmax	MW	94	99	104	109	114	119	123	128	133	138
Primary Energy	GWh	182.69	191.65	200.38	208.71	216.60	223.94	230.48	237.31	243.54	249.22
Pfirm	MW	65.81	67.30	69.85	73.35	77.12	80.76	79.97	66.87	64.77	59.38
Benefit	1000USD	52,680	54,741	57,079	59,631	62,186	64,602	65,541	62,830	63,320	62,721
Cost	1000USD	41,907	42,238	42,624	42,949	43,332	43,650	43,931	44,313	44,623	44,933
B/C		1.26	1.30	1.34	1.39	1.44	1.48	1.49	1.42	1.42	1.40

Civil & Hydromechanical Work Quantity

(1) Dam

Design Flood	m3/s	8,306
Dam Basis EL.	m	293
Non- overflow Width	m	80.2
Spillway Width	m	77
Sand Drain Width	m	16
Intake Width	m	0
Dam Height (Hd)	m	132
Crest Length (L)	m	173.2
Coefficient for Ex	Y=A*X*B	
	A	32335
	B	0.4384
Coefficient for Conc	Y=C*X*D	
	C	0.0015
	D	1.3058

Item	Unit	FSL=420									
		1	2	3	4	5	6	7	8	9	10
Excavation	m3	2,634,583	2,634,583	2,634,583	2,634,583	2,634,583	2,634,583	2,634,583	2,634,583	2,634,583	2,634,583
Concrete	m3	433,788	433,788	433,788	433,788	433,788	433,788	433,788	433,788	433,788	433,788
Gate	t	1,827	1,827	1,827	1,827	1,827	1,827	1,827	1,827	1,827	1,827

(2) Intake

Number	-	1									
Design Velocity	m3/s	3.5									
MOL	EL.m	398.8	399	399.4	399.6	400	400.2	400.4	400.8	401	401.2
Waterway Diameter	m	5.8	5.9	6.1	6.2	6.4	6.5	6.6	6.8	6.9	7
Available Height	m	21.2	21	20.6	20.4	20	19.8	19.6	19.2	19	18.8

Item	Unit	FSL=420									
		1	2	3	4	5	6	7	8	9	10
Excavation	m3	8,242	8,442	8,616	8,804	8,966	9,143	9,311	9,461	9,621	9,780
Concrete	m3	6,933	7,141	7,322	7,519	7,689	7,877	8,056	8,215	8,386	8,557
Reinforce Bar	t	277	286	293	301	308	315	322	329	335	342
Intake Gate	t	120	126	132	139	145	151	157	163	169	176
Intake Screen	t	67	70	73	77	80	84	87	91	94	98

(3) Power Tunnel

Tunnel Inner Diameter	m	5.8	5.9	6.1	6.2	6.4	6.5	6.6	6.8	6.9	7
Concrete Thickness	m	0.6									
Tunnel Length	m	309.3									
Number	-	1									

Item	Unit	FSL=420									
		1	2	3	4	5	6	7	8	9	10
Tunnel Excavation	m3	12,125	12,473	13,186	13,550	14,292	14,671	15,054	15,836	16,235	16,638
Lining Concrete	m3	3,953	4,017	4,147	4,212	4,342	4,407	4,472	4,603	4,669	4,735
Reinforce Bar	t	158	161	166	168	174	176	179	184	187	189

(3) Service Adit

Tunnel Length	m	1642.07
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Item	Unit	FSL=420									
		1	2	3	4	5	6	7	8	9	10
Tunnel Excavation	m3	64,369	66,221	70,005	71,936	75,877	77,887	79,923	84,074	86,189	88,330

Tunnel Excavation	4,506	4,635	4,900	5,036	5,311	5,452	5,595	5,885	6,033	6,183
(4)Penstock										
Tunnel Excavation	543	566	588	610	632	655	676	699	720	742
Lining Concrete	202	207	212	216	220	225	229	233	237	241
Reinforce Bar	16	17	17	18	18	18	19	19	19	20
Others	152	158	163	169	174	180	185	190	195	201
(5)Power House										
Excavation	3,691	3,787	3,880	3,971	4,059	4,147	4,231	4,315	4,396	4,477
Concrete	2,656	2,726	2,792	2,858	2,921	2,984	3,045	3,105	3,164	3,222
Reinforce Bar	49	50	52	53	54	55	56	58	59	60
Others	3,198	3,282	3,362	3,441	3,517	3,593	3,666	3,739	3,809	3,880
(6)Tailrace Tunnel										
Tunnel Excavation	3,525	3,626	3,834	3,939	4,155	4,265	4,377	4,604	4,720	4,837
Lining Concrete	2,911	2,959	3,054	3,102	3,198	3,246	3,294	3,391	3,439	3,487
Reinforce Bar	539	548	566	575	592	601	610	628	637	646
Others	2,093	2,140	2,236	2,285	2,384	2,434	2,484	2,587	2,639	2,691
(7)Tailrace										
Excavation	69	71	74	76	79	81	84	86	89	91
Concrete	240	252	266	278	293	305	317	332	344	356
Reinforce Bar	21	22	22	23	24	24	25	26	26	27
Others	83	86	91	94	99	103	106	111	115	118
(8)P/H Access Tunnel										
Tunnel Excavation	5,807	5,807	5,807	5,807	5,807	5,807	5,807	5,807	5,807	5,807
Lining Concrete	2,397	2,397	2,397	2,397	2,397	2,397	2,397	2,397	2,397	2,397
Reinforce Bar	487	487	487	487	487	487	487	487	487	487
Others	1,738	1,738	1,738	1,738	1,738	1,738	1,738	1,738	1,738	1,738
(9)Miscellaneous Works	8,443	8,479	8,534	8,570	8,625	8,661	8,697	8,753	8,789	8,825
Total	177,294	178,054	179,207	179,962	181,128	181,885	182,634	183,821	184,572	185,329

Hydro- mechanical Works

1,000USD

Item	FSL=420									
	1	2	3	4	5	6	7	8	9	10
(1)Dam & Spillway										
Gate	11,878	11,878	11,878	11,878	11,878	11,878	11,878	11,878	11,878	11,878
(2)Intake										
Gate	787	829	869	910	950	991	1,032	1,073	1,113	1,154
Screen	437	460	483	506	528	551	573	596	618	641
(3)Penstock	1,441	1,514	1,584	1,655	1,726	1,798	1,868	1,939	2,009	2,081
(4)Tailrace										
Gate	787	829	869	910	950	991	1,032	1,073	1,113	1,154
(5)Others	3,066	3,102	3,136	3,172	3,206	3,242	3,277	3,311	3,346	3,381
Total	18,397	18,610	18,819	19,031	19,238	19,451	19,659	19,869	20,077	20,289

Project Cost Summary

1,000USD

Item	FSL=420									
	1	2	3	4	5	6	7	8	9	10
1. Preparation & Compensation	3,546	3,561	3,584	3,599	3,623	3,638	3,653	3,676	3,691	3,707
(1) Access Road										
(2) Compensation										
(3) Others										
2. Environmental Mitigation	35,570	35,570	35,570	35,570	35,570	35,570	35,570	35,570	35,570	35,570
3. Civil Works										
(1) River Treatment	6,053	6,053	6,053	6,053	6,053	6,053	6,053	6,053	6,053	6,053
(2) Dam	124,578	124,578	124,578	124,578	124,578	124,578	124,578	124,578	124,578	124,578
(3) Intake	1,523	1,568	1,607	1,649	1,685	1,726	1,764	1,798	1,834	1,871
(4) Power Tunnel	6,278	6,449	6,797	6,975	7,337	7,521	7,708	8,087	8,281	8,476
(5) Penstock	914	948	980	1,013	1,045	1,077	1,109	1,140	1,172	1,203
(6) Power House	9,594	9,845	10,085	10,322	10,551	10,780	10,999	11,216	11,427	11,639
(7) Tailrace Tunnel	9,068	9,274	9,690	9,901	10,329	10,547	10,766	11,210	11,435	11,662
(8) Tailrace	413	431	454	472	495	513	531	555	574	592
(9)P/S Access Tunnel	10,430	10,430	10,430	10,430	10,430	10,430	10,430	10,430	10,430	10,430
(10) Others	8,443	8,479	8,534	8,570	8,625	8,661	8,697	8,753	8,789	8,825
4. Hydro- Mechanical Works	18,397	18,610	18,819	19,031	19,238	19,451	19,659	19,869	20,077	20,289
5. Electro- Mechanical Works	34,407	35,619	36,811	37,995	39,150	40,289	41,188	42,311	43,408	44,492
6. Transmission Line	10,170	10,170	10,170	10,170	10,170	10,170	10,170	10,170	10,170	10,170
Direct Cost	279,383	281,584	284,160	286,326	288,878	291,002	292,874	295,417	297,488	299,555
7. Administration Fee	41,907	42,238	42,624	42,949	43,332	43,650	43,931	44,313	44,623	44,933
8. Contingency	27,938	28,158	28,416	28,633	28,888	29,100	29,287	29,542	29,749	29,956
9. Interest During Construction	69,846	70,396	71,040	71,581	72,219	72,750	73,218	73,854	74,372	74,889
Total	419,075	422,376	426,241	429,488	433,317	436,503	439,311	443,125	446,231	449,333

Basic Parameters OP4- 425

Waterway Length		
Headrace Tunnel	m	309.3
Penstock	m	148.5
Tailrace Tunnel	m	1199
	m	1656.8
Sedimentation Level	EL.m	386.2

Specification

Item	Unit	FSL=425									
		1	2	3	4	5	6	7	8	9	10
Qmax	m3/s	102.9	107.8	112.6	117.5	122.3	127.2	132	136.9	141.7	146.6
FSL	EL.m	425	425	425	425	425	425	425	425	425	425
MOL	EL.m	399.4	399.8	400	400.2	400.6	400.8	401	401.4	401.6	401.8
TWL	EL.m	302.7	302.8	302.8	302.8	302.9	302.9	302.9	302.9	302.9	303
Loss	m	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2
Effective Head	m	119.1	119	119	119	118.9	118.9	118.9	118.9	118.9	118.8
Pmax	MW	109	114	120	125	130	135	140	145	150	155
Primary Energy	GWh	208.02	216.82	225.47	233.65	241.03	248.06	254.63	261.07	267.18	272.22
Pfirm	MW	70.57	72.75	76.22	79.78	83.45	86.40	80.17	65.51	64.99	60.06
Benefit	1000USD	58,671	60,911	63,512	66,055	68,487	70,640	69,949	66,698	67,641	67,066
Cost	1000USD	44,872	45,257	45,608	45,923	46,301	46,613	46,920	47,296	47,600	47,905
B/C		1.31	1.35	1.39	1.44	1.48	1.52	1.49	1.41	1.42	1.40

Civil & Hydromechanical Work Quantity

(1) Dam

Design Flood	m3/s	8,306
Dam Basis EL	m	293
Non- overflow Width	m	80.2
Spillway Width	m	77
Sand Drain Width	m	16
Intake Width	m	0
Dam Height (Hd)	m	137
Crest Length (L)	m	173.2
Coefficient for Ex	Y=A*X*B	
	A	32335
	B	0.4384
Coefficient for Conc	Y=C*X*D	
	C	0.0015
	D	1.3058

Item	Unit	FSL=425									
		1	2	3	4	5	6	7	8	9	10
Excavation	m3	2,677,877	2,677,877	2,677,877	2,677,877	2,677,877	2,677,877	2,677,877	2,677,877	2,677,877	2,677,877
Concrete	m3	478,021	478,021	478,021	478,021	478,021	478,021	478,021	478,021	478,021	478,021
Gate	t	1,827	1,827	1,827	1,827	1,827	1,827	1,827	1,827	1,827	1,827

(2) Intake

Number	-	1									
Design Velocity	m3/s	3.5									
MOL	EL.m	399.4	399.8	400	400.2	400.6	400.8	401	401.4	401.6	401.8
Waterway Diameter	m	6.1	6.3	6.4	6.5	6.7	6.8	6.9	7.1	7.2	7.3
Available Height	m	25.6	25.2	25	24.8	24.4	24.2	24	23.6	23.4	23.2

Item	Unit	FSL=425									
		1	2	3	4	5	6	7	8	9	10
Excavation	m3	9,429	9,621	9,817	10,012	10,182	10,367	10,544	10,703	10,872	11,040
Concrete	m3	8,182	8,386	8,597	8,808	8,992	9,194	9,387	9,562	9,747	9,933
Reinforce Bar	t	327	335	344	352	360	368	375	382	390	397
Intake Gate	t	136	142	149	155	161	168	174	180	187	193
Intake Screen	t	76	79	83	86	90	93	97	100	104	107

(3) Power Tunnel

Tunnel Inner Diameter	m	6.1	6.3	6.4	6.5	6.7	6.8	6.9	7.1	7.2	7.3
Concrete Thickness	m	0.6									
Tunnel Length	m	309.3									
Number	-	1									

Item	Unit	FSL=425									
		1	2	3	4	5	6	7	8	9	10
Tunnel Excavation	m3	13,186	13,919	14,292	14,671	15,443	15,836	16,235	17,046	17,459	17,878
Lining Concrete	m3	4,147	4,277	4,342	4,407	4,538	4,603	4,669	4,800	4,866	4,932
Reinforce Bar	t	166	171	174	176	182	184	187	192	195	197

(3) Service Adit

Tunnel Length	m	1642.07
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Item	Unit	FSL=425									
		1	2	3	4	5	6	7	8	9	10
Tunnel Excavation	m3	70,005	73,893	75,877	77,887	81,985	84,074	86,189	90,498	92,692	94,912

(4) Penstocks											
Design Velocity 1	m/s	3.5									
Penstock Length 1	m	5									
Design Velocity 2	m/s	5.2									
Penstock Length 2	m	110.2									
Design Velocity 3	m/s	6.08									
Penstock Length 3	m	25.7									
Design Velocity 4	m/s	8.76 2 penstocks									
Penstock Length 4	m	7.6									
Mean Velocity	m/s	5.637079									
Dm	m	4.820984	4.934434	5.043096	5.151657	5.255829	5.360084	5.460281	5.560703	5.667348	5.754333
tm	mm	20.45468	20.87352	21.28913	21.70437	22.08636	22.48479	22.86772	23.25151	23.62086	23.97935

Item	Unit	FSL=425									
		1	2	3	4	5	6	7	8	9	10
Tunnel Excavation	m3	4,228	4,389	4,546	4,705	4,861	5,019	5,174	5,331	5,484	5,641
Lining Concrete	m3	1,517	1,549	1,580	1,610	1,639	1,668	1,696	1,724	1,752	1,779
Reinforce Bar	t	18	19	19	19	20	20	20	21	21	21
Penstock	t	437	456	475	495	514	534	553	572	592	611

(5) Powerhouse											
Undergroundtype											
A	m2	998.1786	1021.382	1043.874	1066.345	1087.603	1109.177	1129.911	1150.692	1170.691	1190.426
d	m	30									

Item	Unit	FSL=425									
		1	2	3	4	5	6	7	8	9	10
Excavation	m3	65,880	67,411	68,896	70,379	71,782	73,206	74,574	75,946	77,266	78,568
Concrete	m3	14,973	15,321	15,658	15,995	16,314	16,638	16,949	17,260	17,560	17,856
Reinforce Bar	t	60	61	63	64	65	67	68	69	70	71

(6) Tailrace Tunnel											
Design Velocity	m/s	3.5									
Tunnel Inner Diameter	m	6.1	6.3	6.4	6.5	6.7	6.8	6.9	7.1	7.2	7.3
Concrete Thickness	m	0.6									
Tunnel Length	m	1199									
Number	-	1									

Item	Unit	FSL=425									
		1	2	3	4	5	6	7	8	9	10
Tunnel Excavation	m3	51,116	53,955	55,403	56,871	59,864	61,389	62,933	66,079	67,681	69,302
Lining Concrete	m3	16,075	16,579	16,832	17,084	17,591	17,845	18,099	18,609	18,864	19,119
Reinforce Bar	t	643	663	673	683	704	714	724	744	755	765

(7) Tailrace											
Item	Unit	FSL=425									
		1	2	3	4	5	6	7	8	9	10
Excavation	m3	6,202	6,440	6,626	6,813	7,046	7,231	7,413	7,647	7,827	8,008
Concrete	m3	2,061	2,175	2,265	2,357	2,473	2,567	2,659	2,780	2,874	2,969
Reinforce Bar	t	27	28	29	29	30	31	32	32	33	34

(8) P/H Access Tunnel											
Tunnel Length	m	1844.1									

Item	Unit	FSL=425									
		1	2	3	4	5	6	7	8	9	10
Tunnel Excavation	m3	82,985	82,985	82,985	82,985	82,985	82,985	82,985	82,985	82,985	82,985
Lining Concrete	m3	18,441	18,441	18,441	18,441	18,441	18,441	18,441	18,441	18,441	18,441
Reinforce Bar	t	553	553	553	553	553	553	553	553	553	553

Civil Work Cost 1,000USD

Item	FSL=425									
	1	2	3	4	5	6	7	8	9	10
(1) Concrete Dam										
(1).1 River Treatment(NEA F/S)	6,053	6,053	6,053	6,053	6,053	6,053	6,053	6,053	6,053	6,053
(1).2 Concrete Dam										
Excavation	48,202	48,202	48,202	48,202	48,202	48,202	48,202	48,202	48,202	48,202
Concrete	62,143	62,143	62,143	62,143	62,143	62,143	62,143	62,143	62,143	62,143
Others	22,069	22,069	22,069	22,069	22,069	22,069	22,069	22,069	22,069	22,069
(2) Intake										
Excavation	179	183	187	190	193	197	200	203	207	210
Concrete	982	1,006	1,032	1,057	1,079	1,103	1,126	1,147	1,170	1,192
Reinforce Bar	272	278	285	292	299	305	312	317	324	330
Others	358	367	376	385	393	401	410	417	425	433
(3) Power Tunnel										
Tunnel Excavation	923	974	1,000	1,027	1,081	1,109	1,136	1,193	1,222	1,251
Lining Concrete	581	599	608	617	635	644	654	672	681	690
Reinforce Bar	146	151	153	155	160	162	164	169	171	174
Others	247	259	264	270	281	287	293	305	311	317
(3) Service Adit										

Tunnel Excavation	4,900	5,173	5,311	5,452	5,739	5,885	6,033	6,335	6,488	6,644
(4)Penstock										
Tunnel Excavation	592	614	636	659	681	703	724	746	768	790
Lining Concrete	212	217	221	225	229	234	237	241	245	249
Reinforce Bar	17	18	18	18	19	19	19	20	20	20
Others	164	170	175	180	186	191	196	201	207	212
(5)Power House										
Excavation	3,953	4,045	4,134	4,223	4,307	4,392	4,474	4,557	4,636	4,714
Concrete	2,845	2,911	2,975	3,039	3,100	3,161	3,220	3,279	3,336	3,393
Reinforce Bar	53	54	55	56	57	59	60	61	62	63
Others	3,425	3,505	3,582	3,659	3,732	3,806	3,877	3,948	4,017	4,085
(6)Tailrace Tunnel										
Tunnel Excavation	3,834	4,047	4,155	4,265	4,490	4,604	4,720	4,956	5,076	5,198
Lining Concrete	3,054	3,150	3,198	3,246	3,342	3,391	3,439	3,536	3,584	3,633
Reinforce Bar	566	584	592	601	619	628	637	655	664	673
Others	2,236	2,334	2,384	2,434	2,535	2,587	2,639	2,744	2,797	2,851
(7)Tailrace										
Excavation	74	77	80	82	85	87	89	92	94	96
Concrete	268	283	295	306	322	334	346	361	374	386
Reinforce Bar	22	23	24	24	25	26	26	27	27	28
Others	91	96	99	103	108	112	115	120	124	128
(8)P/H Access Tunnel										
Tunnel Excavation	5,807	5,807	5,807	5,807	5,807	5,807	5,807	5,807	5,807	5,807
Lining Concrete	2,397	2,397	2,397	2,397	2,397	2,397	2,397	2,397	2,397	2,397
Reinforce Bar	487	487	487	487	487	487	487	487	487	487
Others	1,738	1,738	1,738	1,738	1,738	1,738	1,738	1,738	1,738	1,738
(9)Miscellaneous Works	8,945	9,001	9,037	9,073	9,130	9,166	9,202	9,260	9,296	9,333
Total	187,836	189,012	189,772	190,537	191,722	192,488	193,247	194,461	195,222	195,987

Hydro- mechanical Works

1,000USD

Item	FSL=425									
	1	2	3	4	5	6	7	8	9	10
(1)Dam & Spillway										
Gate	11,878	11,878	11,878	11,878	11,878	11,878	11,878	11,878	11,878	11,878
(2)Intake										
Gate	893	935	976	1,019	1,059	1,102	1,143	1,184	1,225	1,267
Screen	496	520	542	566	589	612	635	658	681	704
(3)Penstock	1,659	1,733	1,806	1,881	1,953	2,028	2,101	2,175	2,248	2,321
(4)Tailrace										
Gate	893	935	976	1,019	1,059	1,102	1,143	1,184	1,225	1,267
(5)Others	3,164	3,200	3,236	3,272	3,308	3,344	3,380	3,416	3,451	3,487
Total	18,983	19,200	19,415	19,634	19,846	20,064	20,278	20,495	20,709	20,924

Project Cost Summary

1,000USD

Item	FSL=425									
	1	2	3	4	5	6	7	8	9	10
1. Preparation & Compensation	3,757	3,780	3,795	3,811	3,834	3,850	3,865	3,889	3,904	3,920
(1) Access Road										
(2) Compensation										
(3) Others										
2. Environmental Mitigation	40,960	40,960	40,960	40,960	40,960	40,960	40,960	40,960	40,960	40,960
3. Civil Works										
(1) River Treatment	6,053	6,053	6,053	6,053	6,053	6,053	6,053	6,053	6,053	6,053
(2) Dam	132,413	132,413	132,413	132,413	132,413	132,413	132,413	132,413	132,413	132,413
(3) Intake	1,791	1,834	1,880	1,925	1,964	2,007	2,048	2,085	2,125	2,164
(4) Power Tunnel	6,797	7,155	7,337	7,521	7,896	8,087	8,281	8,674	8,874	9,077
(5) Penstock	986	1,019	1,051	1,083	1,114	1,146	1,177	1,209	1,240	1,271
(6) Power House	10,275	10,514	10,746	10,977	11,196	11,418	11,632	11,845	12,051	12,254
(7) Tailrace Tunnel	9,690	10,114	10,329	10,547	10,987	11,210	11,435	11,891	12,121	12,354
(8) Tailrace	456	479	497	516	539	558	576	600	619	638
(9)P/S Access Tunnel	10,430	10,430	10,430	10,430	10,430	10,430	10,430	10,430	10,430	10,430
(10) Others	8,945	9,001	9,037	9,073	9,130	9,166	9,202	9,260	9,296	9,333
4. Hydro- Mechanical Works	18,983	19,200	19,415	19,634	19,846	20,064	20,278	20,495	20,709	20,924
5. Electro- Mechanical Works	37,443	38,593	39,938	41,042	42,143	43,219	44,281	45,331	46,370	47,410
6. Transmission Line	10,170	10,170	10,170	10,170	10,170	10,170	10,170	10,170	10,170	10,170
Direct Cost	299,149	301,715	304,050	306,153	308,674	310,750	312,800	315,306	317,334	319,370
7. Administration Fee	44,872	45,257	45,608	45,923	46,301	46,613	46,920	47,296	47,600	47,905
8. Contingency	29,915	30,172	30,405	30,615	30,867	31,075	31,280	31,531	31,733	31,937
9. Interest During Construction	74,787	75,429	76,013	76,538	77,169	77,688	78,200	78,826	79,334	79,842
Total	448,724	452,573	456,075	459,230	463,012	466,125	469,201	472,958	476,002	479,055

Basic Parameters	OP4- 435	
Waterway Length		
Headrace Tunnel	m	309.3
Penstock	m	148.5
Tailrace Tunnel	m	1199
	m	1656.8
Sedimentation Level	EL.m	386.2

Specification

Item	Unit	FSL=435									
		1	2	3	4	5	6	7	8	9	10
Qmax	m3/s	124.6	129.5	134.4	139.4	144.3	149.2	154.1	159.1	164	168.9
FSL	EL.m	435	435	435	435	435	435	435	435	435	435
MOL	EL.m	400.6	401	401.2	401.4	401.6	402	402.2	402.4	402.6	402.8
TWL	EL.m	302.9	302.9	302.9	302.9	303	303	303	303	303	303.1
Loss	m	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2
Effective Head	m	128.9	128.9	128.9	128.9	128.8	128.8	128.8	128.8	128.8	128.7
Pmax	MW	143	149	155	160	166	171	177	183	188	194
Primary Energy	GWh	262.04	270.88	279.00	286.47	293.41	299.76	305.88	311.68	315.90	320.33
Pfirm	MW	81.85	85.61	89.13	92.73	95.73	81.87	76.38	68.53	64.96	60.05
Benefit	1000USD	71,788	74,510	77,030	79,458	81,609	78,583	78,034	76,716	76,402	75,722
Cost	1000USD	52,593	52,996	53,331	53,635	53,965	54,335	54,662	54,988	55,283	55,606
B/C		1.36	1.41	1.44	1.48	1.51	1.45	1.43	1.40	1.38	1.36

Civil & Hydromechanical Work Quantity

(1) Dam

Design Flood	m3/s	8,306
Dam Basis EL.	m	293
Non- overflow Width	m	80.2
Spillway Width	m	77
Sand Drain Width	m	16
Intake Width	m	0
Dam Height (Hd)	m	147
Crest Length (L)	m	173.2
Coefficient for Ex	Y=A*X*B	
	A	32335
	B	0.4384
Coefficient for Conc	Y=C*X*D	
	C	0.0015
	D	1.3058

Item	Unit	FSL=435									
		1	2	3	4	5	6	7	8	9	10
Excavation	m3	2,761,876	2,761,876	2,761,876	2,761,876	2,761,876	2,761,876	2,761,876	2,761,876	2,761,876	2,761,876
Concrete	m3	574,583	574,583	574,583	574,583	574,583	574,583	574,583	574,583	574,583	574,583
Gate	t	1,827	1,827	1,827	1,827	1,827	1,827	1,827	1,827	1,827	1,827

(2) Intake

Number	-	1									
Design Velocity	m3/s	3.5									
MOL	EL.m	400.6	401	401.2	401.4	401.6	402	402.2	402.4	402.6	402.8
Waterway Diameter	m	6.7	6.9	7	7.1	7.2	7.4	7.5	7.6	7.7	7.8
Available Height	m	34.4	34	33.8	33.6	33.4	33	32.8	32.6	32.4	32.2

Item	Unit	FSL=435									
		1	2	3	4	5	6	7	8	9	10
Excavation	m3	11,815	12,016	12,226	12,436	12,637	12,818	13,011	13,204	13,389	13,570
Concrete	m3	10,797	11,023	11,261	11,499	11,728	11,936	12,157	12,379	12,592	12,803
Reinforce Bar	t	432	441	450	460	469	477	486	495	504	512
Intake Gate	t	169	176	183	189	196	203	209	216	222	229
Intake Screen	t	94	98	101	105	109	113	116	120	124	127

(3) Power Tunnel

Tunnel Inner Diameter	m	6.7	6.9	7	7.1	7.2	7.4	7.5	7.6	7.7	7.8
Concrete Thickness	m	0.6									
Tunnel Length	m	309.3									
Number	-	1									

Item	Unit	FSL=435									
		1	2	3	4	5	6	7	8	9	10
Tunnel Excavation	m3	15,443	16,235	16,638	17,046	17,459	18,301	18,729	19,162	19,600	20,043
Lining Concrete	m3	4,538	4,669	4,735	4,800	4,866	4,998	5,064	5,130	5,197	5,263
Reinforce Bar	t	182	187	189	192	195	200	203	205	208	211

(3') Service Adit

Tunnel Length	m	1642.07
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Item	Unit	FSL=435									
		1	2	3	4	5	6	7	8	9	10
Tunnel Excavation	m3	81,985	86,189	88,330	90,498	92,692	97,158	99,431	101,730	104,055	106,406

Tunnel Excavation	5,739	6,033	6,183	6,335	6,488	6,801	6,960	7,121	7,284	7,448
(4) Penstock										
Tunnel Excavation	691	713	735	758	779	801	823	845	867	888
Lining Concrete	231	235	239	243	247	251	255	258	262	266
Reinforce Bar	19	19	19	20	20	20	21	21	21	22
Others	188	194	199	204	209	215	220	225	230	235
(5) Power House										
Excavation	4,466	4,553	4,638	4,724	4,805	4,886	4,965	5,045	5,122	5,197
Concrete	3,214	3,277	3,338	3,400	3,458	3,516	3,573	3,631	3,686	3,740
Reinforce Bar	60	61	62	63	64	65	66	67	68	69
Others	3,870	3,945	4,019	4,093	4,163	4,233	4,302	4,372	4,438	4,503
(6) Tailrace Tunnel										
Tunnel Excavation	4,490	4,720	4,837	4,956	5,076	5,321	5,445	5,571	5,698	5,827
Lining Concrete	3,342	3,439	3,487	3,536	3,584	3,681	3,730	3,779	3,828	3,877
Reinforce Bar	619	637	646	655	664	682	691	700	709	718
Others	2,535	2,639	2,691	2,744	2,797	2,905	2,960	3,015	3,071	3,127
(7) Tailrace										
Excavation	85	88	90	93	95	98	100	102	104	106
Concrete	326	341	353	366	378	394	407	420	432	445
Reinforce Bar	25	26	27	27	28	28	29	29	30	30
Others	109	114	118	121	125	130	134	138	142	145
(8) P/H Access Tunnel										
Tunnel Excavation	5,807	5,807	5,807	5,807	5,807	5,807	5,807	5,807	5,807	5,807
Lining Concrete	2,397	2,397	2,397	2,397	2,397	2,397	2,397	2,397	2,397	2,397
Reinforce Bar	487	487	487	487	487	487	487	487	487	487
Others	1,738	1,738	1,738	1,738	1,738	1,738	1,738	1,738	1,738	1,738
(9) Miscellaneous Works	10,014	10,073	10,110	10,147	10,184	10,244	10,281	10,319	10,356	10,393
Total	210,304	211,524	212,307	213,095	213,872	215,116	215,901	216,692	217,477	218,259

Hydro- mechanical Works

1,000USD

Item	FSL=435									
	1	2	3	4	5	6	7	8	9	10
(1) Dam & Spillway										
Gate	11,878	11,878	11,878	11,878	11,878	11,878	11,878	11,878	11,878	11,878
(2) Intake										
Gate	1,113	1,157	1,200	1,244	1,288	1,331	1,374	1,418	1,461	1,505
Screen	619	643	667	691	715	739	763	788	812	836
(3) Penstock	2,136	2,217	2,297	2,379	2,457	2,538	2,618	2,699	2,779	2,857
(4) Tailrace										
Gate	1,113	1,157	1,200	1,244	1,288	1,331	1,374	1,418	1,461	1,505
(5) Others	3,372	3,410	3,448	3,487	3,525	3,563	3,601	3,640	3,678	3,716
Total	20,231	20,460	20,689	20,924	21,151	21,379	21,608	21,841	22,070	22,296

Project Cost Summary

1,000USD

Item	FSL=435									
	1	2	3	4	5	6	7	8	9	10
1. Preparation & Compensation	4,206	4,230	4,246	4,262	4,277	4,302	4,318	4,334	4,350	4,365
(1) Access Road										
(2) Compensation										
(3) Others										
2. Environmental Mitigation	61,990	61,990	61,990	61,990	61,990	61,990	61,990	61,990	61,990	61,990
3. Civil Works										
(1) River Treatment	6,053	6,053	6,053	6,053	6,053	6,053	6,053	6,053	6,053	6,053
(2) Dam	149,292	149,292	149,292	149,292	149,292	149,292	149,292	149,292	149,292	149,292
(3) Intake	2,348	2,396	2,447	2,497	2,546	2,590	2,637	2,684	2,729	2,774
(4) Power Tunnel	7,896	8,281	8,476	8,674	8,874	9,281	9,488	9,697	9,909	10,122
(5) Penstock	1,129	1,161	1,193	1,225	1,256	1,287	1,318	1,350	1,380	1,411
(6) Power House	11,609	11,835	12,057	12,279	12,490	12,700	12,907	13,115	13,315	13,509
(7) Tailrace Tunnel	10,987	11,435	11,662	11,891	12,121	12,589	12,826	13,065	13,306	13,548
(8) Tailrace	545	569	588	607	626	650	669	689	708	727
(9) P/S Access Tunnel	10,430	10,430	10,430	10,430	10,430	10,430	10,430	10,430	10,430	10,430
(10) Others	10,014	10,073	10,110	10,147	10,184	10,244	10,281	10,319	10,356	10,393
4. Hydro- Mechanical Works	20,231	20,460	20,689	20,924	21,151	21,379	21,608	21,841	22,070	22,296
5. Electro- Mechanical Works	43,718	44,935	46,135	47,124	48,309	49,276	50,425	51,560	52,497	53,624
6. Transmission Line	10,170	10,170	10,170	10,170	10,170	10,170	10,170	10,170	10,170	10,170
Direct Cost	350,618	353,308	355,537	357,564	359,770	362,233	364,411	366,587	368,553	370,704
7. Administration Fee	52,593	52,996	53,331	53,635	53,965	54,335	54,662	54,988	55,283	55,606
8. Contingency	35,062	35,331	35,554	35,756	35,977	36,223	36,441	36,659	36,855	37,070
9. Interest During Construction	87,655	88,327	88,884	89,391	89,942	90,558	91,103	91,647	92,138	92,676
Total	525,927	529,962	533,305	536,346	539,655	543,350	546,617	549,880	552,830	556,056

Basic Parameters	OP4- 435	
Waterway Length		
Headrace Tunnel	m	309.3
Penstock	m	148.5
Tailrace Tunnel	m	1199
	m	1656.8
Sedimentation Level	EL.m	386.2

Specification

Item	Unit	FSL=435									
		1	2	3	4	5	6	7	8	9	10
Qmax	m3/s	124.6	129.5	134.4	139.4	144.3	149.2	154.1	159.1	164	168.9
FSL	EL.m	435	435	435	435	435	435	435	435	435	435
MOL	EL.m	400.6	401	401.2	401.4	401.6	402	402.2	402.4	402.6	402.8
TWL	EL.m	302.9	302.9	302.9	302.9	303	303	303	303	303	303.1
Loss	m	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2
Effective Head	m	128.9	128.9	128.9	128.9	128.8	128.8	128.8	128.8	128.8	128.7
Pmax	MW	143	149	155	160	166	171	177	183	188	194
Primary Energy	GWh	262.04	270.88	279.00	286.47	293.41	299.76	305.88	311.68	315.90	320.33
Pfirm	MW	81.85	85.61	89.13	92.73	95.73	81.87	76.38	68.53	64.96	60.05
Benefit	1000USD	71,788	74,510	77,030	79,458	81,609	78,583	78,034	76,716	76,402	75,722
Cost	1000USD	52,593	52,996	53,331	53,635	53,965	54,335	54,662	54,988	55,283	55,606
B/C		1.36	1.41	1.44	1.48	1.51	1.45	1.43	1.40	1.38	1.36

Civil & Hydromechanical Work Quantity

(1) Dam

Design Flood	m3/s	8,306
Dam Basis EL.	m	293
Non- overflow Width	m	80.2
Spillway Width	m	77
Sand Drain Width	m	16
Intake Width	m	0
Dam Height (Hd)	m	147
Crest Length (L)	m	173.2
Coefficient for Ex	Y=A*X*B	
	A	32335
	B	0.4384
Coefficient for Conc	Y=C*X*D	
	C	0.0015
	D	1.3058

Item	Unit	FSL=435									
		1	2	3	4	5	6	7	8	9	10
Excavation	m3	2,761,876	2,761,876	2,761,876	2,761,876	2,761,876	2,761,876	2,761,876	2,761,876	2,761,876	2,761,876
Concrete	m3	574,583	574,583	574,583	574,583	574,583	574,583	574,583	574,583	574,583	574,583
Gate	t	1,827	1,827	1,827	1,827	1,827	1,827	1,827	1,827	1,827	1,827

(2) Intake

Number	-	1									
Design Velocity	m3/s	3.5									
MOL	EL.m	400.6	401	401.2	401.4	401.6	402	402.2	402.4	402.6	402.8
Waterway Diameter	m	6.7	6.9	7	7.1	7.2	7.4	7.5	7.6	7.7	7.8
Available Height	m	34.4	34	33.8	33.6	33.4	33	32.8	32.6	32.4	32.2

Item	Unit	FSL=435									
		1	2	3	4	5	6	7	8	9	10
Excavation	m3	11,815	12,016	12,226	12,436	12,637	12,818	13,011	13,204	13,389	13,570
Concrete	m3	10,797	11,023	11,261	11,499	11,728	11,936	12,157	12,379	12,592	12,803
Reinforce Bar	t	432	441	450	460	469	477	486	495	504	512
Intake Gate	t	169	176	183	189	196	203	209	216	222	229
Intake Screen	t	94	98	101	105	109	113	116	120	124	127

(3) Power Tunnel

Tunnel Inner Diameter	m	6.7	6.9	7	7.1	7.2	7.4	7.5	7.6	7.7	7.8
Concrete Thickness	m	0.6									
Tunnel Length	m	309.3									
Number	-	1									

Item	Unit	FSL=435									
		1	2	3	4	5	6	7	8	9	10
Tunnel Excavation	m3	15,443	16,235	16,638	17,046	17,459	18,301	18,729	19,162	19,600	20,043
Lining Concrete	m3	4,538	4,669	4,735	4,800	4,866	4,998	5,064	5,130	5,197	5,263
Reinforce Bar	t	182	187	189	192	195	200	203	205	208	211

(3) Service Adit

Tunnel Length	m	1642.07
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Item	Unit	FSL=435									
		1	2	3	4	5	6	7	8	9	10
Tunnel Excavation	m3	81,985	86,189	88,330	90,498	92,692	97,158	99,431	101,730	104,055	106,406

(4) Penstocks											
Design Velocity 1	m/s	3.5									
Penstock Length 1	m	5									
Design Velocity 2	m/s	5.2									
Penstock Length 2	m	110.2									
Design Velocity 3	m/s	6.08									
Penstock Length 3	m	25.7									
Design Velocity 4	m/s	8.76	2 penstocks								
Penstock Length 4	m	7.6									
Mean Velocity	m/s	5.637079									
Dm	m	5.30502	5.408326	5.509696	5.611247	5.709015	5.805136	5.899692	5.99464	6.086252	6.176505
tm	mm	23.93483	24.36197	24.78111	25.20099	25.58737	25.9845	26.37517	26.76745	27.14596	27.49952

Item	Unit	FSL=435									
		1	2	3	4	5	6	7	8	9	10
Tunnel Excavation	m3	4,935	5,093	5,251	5,411	5,567	5,723	5,879	6,037	6,192	6,346
Lining Concrete	m3	1,653	1,682	1,710	1,739	1,766	1,793	1,819	1,846	1,872	1,897
Reinforce Bar	t	20	20	21	21	21	22	22	22	22	23
Penstock	t	562	583	604	626	647	668	689	710	731	752

(5) Powerhouse											
Undergroundtype											
A	m2	1127.734	1149.695	1171.244	1192.831	1213.301	1233.729	1253.824	1274.003	1293.473	1312.314
d	m	30									

Item	Unit	FSL=435									
		1	2	3	4	5	6	7	8	9	10
Excavation	m3	74,430	75,880	77,302	78,727	80,078	81,426	82,752	84,084	85,369	86,613
Concrete	m3	16,916	17,245	17,569	17,892	18,200	18,506	18,807	19,110	19,402	19,685
Reinforce Bar	t	68	69	70	72	73	74	75	76	78	79

(6) Tailrace Tunnel											
Design Velocity	m/s	3.5									
Tunnel Inner Diameter	m	6.7	6.9	7	7.1	7.2	7.4	7.5	7.6	7.7	7.8
Concrete Thickness	m	0.6									
Tunnel Length	m	1199									
Number	-	1									

Item	Unit	FSL=435									
		1	2	3	4	5	6	7	8	9	10
Tunnel Excavation	m3	59,864	62,933	64,497	66,079	67,681	70,942	72,602	74,280	75,978	77,695
Lining Concrete	m3	17,591	18,099	18,354	18,609	18,864	19,375	19,632	19,888	20,145	20,403
Reinforce Bar	t	704	724	734	744	755	775	785	796	806	816

(7) Tailrace											
Item	Unit	FSL=435									
		1	2	3	4	5	6	7	8	9	10
Excavation	m3	7,110	7,345	7,529	7,714	7,895	8,128	8,308	8,490	8,668	8,846
Concrete	m3	2,505	2,624	2,719	2,815	2,910	3,033	3,130	3,228	3,325	3,423
Reinforce Bar	t	30	31	32	33	33	34	35	35	36	37

(8) P/H Access Tunnel											
Tunnel Length	m	1844.1									

Item	Unit	FSL=435									
		1	2	3	4	5	6	7	8	9	10
Tunnel Excavation	m3	82,985	82,985	82,985	82,985	82,985	82,985	82,985	82,985	82,985	82,985
Lining Concrete	m3	18,441	18,441	18,441	18,441	18,441	18,441	18,441	18,441	18,441	18,441
Reinforce Bar	t	553	553	553	553	553	553	553	553	553	553

Civil Work Cost 1,000USD

Item	FSL=435										
	1	2	3	4	5	6	7	8	9	10	
(1) Concrete Dam											
(1).1 River Treatment(NEA F/S)	6,053	6,053	6,053	6,053	6,053	6,053	6,053	6,053	6,053	6,053	6,053
(1).2 Concrete Dam											
Excavation	49,714	49,714	49,714	49,714	49,714	49,714	49,714	49,714	49,714	49,714	49,714
Concrete	74,696	74,696	74,696	74,696	74,696	74,696	74,696	74,696	74,696	74,696	74,696
Others	24,882	24,882	24,882	24,882	24,882	24,882	24,882	24,882	24,882	24,882	24,882
(2) Intake											
Excavation	224	228	232	236	240	244	247	251	254	258	
Concrete	1,296	1,323	1,351	1,380	1,407	1,432	1,459	1,485	1,511	1,536	
Reinforce Bar	358	366	374	382	389	396	404	411	418	425	
Others	470	479	489	499	509	518	527	537	546	555	
(3) Power Tunnel											
Tunnel Excavation	1,081	1,136	1,165	1,193	1,222	1,281	1,311	1,341	1,372	1,403	
Lining Concrete	635	654	663	672	681	700	709	718	728	737	
Reinforce Bar	160	164	167	169	171	176	178	181	183	185	
Others	281	293	299	305	311	324	330	336	342	349	
(3) Service Adit											

Tunnel Excavation	5,739	6,033	6,183	6,335	6,488	6,801	6,960	7,121	7,284	7,448
(4)Penstock										
Tunnel Excavation	691	713	735	758	779	801	823	845	867	888
Lining Concrete	231	235	239	243	247	251	255	258	262	266
Reinforce Bar	19	19	19	20	20	20	21	21	21	22
Others	188	194	199	204	209	215	220	225	230	235
(5)Power House										
Excavation	4,466	4,553	4,638	4,724	4,805	4,886	4,965	5,045	5,122	5,197
Concrete	3,214	3,277	3,338	3,400	3,458	3,516	3,573	3,631	3,686	3,740
Reinforce Bar	60	61	62	63	64	65	66	67	68	69
Others	3,870	3,945	4,019	4,093	4,163	4,233	4,302	4,372	4,438	4,503
(6)Tailrace Tunnel										
Tunnel Excavation	4,490	4,720	4,837	4,956	5,076	5,321	5,445	5,571	5,698	5,827
Lining Concrete	3,342	3,439	3,487	3,536	3,584	3,681	3,730	3,779	3,828	3,877
Reinforce Bar	619	637	646	655	664	682	691	700	709	718
Others	2,535	2,639	2,691	2,744	2,797	2,905	2,960	3,015	3,071	3,127
(7)Tailrace										
Excavation	85	88	90	93	95	98	100	102	104	106
Concrete	326	341	353	366	378	394	407	420	432	445
Reinforce Bar	25	26	27	27	28	28	29	29	30	30
Others	109	114	118	121	125	130	134	138	142	145
(8)P/H Access Tunnel										
Tunnel Excavation	5,807	5,807	5,807	5,807	5,807	5,807	5,807	5,807	5,807	5,807
Lining Concrete	2,397	2,397	2,397	2,397	2,397	2,397	2,397	2,397	2,397	2,397
Reinforce Bar	487	487	487	487	487	487	487	487	487	487
Others	1,738	1,738	1,738	1,738	1,738	1,738	1,738	1,738	1,738	1,738
(9)Miscellaneous Works	10,014	10,073	10,110	10,147	10,184	10,244	10,281	10,319	10,356	10,393
Total	210,304	211,524	212,307	213,095	213,872	215,116	215,901	216,692	217,477	218,259

Hydro- mechanical Works

1,000USD

Item	FSL=435									
	1	2	3	4	5	6	7	8	9	10
(1)Dam & Spillway										
Gate	11,878	11,878	11,878	11,878	11,878	11,878	11,878	11,878	11,878	11,878
(2)Intake										
Gate	1,113	1,157	1,200	1,244	1,288	1,331	1,374	1,418	1,461	1,505
Screen	619	643	667	691	715	739	763	788	812	836
(3)Penstock	2,136	2,217	2,297	2,379	2,457	2,538	2,618	2,699	2,779	2,857
(4)Tailrace										
Gate	1,113	1,157	1,200	1,244	1,288	1,331	1,374	1,418	1,461	1,505
(5)Others	3,372	3,410	3,448	3,487	3,525	3,563	3,601	3,640	3,678	3,716
Total	20,231	20,460	20,689	20,924	21,151	21,379	21,608	21,841	22,070	22,296

Project Cost Summary

1,000USD

Item	FSL=435									
	1	2	3	4	5	6	7	8	9	10
1. Preparation & Compensation	4,206	4,230	4,246	4,262	4,277	4,302	4,318	4,334	4,350	4,365
(1) Access Road										
(2) Compensation										
(3) Others										
2. Environmental Mitigation	61,990	61,990	61,990	61,990	61,990	61,990	61,990	61,990	61,990	61,990
3. Civil Works										
(1) River Treatment	6,053	6,053	6,053	6,053	6,053	6,053	6,053	6,053	6,053	6,053
(2) Dam	149,292	149,292	149,292	149,292	149,292	149,292	149,292	149,292	149,292	149,292
(3) Intake	2,348	2,396	2,447	2,497	2,546	2,590	2,637	2,684	2,729	2,774
(4) Power Tunnel	7,896	8,281	8,476	8,674	8,874	9,281	9,488	9,697	9,909	10,122
(5) Penstock	1,129	1,161	1,193	1,225	1,256	1,287	1,318	1,350	1,380	1,411
(6) Power House	11,609	11,835	12,057	12,279	12,490	12,700	12,907	13,115	13,315	13,509
(7) Tailrace Tunnel	10,987	11,435	11,662	11,891	12,121	12,589	12,826	13,065	13,306	13,548
(8) Tailrace	545	569	588	607	626	650	669	689	708	727
(9)P/S Access Tunnel	10,430	10,430	10,430	10,430	10,430	10,430	10,430	10,430	10,430	10,430
(10) Others	10,014	10,073	10,110	10,147	10,184	10,244	10,281	10,319	10,356	10,393
4. Hydro- Mechanical Works	20,231	20,460	20,689	20,924	21,151	21,379	21,608	21,841	22,070	22,296
5. Electro- Mechanical Works	43,718	44,935	46,135	47,124	48,309	49,276	50,425	51,560	52,497	53,624
6. Transmission Line	10,170	10,170	10,170	10,170	10,170	10,170	10,170	10,170	10,170	10,170
Direct Cost	350,618	353,308	355,537	357,564	359,770	362,233	364,411	366,587	368,553	370,704
7. Administration Fee	52,593	52,996	53,331	53,635	53,965	54,335	54,662	54,988	55,283	55,606
8. Contingency	35,062	35,331	35,554	35,756	35,977	36,223	36,441	36,659	36,855	37,070
9. Interest During Construction	87,655	88,327	88,884	89,391	89,942	90,558	91,103	91,647	92,138	92,676
Total	525,927	529,962	533,305	536,346	539,655	543,350	546,617	549,880	552,830	556,056

Details of Alternatives in 10.4

Basic Parameters	OP3b3- 405	
Waterway Length		
Headrace Tunnel	m	1074.8
Penstock	m	139.64
Tailrace Tunnel	m	247.2
	m	1461.64
Sedimentation Level	EL.m	386.2

Specification

Item	Unit	FSL=405									
		1	2	3	4	5	6	7	8	9	10
Qmax	m3/s	65.4	72.3	79.2	86.1	93	99.8	106.7	113.6	120.5	127.4
FSL	EL.m	405	405	405	405	405	405	405	405	405	405
MOL	EL.m	387.2	387.2	387.2	387.2	387.2	387.2	387.2	387.2	387.2	387.2
TWL	EL.m	288.6	288.7	288.8	288.8	288.9	288.9	289	289	289.1	289.2
Loss	m	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8
Effective Head	m	113.6	113.5	113.4	113.4	113.3	113.3	113.2	113.2	113.1	113
Pmax	MW	66	73	80	87	94	101	108	115	122	128
Primary Energy	GWh	132.88	146.10	159.19	172.03	184.37	196.27	207.14	217.21	226.37	234.20
Pfirm	MW	48.67	53.75	58.81	63.93	67.60	70.73	75.53	69.61	63.21	51.00
Benefit	1000USD	38,558	42,466	46,344	50,196	53,521	56,604	60,005	60,036	59,760	57,497
Cost	1000USD	34,691	35,226	35,802	36,362	36,917	37,461	38,004	38,542	39,076	39,574
B/C		1.11	1.21	1.29	1.38	1.45	1.51	1.58	1.56	1.53	1.45

Civil & Hydromechanical Work Quantity

(1) Dam

Design Flood	m3/s	8,306
Dam Basis EL.	m	293
Non- overflow Width	m	80.2
Spillway Width	m	77
Sand Drain Width	m	16
Intake Width	m	0
Dam Height (Hd)	m	117
Crest Length (L)	m	173.2
Coefficient for Ex	Y=A*X*B	
	A	32335
	B	0.4384
Coefficient for Conc	Y=C*X*D	
	C	0.0015
	D	1.3058

Item	Unit	FSL=405									
		1	2	3	4	5	6	7	8	9	10
Excavation	m3	2,498,877	2,498,877	2,498,877	2,498,877	2,498,877	2,498,877	2,498,877	2,498,877	2,498,877	2,498,877
Concrete	m3	316,564	316,564	316,564	316,564	316,564	316,564	316,564	316,564	316,564	316,564
Gate	t	1,827	1,827	1,827	1,827	1,827	1,827	1,827	1,827	1,827	1,827

(2) Intake

Number	-	1
Design Velocity	m3/s	4
MOL	EL.m	387.2
Waterway Diameter	m	4.6
Available Height	m	17.8

Item	Unit	FSL=405									
		1	2	3	4	5	6	7	8	9	10
Excavation	m3	6,319	6,674	7,016	7,347	7,669	7,978	8,285	8,585	8,879	9,167
Concrete	m3	5,001	5,348	5,687	6,019	6,345	6,662	6,978	7,290	7,598	7,903
Reinforce Bar	t	200	214	227	241	254	266	279	292	304	316
Intake Gate	t	83	92	101	110	119	127	136	145	154	163
Intake Screen	t	46	51	56	61	66	71	76	81	86	91

(3) Power Tunnel

Tunnel Inner Diameter	m	4.6
Concrete Thickness	m	0.6
Tunnel Base	EL.m	378
Tunnel Length	m	1105.2
Number	-	1

Item	Unit	FSL=405									
		1	2	3	4	5	6	7	8	9	10
Tunnel Excavation	m3	29,743	31,837	34,009	36,254	38,563	40,953	43,407	45,932	48,540	51,210
Lining Concrete	m3	11,376	11,833	12,294	12,757	13,219	13,686	14,151	14,617	15,088	15,558
Reinforce Bar	t	455	473	492	510	529	547	566	585	604	622

(3') Service Adit

Tunnel Length	m	1055
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Item	Unit	FSL=405									
		1	2	3	4	5	6	7	8	9	10
Tunnel Excavation	m3	28,392	30,384	32,443	34,570	36,765	39,027	41,356	43,753	46,217	48,749

(4) Penstocks

Design Velocity 1	m/s	4										
Penstock Length 1	m	5										
Design Velocity 2	m/s	4.47										
Penstock Length 2	m	101.24	101	100.52	100.04	99.79	99.31	99.07	98.83	98.35	98.11	
Design Velocity 3	m/s	6.08										
Penstock Length 3	m	25.8										
Design Velocity 4	m/s	8.76										
Penstock Length 4	m	7.6										
Mean Velocity	m/s	5.179019	5.180177	5.182503	5.184845	5.186071	5.188436	5.189625	5.190818	5.193214	5.194419	
Dm	m	4.009777	4.215527	4.41111	4.598209	4.778343	4.948825	5.116456	5.278692	5.435387	5.588192	
tm	mm	16.6089	17.34532	18.04347	18.72396	19.36416	19.98368	20.57683	21.16588	21.71779	22.25462	

Item	Unit	FSL=405										
		1	2	3	4	5	6	7	8	9	10	
Tunnel Excavation	m3	2,977	3,211	3,435	3,655	3,879	4,089	4,308	4,524	4,729	4,940	
Lining Concrete	m3	1,213	1,265	1,312	1,356	1,401	1,440	1,481	1,521	1,556	1,592	
Reinforce Bar	t	15	15	16	16	17	17	18	18	19	19	
Penstock	t	278	305	331	357	383	408	433	459	483	508	

(5) Powerhouse

Undergroundtype

A	m2	783.3304	823.3752	861.5165	898.2611	933.286	966.8043	999.3732	1031.18	1061.723	1091.375
d	m	30									

Item	Unit	FSL=405										
		1	2	3	4	5	6	7	8	9	10	
Excavation	m3	51,700	54,343	56,860	59,285	61,597	63,809	65,959	68,058	70,074	72,031	
Concrete	m3	11,750	12,351	12,923	13,474	13,999	14,502	14,991	15,468	15,926	16,371	
Reinforce Bar	t	47	49	52	54	56	58	60	62	64	65	

(6) Tailrace Tunnel

Design Velocity	m/s	3.5										
Tunnel Inner Diameter	m	4.9	5.1	5.4	5.6	5.8	6	6.2	6.4	6.6	6.8	
Concrete Thickness	m	0.6										
Tunnel Length	m	247.2										
Number	-	1										

Item	Unit	FSL=405										
		1	2	3	4	5	6	7	8	9	10	
Tunnel Excavation	m3	7,359	7,849	8,614	9,144	9,690	10,252	10,829	11,423	12,032	12,657	
Lining Concrete	m3	2,697	2,799	2,953	3,056	3,159	3,262	3,366	3,470	3,575	3,679	
Reinforce Bar	t	108	112	118	122	126	130	135	139	143	147	

(7) Tailrace

Item	Unit	FSL=405										
		1	2	3	4	5	6	7	8	9	10	
Excavation	m3	4,494	4,807	5,161	5,466	5,768	6,063	6,360	6,654	6,946	7,237	
Concrete	m3	1,301	1,433	1,585	1,721	1,858	1,996	2,137	2,279	2,423	2,570	
Reinforce Bar	t	21	22	23	24	25	27	28	29	30	31	

(8) P/H Access Tunnel

Tunnel Length	m	1220										
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Item	Unit	FSL=405										
		1	2	3	4	5	6	7	8	9	10	
Tunnel Excavation	m3	54,900	54,900	54,900	54,900	54,900	54,900	54,900	54,900	54,900	54,900	
Lining Concrete	m3	12,200	12,200	12,200	12,200	12,200	12,200	12,200	12,200	12,200	12,200	
Reinforce Bar	t	366	366	366	366	366	366	366	366	366	366	

(9) Surge Tank

LWL	EL.m	387.2										
Available Depth	m	17.8										
Number of waterway	-	1										

Item	Unit	FSL=405										
		1	2	3	4	5	6	7	8	9	10	
Excavation	m3	14,288	15,796	17,303	18,811	20,318	21,804	23,311	24,819	26,326	27,834	
Concrete	m3	4,136	4,572	5,009	5,445	5,882	6,312	6,748	7,184	7,621	8,057	
Reinforce Bar	t	207	229	250	272	294	316	337	359	381	403	

(9) Service Adit

Tunnel Length	m	960										
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Item	Unit	FSL=405										
		1	2	3	4	5	6	7	8	9	10	
Tunnel Excavation	m3	25,836	27,648	29,522	31,457	33,454	35,512	37,632	39,813	42,056	44,360	

Civil Work Cost

1,000USD

Item	FSL=405									
	1	2	3	4	5	6	7	8	9	10

3. Civil Works										
(1) River Treatment	6,053	6,053	6,053	6,053	6,053	6,053	6,053	6,053	6,053	6,053
(2) Dam	103,360	103,360	103,360	103,360	103,360	103,360	103,360	103,360	103,360	103,360
(3) Intake	1,108	1,183	1,256	1,327	1,397	1,465	1,533	1,600	1,666	1,731
(4) Power Tunnel	6,674	7,074	7,486	7,909	8,341	8,786	9,240	9,705	10,183	10,669
(5) Penstock	721	769	816	861	906	949	993	1,036	1,077	1,119
(6) Power House	8,064	8,476	8,869	9,247	9,607	9,952	10,288	10,615	10,930	11,235
(7) Tailrace Tunnel	1,507	1,585	1,704	1,786	1,870	1,955	2,041	2,130	2,220	2,311
(8) Tailrace	300	327	359	387	415	443	471	500	529	558
(9) P/S Access Tunnel	6,900	6,900	6,900	6,900	6,900	6,900	6,900	6,900	6,900	6,900
(10) Surge Tank	5,736	6,265	6,799	7,337	7,881	8,425	8,979	9,539	10,103	10,673
(11) Others	7,041	6,808	6,863	6,916	6,968	7,020	7,073	7,126	7,178	7,231
4. Hydro- Mechanical Works	17,196	17,497	17,794	18,091	18,389	18,680	18,977	19,275	19,567	19,862
5. Electro- Mechanical Works	27,209	29,112	30,957	32,741	34,488	36,183	37,850	39,472	41,073	42,424
6. Transmission Line	10,170	10,170	10,170	10,170	10,170	10,170	10,170	10,170	10,170	10,170
Direct Cost	231,275	234,842	238,682	242,415	246,110	249,738	253,359	256,943	260,504	263,827
7. Administration Fee	34,691	35,226	35,802	36,362	36,917	37,461	38,004	38,542	39,076	39,574
8. Preliminary Cost	23,127	23,484	23,868	24,242	24,611	24,974	25,336	25,694	26,050	26,383
9. Interest During Construction	57,819	58,711	59,671	60,604	61,528	62,434	63,340	64,236	65,126	65,957
Total	346,912	352,264	358,024	363,623	369,165	374,607	380,038	385,415	390,757	395,740

Project Cost Summary

1,000USD

Item	FSL=410									
	1	2	3	4	5	6	7	8	9	10
1. Preparation & Compensation	3,142	3,168	3,200	3,231	3,263	3,296	3,328	3,353	3,385	3,417
(1) Access Road										
(2) Compensation										
(3) Others										
2. Environmental Mitigation	28,230	28,230	28,230	28,230	28,230	28,230	28,230	28,230	28,230	28,230
3. Civil Works										
(1) River Treatment	6,053	6,053	6,053	6,053	6,053	6,053	6,053	6,053	6,053	6,053
(2) Dam	110,062	110,062	110,062	110,062	110,062	110,062	110,062	110,062	110,062	110,062
(3) Intake	1,349	1,424	1,498	1,570	1,641	1,711	1,780	1,844	1,911	1,977
(4) Power Tunnel	7,076	7,488	7,910	8,344	8,788	9,244	9,709	9,948	10,431	10,924
(5) Penstock	776	819	862	902	942	981	1,022	1,058	1,095	1,133
(6) Power House	8,682	9,048	9,403	9,741	10,071	10,388	10,698	10,996	11,289	11,571
(7) Tailrace Tunnel	1,624	1,704	1,786	1,870	1,955	2,041	2,130	2,220	2,265	2,358
(8) Tailrace	335	362	388	415	441	469	496	523	546	574
(9) P/S Access Tunnel	6,900	6,900	6,900	6,900	6,900	6,900	6,900	6,900	6,900	6,900
(10) Surge Tank	6,346	6,853	7,365	7,882	8,404	8,931	9,464	9,907	10,447	10,993
(11) Others	7,481	7,216	7,267	7,319	7,370	7,421	7,473	7,512	7,561	7,613
4. Hydro- Mechanical Works	17,649	17,932	18,217	18,498	18,779	19,057	19,343	19,617	19,894	20,174
5. Electro- Mechanical Works	29,994	31,775	33,256	34,954	36,602	37,997	39,581	41,146	42,671	43,969
6. Transmission Line	10,170	10,170	10,170	10,170	10,170	10,170	10,170	10,170	10,170	10,170
Direct Cost	245,870	249,202	252,565	256,139	259,672	262,951	266,438	269,538	272,910	276,118
7. Administration Fee	36,880	37,380	37,885	38,421	38,951	39,443	39,966	40,431	40,936	41,418
8. Preliminary Cost	24,587	24,920	25,257	25,614	25,967	26,295	26,644	26,954	27,291	27,612
9. Interest During Construction	61,467	62,301	63,141	64,035	64,918	65,738	66,609	67,384	68,227	69,029
Total	368,805	373,803	378,848	384,209	389,507	394,426	399,657	404,307	409,365	414,177

Project Cost Summary

1,000USD

Item	FSL=415									
	1	2	3	4	5	6	7	8	9	10
1. Preparation & Compensation	3,343	3,368	3,401	3,433	3,466	3,491	3,523	3,555	3,581	3,613
(1) Access Road										
(2) Compensation										
(3) Others										
2. Environmental Mitigation	30,180	30,180	30,180	30,180	30,180	30,180	30,180	30,180	30,180	30,180
3. Civil Works										
(1) River Treatment	6,053	6,053	6,053	6,053	6,053	6,053	6,053	6,053	6,053	6,053
(2) Dam	117,131	117,131	117,131	117,131	117,131	117,131	117,131	117,131	117,131	117,131
(3) Intake	1,605	1,684	1,763	1,839	1,915	1,985	2,059	2,131	2,198	2,269
(4) Power Tunnel	7,698	8,125	8,563	9,014	9,473	9,709	10,186	10,672	10,921	11,426
(5) Penstock	835	879	922	965	1,008	1,050	1,091	1,133	1,174	1,214
(6) Power House	9,316	9,667	10,009	10,336	10,656	10,964	11,266	11,557	11,844	12,124
(7) Tailrace Tunnel	1,745	1,828	1,912	1,998	2,085	2,174	2,220	2,311	2,404	2,452
(8) Tailrace	373	399	426	453	480	508	530	558	586	609
(9)P/S Access Tunnel	6,900	6,900	6,900	6,900	6,900	6,900	6,900	6,900	6,900	6,900
(10) Surge Tank	7,075	7,590	8,110	8,635	9,166	9,608	10,146	10,689	11,138	11,689
(11) Others	7,960	7,658	7,710	7,763	7,815	7,854	7,904	7,956	7,996	8,046
4. Hydro- Mechanical Works	18,141	18,436	18,732	19,025	19,321	19,613	19,908	20,202	20,496	20,790
5. Electro- Mechanical Works	32,800	34,474	36,100	37,700	39,258	40,797	42,297	43,783	45,233	46,660
6. Transmission Line	10,170	10,170	10,170	10,170	10,170	10,170	10,170	10,170	10,170	10,170
Direct Cost	261,324	264,543	268,081	271,595	275,076	278,187	281,562	284,981	288,003	291,325
7. Administration Fee	39,199	39,681	40,212	40,739	41,261	41,728	42,234	42,747	43,201	43,699
8. Preliminary Cost	26,132	26,454	26,808	27,159	27,508	27,819	28,156	28,498	28,800	29,132
9. Interest During Construction	65,331	66,136	67,020	67,899	68,769	69,547	70,391	71,245	72,001	72,831
Total	391,987	396,814	402,121	407,392	412,614	417,280	422,344	427,472	432,005	436,987

Project Cost Summary

1,000USD

Item	FSL=420									
	1	2	3	4	5	6	7	8	9	10
1. Preparation & Compensation	3,555	3,580	3,612	3,645	3,670	3,702	3,728	3,761	3,794	3,819
(1) Access Road										
(2) Compensation										
(3) Others										
2. Environmental Mitigation	35,570	35,570	35,570	35,570	35,570	35,570	35,570	35,570	35,570	35,570
3. Civil Works										
(1) River Treatment	6,053	6,053	6,053	6,053	6,053	6,053	6,053	6,053	6,053	6,053
(2) Dam	124,578	124,578	124,578	124,578	124,578	124,578	124,578	124,578	124,578	124,578
(3) Intake	1,876	1,960	2,041	2,122	2,198	2,274	2,348	2,424	2,499	2,569
(4) Power Tunnel	8,345	8,788	9,243	9,709	9,947	10,428	10,676	11,173	11,682	11,943
(5) Penstock	896	939	982	1,024	1,065	1,106	1,147	1,188	1,228	1,268
(6) Power House	9,976	10,316	10,643	10,962	11,269	11,566	11,858	12,145	12,422	12,696
(7) Tailrace Tunnel	1,870	1,955	2,041	2,130	2,174	2,265	2,358	2,452	2,499	2,596
(8) Tailrace	413	440	467	494	517	544	572	600	623	652
(9) P/S Access Tunnel	6,900	6,900	6,900	6,900	6,900	6,900	6,900	6,900	6,900	6,900
(10) Surge Tank	7,860	8,363	8,912	9,445	9,889	10,425	10,872	11,421	11,975	12,429
(11) Others	8,464	8,124	8,176	8,229	8,267	8,319	8,359	8,412	8,462	8,501
4. Hydro- Mechanical Works	18,684	18,986	19,286	19,588	19,887	20,184	20,482	20,783	21,083	21,382
5. Electro- Mechanical Works	35,850	37,414	38,957	40,673	42,156	43,604	45,040	46,442	48,032	49,392
6. Transmission Line	10,170	10,170	10,170	10,170	10,170	10,170	10,170	10,170	10,170	10,170
Direct Cost	281,060	284,156	287,631	291,291	294,309	297,689	300,708	304,071	307,569	310,518
7. Administration Fee	42,159	42,623	43,145	43,694	44,146	44,653	45,106	45,611	46,135	46,578
8. Preliminary Cost	28,106	28,416	28,763	29,129	29,431	29,769	30,071	30,407	30,757	31,052
9. Interest During Construction	70,265	71,039	71,908	72,823	73,577	74,422	75,177	76,018	76,892	77,629
Total	421,590	426,233	431,447	436,937	441,464	446,533	451,062	456,107	461,354	466,777

Basic Parameters	OP3b3- 425	
Waterway Length		
Headrace Tunnel	m	1074.8
Penstock	m	162.6
Tailrace Tunnel	m	247.2
	m	1484.6
Sedimentation Level	EL.m	386.2

Specification

Item	Unit	FSL=425									
		1	2	3	4	5	6	7	8	9	10
Qmax	m3/s	102.9	107.8	112.6	117.5	122.3	127.2	132	136.9	141.7	146.6
FSL	EL.m	425	425	425	425	425	425	425	425	425	425
MOL	EL.m	398.6	399	399.2	399.4	399.6	400	400.2	400.4	400.6	400.8
TWL	EL.m	289	289	289	289.1	289.1	289.1	289.2	289.2	289.3	289.3
Loss	m	3	3	3	3	3	3	3	3	3	3
Effective Head	m	133	133	133	132.9	132.9	132.9	132.8	132.8	132.7	132.7
Pmax	MW	122	128	134	139	145	151	156	162	168	174
Primary Energy	GWh	255.15	264.49	273.70	281.95	289.31	296.88	303.84	310.11	315.75	321.40
Pfirm	MW	88.47	92.48	96.80	100.96	98.75	87.85	76.75	74.33	65.17	58.56
Benefit	1000USD	72,539	75,426	78,383	81,120	81,780	79,864	77,778	78,178	76,438	75,467
Cost	1000USD	45,214	45,588	45,965	46,313	46,692	47,117	47,456	47,832	48,196	48,560
B/C		1.60	1.65	1.71	1.75	1.75	1.70	1.64	1.63	1.59	1.55

Civil & Hydromechanical Work Quantity

(1) Dam

Design Flood	m3/s	8,306
Dam Basis EL.	m	293
Non- overflow Width	m	80.2
Spillway Width	m	77
Sand Drain Width	m	16
Intake Width	m	0
Dam Height (Hd)	m	137
Crest Length (L)	m	173.2
Coefficient for Ex	Y=A*X*B	
	A	32335
	B	0.4384
Coefficient for Conc	Y=C*X*D	
	C	0.0015
	D	1.3058

Item	Unit	FSL=425									
		1	2	3	4	5	6	7	8	9	10
Excavation	m3	2,677,877	2,677,877	2,677,877	2,677,877	2,677,877	2,677,877	2,677,877	2,677,877	2,677,877	2,677,877
Concrete	m3	478,021	478,021	478,021	478,021	478,021	478,021	478,021	478,021	478,021	478,021
Gate	t	1,827	1,827	1,827	1,827	1,827	1,827	1,827	1,827	1,827	1,827

(2) Intake

Number	-	1									
Design Velocity	m3/s	4									
MOL	EL.m	398.6	399	399.2	399.4	399.6	400	400.2	400.4	400.6	400.8
Waterway Diameter	m	5.7	5.9	6	6.1	6.2	6.4	6.5	6.6	6.7	6.8
Available Height	m	26.4	26	25.8	25.6	25.4	25	24.8	24.6	24.4	24.2

Item	Unit	FSL=425									
		1	2	3	4	5	6	7	8	9	10
Excavation	m3	9,489	9,682	9,879	10,076	10,264	10,434	10,612	10,790	10,960	11,130
Concrete	m3	8,245	8,452	8,664	8,877	9,081	9,267	9,462	9,657	9,844	10,032
Reinforce Bar	t	330	338	347	355	363	371	378	386	394	401
Intake Gate	t	136	143	149	155	162	168	174	181	187	193
Intake Screen	t	76	79	83	86	90	93	97	100	104	107

(3) Power Tunnel

Tunnel Inner Diameter	m	5.7	5.9	6	6.1	6.2	6.4	6.5	6.6	6.7	6.8
Concrete Thickness	m	0.6									
Tunnel Length	m	1074.8									
Number	-	1									

Item	Unit	FSL=425									
		1	2	3	4	5	6	7	8	9	10
Tunnel Excavation	m3	40,937	43,345	44,574	45,821	47,085	49,664	50,980	52,313	53,663	55,030
Lining Concrete	m3	13,511	13,960	14,185	14,410	14,636	15,088	15,315	15,542	15,769	15,996
Reinforce Bar	t	540	558	567	576	585	604	613	622	631	640

(3) Service Adit

Tunnel Length	m	1055
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Item	Unit	FSL=425									
		1	2	3	4	5	6	7	8	9	10
Tunnel Excavation	m3	40,183	42,546	43,753	44,977	46,217	48,749	50,041	51,349	52,674	54,016

3. Civil Works										
(1) River Treatment	6,053	6,053	6,053	6,053	6,053	6,053	6,053	6,053	6,053	6,053
(2) Dam	132,413	132,413	132,413	132,413	132,413	132,413	132,413	132,413	132,413	132,413
(3) Intake	1,804	1,848	1,894	1,939	1,983	2,022	2,064	2,106	2,146	2,186
(4) Power Tunnel	8,830	9,280	9,509	9,740	9,974	10,450	10,692	10,937	11,184	11,434
(5) Penstock	1,161	1,201	1,239	1,277	1,315	1,353	1,390	1,428	1,464	1,502
(6) Power House	10,661	10,911	11,152	11,389	11,619	11,850	12,068	12,290	12,501	12,715
(7) Tailrace Tunnel	1,998	2,085	2,130	2,174	2,265	2,311	2,358	2,452	2,499	2,547
(8) Tailrace	456	479	497	516	539	558	576	600	619	638
(9) P/S Access Tunnel	6,900	6,900	6,900	6,900	6,900	6,900	6,900	6,900	6,900	6,900
(10) Surge Tank	8,729	9,179	9,535	9,898	10,257	10,720	11,083	11,452	11,817	12,189
(11) Others	8,978	8,588	8,620	8,652	8,685	8,730	8,761	8,795	8,826	8,857
4. Hydro- Mechanical Works	19,635	19,884	20,128	20,376	20,620	20,867	21,109	21,357	21,598	21,846
5. Electro- Mechanical Works	38,909	40,177	41,425	42,462	43,677	44,876	45,875	47,046	48,215	49,358
6. Transmission Line	10,170	10,170	10,170	10,170	10,170	10,170	10,170	10,170	10,170	10,170
Direct Cost	301,428	303,919	306,435	308,750	311,283	314,114	316,372	318,880	321,307	323,731
7. Administration Fee	45,214	45,588	45,965	46,313	46,692	47,117	47,456	47,832	48,196	48,560
8. Preliminary Cost	30,143	30,392	30,644	30,875	31,128	31,411	31,637	31,888	32,131	32,373
9. Interest During Construction	75,357	75,980	76,609	77,188	77,821	78,528	79,093	79,720	80,327	80,933
Total	452,142	455,879	459,653	463,125	466,925	471,171	474,558	478,320	481,960	485,596

Basic Parameters	OP3b3- 435	
Waterway Length		
Headrace Tunnel	m	1074.8
Penstock	m	162.6
Tailrace Tunnel	m	247.2
	m	1484.6
Sedimentation Level	EL.m	386.2

Specification

Item	Unit	FSL=435									
		1	2	3	4	5	6	7	8	9	10
Qmax	m3/s	124.6	129.5	134.4	139.4	144.3	149.2	154.1	159.1	164	168.9
FSL	EL.m	435	435	435	435	435	435	435	435	435	435
MOL	EL.m	399.8	400	400.2	400.6	400.8	401	401.2	401.4	401.6	401.8
TWL	EL.m	289.1	289.2	289.2	289.2	289.3	289.3	289.3	289.4	289.4	289.4
Loss	m	3	3	3	3	3	3	3	3	3	3
Effective Head	m	142.9	142.8	142.8	142.8	142.7	142.7	142.7	142.6	142.6	142.6
Pmax	MW	159	165	171	178	184	190	196	202	209	215
Primary Energy	GWh	314.34	323.08	330.92	339.11	346.07	352.38	358.06	363.28	367.83	371.87
Pfirm	MW	103.54	107.61	111.59	103.80	93.79	89.07	78.40	72.94	69.03	58.31
Benefit	1000USD	87,726	90,523	93,132	92,263	90,505	90,221	88,034	87,331	86,974	84,476
Cost	1000USD	53,156	53,452	53,816	54,264	54,626	54,993	55,351	55,710	56,090	56,443
B/C		1.65	1.69	1.73	1.70	1.66	1.64	1.59	1.57	1.55	1.50

Civil & Hydromechanical Work Quantity

(1) Dam

Design Flood	m3/s	8,306
Dam Basis EL.	m	293
Non- overflow Width	m	80.2
Spillway Width	m	77
Sand Drain Width	m	16
Intake Width	m	0
Dam Height (Hd)	m	147
Crest Length (L)	m	173.2
Coefficient for Ex	Y=A*X*B	
	A	32335
	B	0.4384
Coefficient for Conc	Y=C*X*D	
	C	0.0015
	D	1.3058

Item	Unit	FSL=435									
		1	2	3	4	5	6	7	8	9	10
Excavation	m3	2,761,876	2,761,876	2,761,876	2,761,876	2,761,876	2,761,876	2,761,876	2,761,876	2,761,876	2,761,876
Concrete	m3	574,583	574,583	574,583	574,583	574,583	574,583	574,583	574,583	574,583	574,583
Gate	t	1,827	1,827	1,827	1,827	1,827	1,827	1,827	1,827	1,827	1,827

(2) Intake

Number	-	1									
Design Velocity	m3/s	4									
MOL	EL.m	399.8	400	400.2	400.6	400.8	401	401.2	401.4	401.6	401.8
Waterway Diameter	m	6.3	6.4	6.5	6.7	6.8	6.9	7	7.1	7.2	7.3
Available Height	m	35.2	35	34.8	34.4	34.2	34	33.8	33.6	33.4	33.2

Item	Unit	FSL=435									
		1	2	3	4	5	6	7	8	9	10
Excavation	m3	11,872	12,089	12,300	12,497	12,699	12,897	13,091	13,286	13,472	13,655
Concrete	m3	10,862	11,106	11,345	11,569	11,799	12,026	12,249	12,473	12,689	12,901
Reinforce Bar	t	434	444	454	463	472	481	490	499	508	516
Intake Gate	t	170	176	183	190	196	203	209	216	223	229
Intake Screen	t	94	98	102	105	109	113	116	120	124	127

(3) Power Tunnel

Tunnel Inner Diameter	m	6.3	6.4	6.5	6.7	6.8	6.9	7	7.1	7.2	7.3
Concrete Thickness	m	0.6									
Tunnel Length	m	1074.8									
Number	-	1									

Item	Unit	FSL=435									
		1	2	3	4	5	6	7	8	9	10
Tunnel Excavation	m3	48,366	49,664	50,980	53,663	55,030	56,414	57,816	59,234	60,670	62,123
Lining Concrete	m3	14,862	15,088	15,315	15,769	15,996	16,224	16,452	16,681	16,910	17,139
Reinforce Bar	t	594	604	613	631	640	649	658	667	676	686

(3) Service Adit

Tunnel Length	m	1055
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Item	Unit	FSL=435									
		1	2	3	4	5	6	7	8	9	10
Tunnel Excavation	m3	47,475	48,749	50,041	52,674	54,016	55,375	56,751	58,143	59,553	60,979

3. Civil Works										
(1) River Treatment	6,053	6,053	6,053	6,053	6,053	6,053	6,053	6,053	6,053	6,053
(2) Dam	149,292	149,292	149,292	149,292	149,292	149,292	149,292	149,292	149,292	149,292
(3) Intake	2,362	2,414	2,465	2,512	2,561	2,609	2,657	2,704	2,750	2,795
(4) Power Tunnel	10,211	10,450	10,692	11,184	11,434	11,686	11,942	12,199	12,460	12,723
(5) Penstock	1,333	1,371	1,408	1,447	1,484	1,521	1,558	1,596	1,633	1,669
(6) Power House	12,015	12,246	12,476	12,706	12,924	13,142	13,356	13,567	13,775	13,979
(7) Tailrace Tunnel	2,265	2,358	2,404	2,452	2,499	2,596	2,644	2,694	2,743	2,793
(8) Tailrace	545	569	588	607	626	650	669	689	708	727
(9) P/S Access Tunnel	6,900	6,900	6,900	6,900	6,900	6,900	6,900	6,900	6,900	6,900
(10) Surge Tank	10,495	10,862	11,231	11,708	12,080	12,454	12,829	13,211	13,589	13,968
(11) Others	10,107	9,617	9,649	9,694	9,726	9,761	9,793	9,825	9,857	9,889
4. Hydro- Mechanical Works	21,054	21,313	21,575	21,840	22,099	22,360	22,620	22,883	23,144	23,404
5. Electro- Mechanical Works	45,339	46,485	47,607	48,900	50,007	51,090	52,162	53,236	54,461	55,500
6. Transmission Line	10,170	10,170	10,170	10,170	10,170	10,170	10,170	10,170	10,170	10,170
Direct Cost	354,374	356,345	358,777	361,760	364,171	366,622	369,004	371,400	373,935	376,284
7. Administration Fee	53,156	53,452	53,816	54,264	54,626	54,993	55,351	55,710	56,090	56,443
8. Preliminary Cost	35,437	35,635	35,878	36,176	36,417	36,662	36,900	37,140	37,393	37,628
9. Interest During Construction	88,594	89,086	89,694	90,440	91,043	91,656	92,251	92,850	93,484	94,071
Total	531,561	534,518	538,165	542,640	546,257	549,933	553,507	557,099	560,902	564,426

Details of Alternatives in 10.5

Basic Parameters	OP3b3- 415	
Waterway Length		
Headrace Tunnel	m	1074.8
Penstock	m	136.03
Tailrace Tunnel	m	247.2
	m	1458.03
Sedimentation Level	EL.m	386.2

Specification

Item	Unit	FSL=415									
		1	2	3	4	5	6	7	8	9	10
Qmax	m3/s	127.4	127.4	127.4	127.4	127.4	127.4	127.4	127.4	127.4	127.4
FSL	EL.m	415	415	415	415	415	415				
IWL	EL.m	390	395	400	405	410	415				
MOL	EL.m	387.2	387.2	387.2	387.2	387.2	387.2				
TWL	EL.m	289.2	289.2	289.2	289.2	289.2	289.2				
Loss	m	2.8	2.8	2.8	2.8	2.8	2.8				
Effective Head	m	98	103	108	113	118	123				
Pmax	MW	111	117	123	128	134	140				
Primary Energy	GWh	233.28	241.61	248.88	252.94	255.38	253.45				
Pfirm	MW	86.20	86.00	85.92	85.85	84.72	84.66				
Benefit	1000USD	67,919	69,359	70,643	71,353	71,452	71,087				
Cost	1000USD	42,185	42,246	42,383	42,483	42,613	42,739				
B/C		1.6100	1.6418	1.6668	1.6796	1.6768	1.6633				
		25,734	27,113	28,260	28,870	28,839	28,348				

Civil & Hydromechanical Work Quantity

(1) Dam

Design Flood	m3/s	8,306
Dam Basis EL.	m	293
Non- overflow Width	m	80.2
Spillway Width	m	77
Sand Drain Width	m	16
Intake Width	m	0
Dam Height (Hd)	m	127
Crest Length (L)	m	173.2
Coefficient for Ex	Y=A*X*B	
	A	32335
	B	0.4384
Coefficient for Conc	Y=C*X*D	
	C	0.0015
	D	1.3058

Item	Unit	FSL=415									
		1	2	3	4	5	6	7	8	9	10
Excavation	m3	2,590,358	2,590,358	2,590,358	2,590,358	2,590,358	2,590,358	2,590,358	2,590,358	2,590,358	2,590,358
Concrete	m3	392,176	392,176	392,176	392,176	392,176	392,176	392,176	392,176	392,176	392,176
Gate	t	1,827	1,827	1,827	1,827	1,827	1,827	1,827	1,827	1,827	1,827

(2) Intake

Number	-	1									
Design Velocity	m3/s	4									
MOL	EL.m	387.2	387.2	387.2	387.2	387.2	387.2	387.2	387.2	387.2	387.2
Waterway Diameter	m	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4
Available Height	m	27.8	27.8	27.8	27.8	27.8	27.8	27.8	27.8	27.8	27.8

Item	Unit	FSL=415									
		1	2	3	4	5	6	7	8	9	10
Excavation	m3	10,898	10,898	10,898	10,898	10,898	10,898	10,898	10,898	10,898	10,898
Concrete	m3	9,776	9,776	9,776	9,776	9,776	9,776	9,776	9,776	9,776	9,776
Reinforce Bar	t	391	391	391	391	391	391	391	391	391	391
Intake Gate	t	170	170	170	170	170	170	170	170	170	170
Intake Screen	t	94	94	94	94	94	94	94	94	94	94

(3) Power Tunnel

Tunnel Inner Diameter	m	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4
Concrete Thickness	m	0.6									
Tunnel Base EL.	m	374.4	374.4	374.4	374.4	374.4	374.4	374.4	374.4	374.4	374.4
Tunnel Length	m	1108.71	1108.71	1108.71	1108.71	1108.71	1108.71	1108.71	1108.71	1108.71	1108.71
Number	-	1									

Item	Unit	FSL=415									
		1	2	3	4	5	6	7	8	9	10
Tunnel Excavation	m3	51,231	51,231	51,231	51,231	51,231	51,231	51,231	51,231	51,231	51,231
Lining Concrete	m3	15,564	15,564	15,564	15,564	15,564	15,564	15,564	15,564	15,564	15,564
Reinforce Bar	t	623	623	623	623	623	623	623	623	623	623

(3) Service Adit

Tunnel Length	m	1055
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Item	Unit	FSL=415									
		1	2	3	4	5	6	7	8	9	10

Tunnel Excavation	m3	48,749	48,749	48,749	48,749	48,749	48,749	48,749	48,749	48,749	48,749
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(4) Penstocks

Design Velocity 1	m/s	4									
Penstock Length 1	m	5									
Design Velocity 2	m/s	4.47									
Penstock Length 2	m	97.63	97.63	97.63	97.63	97.63	97.63	97.63	97.63	97.63	97.63
Design Velocity 3	m/s	6.08									
Penstock Length 3	m	25.8									
Design Velocity 4	m/s	8.76	2 penstocks								
Penstock Length 4	m	7.6									
Mean Velocity	m/s	5.19684	5.19684	5.19684	5.19684	5.19684	5.19684	5.19684	5.19684	5.19684	5.19684
Dm	m	5.58689	5.58689	5.58689	5.58689	5.58689	5.58689	5.58689	5.58689	5.58689	5.58689
tm	mm	23.9986	23.9986	23.9986	23.9986	23.9986	23.9986	2	2	2	2

Item	Unit	FSL=415									
		1	2	3	4	5	6	7	8	9	10
Tunnel Excavation	m3	4,921	4,921	4,921	4,921	4,921	4,921	4,921	4,921	4,921	4,921
Lining Concrete	m3	1,586	1,586	1,586	1,586	1,586	1,586	1,586	1,586	1,586	1,586
Reinforce Bar	t	19	19	19	19	19	19	19	19	19	19
Penstock	t	546	546	546	546	546	546	46	46	46	46

(5) Powerhouse

Undergroundtype

A	m2	1040.775	1058.182	1075.035	1091.375	1107.241	1122.664	0	0	0	0
d	m	30									

Item	Unit	FSL=415									
		1	2	3	4	5	6	7	8	9	10
Excavation	m3	68,691	69,840	70,952	72,031	73,078	74,096	0	0	0	0
Concrete	m3	15,612	15,873	16,126	16,371	16,609	16,840	0	0	0	0
Reinforce Bar	t	62	63	65	65	66	67	0	0	0	0

(6) Tailrace Tunnel

Design Velocity	m/s	3.5									
Tunnel Inner Diameter	m	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8
Concrete Thickness	m	0.6									
Tunnel Length	m	247.2									
Number	-	1									

Item	Unit	FSL=415									
		1	2	3	4	5	6	7	8	9	10
Tunnel Excavation	m3	12,657	12,657	12,657	12,657	12,657	12,657	12,657	12,657	12,657	12,657
Lining Concrete	m3	3,679	3,679	3,679	3,679	3,679	3,679	3,679	3,679	3,679	3,679
Reinforce Bar	t	147	147	147	147	147	147	147	147	147	147

(7) Tailrace

Item	Unit	FSL=415									
		1	2	3	4	5	6	7	8	9	10
Excavation	m3	7,237	7,237	7,237	7,237	7,237	7,237	7,237	7,237	7,237	7,237
Concrete	m3	2,570	2,570	2,570	2,570	2,570	2,570	2,570	2,570	2,570	2,570
Reinforce Bar	t	31	31	31	31	31	31	31	31	31	31

(8) P/H Access Tunnel

Tunnel Length	m	1220									
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Item	Unit	FSL=415									
		1	2	3	4	5	6	7	8	9	10
Tunnel Excavation	m3	54,900	54,900	54,900	54,900	54,900	54,900	54,900	54,900	54,900	54,900
Lining Concrete	m3	12,200	12,200	12,200	12,200	12,200	12,200	12,200	12,200	12,200	12,200
Reinforce Bar	t	366	366	366	366	366	366	366	366	366	366

(9) Surge Tank

LWL	EL.m	387.2									
Available Depth	m	27.8 m									
Number of waterway	-	1									

Item	Unit	FSL=415									
		1	2	3	4	5	6	7	8	9	10
Excavation	m3	27,897	27,897	27,897	27,897	27,897	27,897	27,897	27,897	27,897	27,897
Concrete	m3	8,075	8,075	8,075	8,075	8,075	8,075	8,075	8,075	8,075	8,075
Reinforce Bar	t	404	404	404	404	404	404	404	404	404	404

(9) Service Adit

Tunnel Length	m	960									
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Item	Unit	FSL=415									
		1	2	3	4	5	6	7	8	9	10
Tunnel Excavation	m3	44,360	44,360	44,360	44,360	44,360	44,360	44,360	44,360	44,360	44,360

Civil Work Cost

1,000USD

(2) Compensation											
(3) Others											
2. Environmental Mitigation	30,180	30,180	30,180	30,180	30,180	30,180	30,180	30,180	30,180	30,180	30,180
3. Civil Works									164,939		
(1) River Treatment	6,053	6,053	6,053	6,053	6,053	6,053	6,053	6,053	6,053	6,053	6,053
(2) Dam	117,131	117,131	117,131	117,131	117,131	117,131	117,131	117,131	117,131	117,131	117,131
(3) Intake	2,131	2,131	2,131	2,131	2,131	2,131	2,131	2,131	2,131	2,131	2,131
(4) Power Tunnel	10,672	10,672	10,672	10,672	10,672	10,672	10,672	10,672	10,672	10,672	10,672
(5) Penstock	1,115	1,115	1,115	1,115	1,115	1,115	1,115	1,115	1,115	1,115	1,115
(6) Power House	10,714	10,893	11,067	11,235	11,398	11,557	0	0	0	0	0
(7) Tailrace Tunnel	2,311	2,311	2,311	2,311	2,311	2,311	2,311	2,311	2,311	2,311	2,311
(8) Tailrace	558	558	558	558	558	558	558	558	558	558	558
(9) P/S Access Tunnel	6,900	6,900	6,900	6,900	6,900	6,900	6,900	6,900	6,900	6,900	6,900
(10) Surge Tank	10,689	10,689	10,689	10,689	10,689	10,689	10,689	10,689	10,689	10,689	10,689
(11) Others	8,448	7,922	7,931	7,939	7,948	7,956	7,378	7,378	7,378	7,378	7,378
4. Hydro- Mechanical Works	20,164	20,164	20,164	20,164	20,164	20,164	17,881	17,881	17,881	17,881	17,881
5. Electro- Mechanical Works	40,451	41,208	41,939	42,424	43,114	43,783	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
6. Transmission Line	10,170	10,170	10,170	10,170	10,170	10,170	5,298	5,298	5,298	5,298	5,298
Direct Cost	281,235	281,639	282,556	283,221	284,086	284,925	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
7. Administration Fee	42,185	42,246	42,383	42,483	42,613	42,739	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
8. Preliminary Cost	28,124	28,164	28,256	28,322	28,409	28,492	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
9. Interest During Construction	70,309	70,410	70,639	70,805	71,021	71,231	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Total	421,853	422,459	423,833	424,831	426,129	427,387	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!