9.2.5 Penstock line

There are two types of the penstocks, namely, inclined underground pressure tunnel and open air steel conduit. Among them, the underground inclined penstock was adopted for case of connection with the surge tank which will be below the ground surface.

The inside diameter of the steel lined inclined pressure penstock was calculated by the following equation;

$$D = 1.125(Qp^{3/7}/H^{1/7}) + 0.494$$

where ; D ; Inside diameter of pressure shaft (m)
Qp ; maximum plant discharge (m^3/sec)
H ; Static head (m)

The thickness of the lined concrete was set at 0.6 m in consideration of the working space of the execution work.

The alignment of the penstock line was decided based on the topographic maps at a scale of 1:50,000 and 1:10,000.

The thickness of the steel conduit was estimated by dividing into two parts, namely, upper part (L_1) and lower part (L_2) as shown in Fig. VI. 6.1. L_1 is defined as the conduit length which has smaller head than the head bearable by the minimum thickness of the conduit shell. L_2 is defined as the conduit length which is larger head than the head bearable by the minimum thickness of the conduit shell. The minimum thickness of the conduit shell is defined as follows;

$D \leq 1.6m$ t min = 0.6 cm
$D > 1.6m$ t min = 0.25D + 0.2 (cm)

where ; D ; Diameter of conduit (m)
t min ; Minimum thickness of conduit shell (cm)

The head bearable by the minimum thickness of the conduit shell was calculated by the following equations;

$H_B = 2(t\ min-\varepsilon)\sigma/D$

where ; H_B ; Head bearable by the minimum thickness of conduit shell (m)

ε ; Allowance for thickness (0.15 cm)

σ ; Allowable strength (0.9x12,000 t/m^2)

L_1 was estimated by the following equation;

$$L1 = L_0 + \frac{HB-(H_0+h_t)}{HGROS-H_0} \times L_3$$

If $H_B < ht + H_0$, $L_1 = O$

If $H_B \geq (HGROS+PR)$, $L_1 = L_p$

$$ht = 0.72 \times (Q_p/Nt)^{1/3} \times [(LTxI)^{1/2} + (LTxI)^{1/3}]$$

where ; H_0 ; Statical head below FSL at the upper end of penstock, expressed as $H_0 = 1.5\ DIAT + ht + RD$

DIAT ; Diameter of headrace tunnel (m)

RD ; Reservoir drawdown depth (m)

HGROS ; Gross head between FSL and TWL (m)

PR ; Max. pressure rise (25% of HGROS(m))

LP ; Total length of penstock (m)

L_0 ; Length of upper horizontal part (m)

L_3 ; Length of inclined part (m)

LT ; Length of headrace tunnel (m)

I ; Hydraulic gradient of headrace tunnel ; 1/700

N_t ; No. of tailrace tunnels

The thickness of the conduit shell for L_2 was estimated by the following equation;

$$t = \frac{Ha \times D}{(2x\sigma) + \varepsilon}$$

$$Ha = \frac{(H_B+HGROS+PR)}{2}$$

9.2.6 Powerhouse

An open-air type powerhouse was adopted for all the schemes and an outdoor switchyard was planned to be provided adjacent to the powerhouse.

A skeleton map of the powerhouse and general equations to estimate dimensions of the powerhouse structure are shown in Fig. VI.9.1. Using the equations shown in this figure, length, width and height of super and substructures of the powerhouse were determined under the condition that the powerhouse is placed on a good foundation site.

A Francis type power generating equipment was applied to all the scheme in consideration of extent of effective head and installed capacity.

9.2.7 Transmission line and substation

The specification for the transmission line applied to the first screening study was adopted for the second screening study. The transmission line from the proposed project site was connected with the nearest existing substation and/or transmission line.

9.3 Work Quantity

9.3.1 Preparation of general layout

Based on the result of design for the foregoing facilities, the general layout for five schemes was prepared on the topographic maps at a scale of 1:50,000 as shown in Figs VI.9.2 to VI.9.6.

9.3.2 Estimate of work quantity

Based on the prepared general layout plans, work quantities of civil works were estimated for the respective five schemes. For estimation of the work quantity of the metal works, experimental formulae as applied to the first screening study were adopted.

9.4 Construction Cost Estimate

The unit prices as set out for the first screening study were applied for the cost estimate of the civil, metal and other relevant works of the five schemes.

Based on the work quantities for the work component for the major structures and their unit prices thus obtained, the construction costs for the five schemes were estimated as shown in Tables VI.9.1 to VI.9.5.

9.5 Second Screening of Promising Schemes

The Second screening was carried out in the same manner as applied to the first screening, namely, evaluation by comparing the unit price of the guaranteed energy with marginal cost of the expanded energy of the system.

The power output and energy for the five schemes were recalculated based on the loss calculation for the fixed dimension of the power facilities. Based on the power output calculation and cost estimate, unit cost of the guaranteed energy for the five schemes was also recalculated.

Information on the hydropower potential so far obtained for the five schemes is compiled as the inventory in Table VI.9.6. Main features of the five schemes, which were derived from this inventory are as follows;

Name of scheme	Installed capacity (MW)	Annual energy (GWh)	Guaranteed energy (GWh)	Const cost (Mil US$)	Unit cost of guaranteed energy (US$/MWh)
Salto Pilao (1)	118.7	757.7	682	122.6	17.2
Salto Pilao (2)	67.8	490	441	87.2	19.9
Dalbergia	15.9	109.5	98.6	65.2	65.6
Benedito Novo	12.8	69.8	62.9	26.4	40.6
Alto Benedito Novo	13.2	59.4	53.4	38.2	70.1

For these five schemes, a technical review was made to judge the appropriateness for actual implementation. Main items of the technical review were;

- Technical aspect ; geology in particular
- Constraints to construction works ; access facilities and other pre-construction work requirement in particular
- Any notable sociological and environmental problems, and
- Any other constraints to project implementation

From the geological aspects, the possibility of a fractured zone in the heavily weathered part of the upstream tunnel route was pointed out for Benedito Novo scheme. It was also presumed for Alto Benedito Novo scheme that a landslide might occur in the weathered zone at the powerhouse site. But it is possible to cope with these unfavorable geological conditions by means of technical treatment. Except for these two schemes, no geological problems were pointed out for other schemes.

It has been confirmed that there would be no problems over accessibility to the project site since there are existing roads near all the power development sites.

Since the five schemes selected are all run-of-river type and these have relatively small submerged area, no social problems have been identified. It has been also shown by the environmental studies that there will be no notable environmental problems due to project realization.

Judging from the above, it was considered that there would be no technical problems in implementing these schemes.

Of the five schemes selected, Salto Pilao (2) scheme is an alternative for Salto Pilao (1) scheme and both schemes are mutually exclusive. Of the two schemes, Salto Pilao (1) is superior to Salto Pilao (2) from the viewpoint of economic viability and scale of the installed capacity.

The unit cost of the guaranteed energy for Alto Benedito Novo scheme will exceed the marginal cost of the expanded energy from 2011 onward. The unit cost of the guaranteed energy for Dalbergia scheme will exceed slightly the marginal cost from 2011 onward but an annual energy to be generated by Dalbergia scheme is about 1.8 times that for Alto Benedito Novo scheme. The unit cost of the guaranteed energy for Benedito Novo scheme is smaller than the marginal cost of the expanded energy for 2000-2005 period.

Considering all the above, it was decided to select three schemes, i.e, Salto Pilao (1), Dalbergia and Benedito Novo schemes for pre-feasibility study to be carried out in the next stage.

10. MASTER PLAN PROGRAM FOR ORDERLY DEVELOPMENT OF HYDROPOWER POTENTIALS

10.1 General

It was decided in the second screening study that three scheme, i.e, Salto Pilao (1), Dalbergia and Benedito Novo schemes, be selected for pre-feasibility study to be carried out in the following stage.

It has been specified by ELETROBRAS that the power development plan should be incorporated in the south/southeast power supply system. This power supply system also specifies the relationship between the marginal cost of the expanded energy of the system and the period to be developed. Thus, the preparation of an orderly development program for the three schemes selected was made considering the above-mentioned relationship.

10.2 Proposed Orderly Power Development Program

The orderly development program of the selected hydropower schemes was established by comparing the unit cost of the guaranteed energy with the relationship between marginal cost of the expanded energy and the period to be developed. Accordingly the concepts for establishment of the development program were set out as follows;

(1) The unit cost of the guaranteed energy for Salto Pilao (1) scheme is only 17.2 US$/MWh. This means that Salto Pilao (1) scheme is worth developing at the earliest stage possible. However it is presumed that about 8 years are needed for the series of works from feasibility study to construction works. Thus, the earliest commissioning time for the power plant for Salto Pilao (1) scheme would be year 2000 even if its feasibility studies started in 1992.

(2) The unit cost of the guaranteed energy for Benedito Novo scheme is 40.6 US$/MWh. This figure is close to the marginal cost of 43 US$/MWh for 2001-2005 period. Assuming that the commissioning time of the power plant starts in year 2001, its feasibility study will have to be carried out from 1993.

(3) The unit price of the guaranteed energy for Dalbergia scheme is 65.6 US$/MWh. This means that the scheme will become viable if it is realized from

2011 onward. Assuming that the commissioning time of the power plant starts in year 2011, its feasibility study will have to be commenced from year 2002.

Based on these concepts, an orderly development program for three schemes was prepared as illustrated in Fig VI. 10.1.

10.3 Fund Requirement

Based on the orderly development program for three schemes as given in Fig. VI. 10.1, the annual disbursement schedule including the fund needed for feasibility study and detailed design was prepared based on the following developments ratio;

Construction period (year)	Development ratio (%)
3	30/40/30
3.5	20/30/40/10

The annual disbursement schedule prepared using the above development ratio is as follows;

Year	Annual disbursement (Mil US$)	Year	Annual disbursement (Mil US$)
1992	1.5	2002	1.5
1993	1.5	2003	-
1994	2.7	2004	2.7
1995	2.7	2005	-
1996	-	2006	-
1997	24.5	2007	13
1998	44.7	2008	19.6
1999	59.6	2009	26.1
2000	20.2	2010	6.5
2001	-		
Sub-total	157.4		69.4
Grand-total			226.8

The above disbursement schedule shows that about 66% of the total required disbursement concentrated in the 1997-2000 period, and the fund requirement will peak in 1999.

TABLES

Table VI.4.1 CRITERIA FOR MAP PLANNING

Item	Guideline/Criteria for Planning
Maximum dam height;	Max dam height assumed to be highest high water level plus free board (1.5m).
Saddle dam;	Not considered in this study.
Spillway;	Spillway with gated weir is assumed.
Dam type;	In initial planning, a rockfill dam is considered for reservoir type scheme and for run-of-river type scheme, a concrete weir with gated spillway.
Headrace Tunnel;	In general, a pressure tunnel is assumed. An open channel is only considered if a tunnel is topographically not applicable.
Surge tank;	The surge tank will be located on a well-formed slope and its height will correspond to the proposed dam site level or maximum dam crest.
Penstock;	The penstock(s) will be located on a well-formed and sufficiently wide ridge.
Power house;	Open-air powerhouse generally is assumed.
Transmission line;	Approximate line route determined by 1/50,000 map from powerhouse to nearest major town where a receiving substation is expected.

Table VI. 4. 2 SCHEMES IDENTIFIED FROM MAP STUDY

No.	Name of Scheme	Name of River	Type	Catchment Area (Sq. km)	Annual Rainfall (mm)
1	Salto Pilao (1)	Itajai	ROR /1	5,597	1,530
2	Salto Pilao (2)	Itajai	ROR	5,597	1,530
3	Ibirama	Itajai	ROR	9,041,	1,510
4	Subida	Itajai	ROR	9,147	1,510
5	Ascurra	Itajai	ROR	9,586	1,510
6	Indaial	Itajai	ROR	11,493	1,500
7	Dalbergia	Itajai do Norte	ROR	3,212	1,520
8	Barra da Pratinha	Itajai do Norte	RES /2	1,405	1,620
9	Barra das Pombas	Itajai do Norte	RES	979	1,670
10	Timbo	Benedito	RES	765	1,510
11	Benedito Novo	Benedito	ROR	586	1,510
12	Alto Benedito Novo	Benedito	ROR	473	1,520
13	Doutor Pedrinho	Benedito	RES	161	1,550
14	Trombudo Central (1)	Trombudo	RES	293	1,550
15	Trombudo Central (2)	Trombudo	RES	117	1,550
16	Botuvera	Itajai Mirim	RES	625	1,560

Notes:

/1: ROR means Run-of-river type.

/2: RES means Reservoir type.

Table VI.5.1 POWER OUTPUT CALCULATION CRITERIA (1/2)

	Run-of-River Scheme	Reservoir Scheme
1. Firm discharge	Average available flow which is defined in item 2	Regulated outflow (Qo) obtained from a storage draft curve
2. Max plant discharge	Qp = F (WUF) WUF = Ap / Ao WUF: Water utilization factor = 0.5, 0.6, 0.7, 0.8, 0.9, 1.0 Qp: Max plant discharge Ap:Average available flow, which corresponds to the area below Qp on a flow duration curve Ao: Average riverflow, which corresponds to total area of the flow duration curve	Qp = Qo / Pf Qp: Max plant discharge Qo: Firm discharge Pf: Plant capacity factor (herein assumed at 0.5)
Operating level and Head 1. Operating level	NOL = RL + h + Ho = RL + h + $(Qp/2)^{1/2}$ NOL: Normal operating level RL: River bed level Qp: Max plant discharge V: Flow velocity at trashrack =0.5 m/s B: Channel width at trashrack = 4 x Ho (m) Ho: Water depth at trashrack = Qp/ B x V = $(Qp/2)^{1/2}$ h: Sill height of intake = 1 m	Lowest minimum operating level: MOLmin = SEDL + 2xWDLA MOLmin: Lowest minimum operating level SEDL: Reservoir sedimentation level WDLA: Diameter of waterway at flow velocity of 3 ~ 4 m/s
2. Operating head	HGROS = NOL - TWL HGROS: Operating head, gross NOL: Normal operating level (EL.m) TWL: Tail water level (EL. m)	Average operating level and head AOL= FSL - 1/3 (FSL - MOL) AHD = AOL - TWL AOL:Average operating level (m) AHD: Average operating head, gross (m) FSL: Full supply level (EL. m) MOL:Minimum operating level (EL. m) TWL: Tail water level (EL. m)

Table VI.5.1 POWER OUTPUT CALCULATION CRITERIA (2/2)

Hydropower Calculation		
1. Power output	Po = 9.8 x Qo x (HGROS-HLOS) x EFF Pinst = 9.8 x Qp x (HGROS-HLOS) x EFF HLOS = a x L1+b x L2 + c x L3 + Δh Po: Firm capacity (kW) Pinst: Installed capacity (kW) Qo: Average discharge (m3/s) Qp: Max plant discharge (m3/s) HGROS:Average gross head between average operating level and TWL (m) HLOS: Average loss head (m) L1: Length of headrace (m) L2: Length of penstock pipe (m) L3: Length of tailrace (m) a: Pressure tunnel; 1/700 Non-pressure tunnel; 1/1,000 b: Penstock pipe; 1/200 c: Pressure tailrace; 1/700 Non-pressure tail race; 1/1,000 Δh: Other loss EFF: Overall efficiency of generating equipment = 0.84	Po = 9.8 x Qo x(AHD-HLOS) x EFF Pinst = 9.8 x Op x (AHD-HLOS) x EFF
2. Annual energy	(1) Firm energy Efirm = 9.8 x Qo x (HGROS-HLOS) x EFF x 8760 Efirm: Firm energy (kWh/year) (2) Guaranteed energy Eg = 0.9 Efirm Eg: Guaranteed energy (kWh/year) (3) Secondary energy Ei = 9.8 x I x (HGROS-HLOS) x EFF x 8760 Es = Ei - Ef Ei = Average energy (kWh/year) Es = Secondary energy (kWh/year) I: Long-term average river discharge excluding the parts of daily discharges exceeding the maximum plant discharge (m3/s)	(1) Firm energy Same as left column. (2) Guaranteed energy Eg = 0.9 Efirm Eg: Guaranteed energy (3) Secondary energy Es = 9.8 (I - Qo)/2 x (HGROS - HLOS) x EFF x 8760 Es: Secondary energy (kWh/year) I: Long-term average discharge (m3/s)

Table VI.6.1 EMPIRICAL FORMULA FOR WORK QUANTITY (1/5)

	QUANTITY FORMULA	SYMBOLS	
1.	STORAGE DAM		
1.1	Rockfill dam		
(1)	Dam embankment		
	$Vdf = 1/2xBxHdx(a+b)+1/6x(m+n)xHd^2x(a+2b)$	Vdf:	Embankment volume (m^3)
		B:	Crest width (m)
		Hd:	Dam height (m)
		a:	Dam crest length (m)
		b:	Bottom width of valley (m)
		m:	Upstream slope of embankment
		n:	Downstream slope of embankment
(2)	Excavation		
	$Vef = 5 \times Hd \times a$	Vef:	Excavation volume (m^3)
		Hd:	Dam height (m)
		a:	Dam crest length (m)
1.2	Spillway		
	$V_{ES} = 84 \times Qd^{1/2} \times Hd$	V_{ES}:	Excavation volume (m^3)
	$V_{CS} = 13 \times Qd^{1/2} \times Hd$	V_{CS}:	Concrete volume (m^3)
	$W_{RS} = 0.02 \times V_{CS}$	W_{RS}:	Reinforcing bar (ton)
	$W_{GS} = 0.22 \times Qd$	W_{GS}:	Weight of gates (ton)
		Qd:	Design flood discharge (m^3/s)
		Hd:	Dam height (m)
1.3	Diversion tunnel		
	VET $= 1.87 \times D^{1.69} \times LT \times N$, if D<3 m	VET:	Tunnel excavation volume (m^3)
	$= 1.48 \times D^{1.90} \times LT \times N$, if $D \geq 3$ m		
	VCT $= 1.04 \times D^{0.87} \times LT \times N$, if D<3 m	VCT:	Lining concrete volume (m^3)
	$= 0.33 \times D^{1.93} \times LT \times N$, if $D \geq 3$ m		
	RST $= 0.005 \times VCT$	RST:	Reinforcing bar (ton)
		D:	Tunnel diameter
		LT:	Length of diversion tunnel (m)
		N:	Number of tunnels (nos.)
2.	DIVERSION DAM		
2.1	Concrete dam		
	$V_{ED} = 0.3V_{CD}$	V_{ED}:	Excavation volume (m^3)
	$V_{CD} = C_1 + C_2 + C_3 + C_4 + C_5$	V_{CD}:	Total concrete volume (m^3)
	$C_1 = (0.2625Hd^2 + 5).L_N$	C_1:	Concrete in non-overflow portion (Typical portion)(m^3)

Table VI.6.1 EMPIRICAL FORMULA FOR WORK QUANTITY (2/5)

QUANTITY FORMULA	SYMBOLS	
$C_2 = (0.13Hd^2 + 6) \cdot L_N$	C_2:	Concrete in non-overflow portion (Transition portion) (m^3)
$C_3 = 0.5W_T\{2.1(D+1)+1.05Hd\} \times \{Hd-2(D+1)\}$	C_3:	Concrete in overflow portion(m^3)
$C_4 = 15W_T \cdot D^{1/2}$	C_4:	Concrete in stilling basin slab (m^3)
$C_5 = (4.2D^2+16.4D+24.2)(N-1)$	C_5:	Concrete in piers (m^3)
$Rsd = 2WT$	Hd:	Dam height (m)
$WG = (1.9-0.12xGH+0.07GH^2) \times G_W \times N$	L_N:	Length of non-overflow portion (m)
	Wt:	Width of overflow portion (m)
	D:	Diameter of headrace tunnel (m)
	Rsd:	Reinforcing bar (ton)
	WG:	Weight of gates (ton)
	GH:	Gate height (m)
	GW:	Gate width (m)
	N:	No. of gates (nos.)

2.2 River diversion works

The cost for river diversion works is estimated at 20% of the above civil works cost.

3. INTAKE

(1) Pressure type intake

$VEIp = 250 \times \{(H_a+DT)xQp\}^{1/2} \times N^{1/3}$	VEIp:	Excavation volume (m^3)
$VCIp = 90 \times \{(H_a+DT)xQp\}^{1/2} \times N^{1/3}$	VCI_p:	Concrete volume (m^3)
$RSIp = 0.04 \times VCIp$	RSIp:	Reinforcing bar (ton)
$WGIp = 0.9 \times (H_a+DT)^{1/9} \times Qp$	WGIp:	Weight of gates (ton)
$WSIp = 0.5 \times (H_a+DT)^{1/9} \times Qp$	WSIp:	Weight of trashracks (ton)
	H_a:	Reservoir drawdown depth (m)
	DT:	Tunnel diameter (m)
	Qp:	Max. plant discharge (m^3/s)
	N:	No. of headrace tunnels (nos.)

(2) Non-pressure type intake

$VEI_n = 200 \times (DTxQp/2)^{0.83}$	VEI_n:	Excavation volume (m^3)
$VCI_n = 70 (DTxQp/2)^{0.86}$	VCI_n:	Concrete volume (m^3)
$RSI_n = 0.04 \times VCI_n$	RSI_n:	Reinforcing bar (ton)
$WSI_n = 1.3 \times (DTxQp/2)^{1/2}$	WSI_n:	Weight of trashracks (ton)
$WGI_n = 3.4 \times (DTxQp/2)^{1/2}$	WGI_n:	Weight of gates (ton)
	Qp:	Max. plant discharge (m^3/s)

Table VI.6.1 EMPIRICAL FORMULA FOR WORK QUANTITY (3/5)

QUANTITY FORMULA	SYMBOLS
4. SAND TRAP BASIN	
VEB = 1,200 x $Qp^{3/4}$	VEB: Excavation volume (m^3)
VCB = 380 x Qp3/4	VCB: Concrete volume (m^3)
RSB = 0.05 x VCB	RSB: Reinforcing bar (ton)
WGB = 0.5 x Qp	WGB: Weight of gates (ton)
WSB = 0.27 x Qp	WSB: Weight of trashracks (ton)
	Qp: Max plant discharge (m^3/s)
5. HEADRACE	
(1) Headrace tunnel - Pressure type	
VEP = 1.73 x $DTP^{1.84}$ x LT x N, if DTP<3 m	VEP: Tunnel excavation volume (m^3)
= 1.54 x $DTP^{1.94}$ x LT x N, if DTP≧3 m	
VCP = 0.75 x $DTP^{1.53}$ x LT x N, if DTP<3 m	VCP: Lining concrete volume (m^3)
= 0.46 x $DTP^{1.98}$ x LT x N, if DTP≧3 m	
RSP = 10^{A} x LT x N	RSP: Reinforcing bar (ton)
	DTP: Tunnel diameter (m)
	LT: Tunnel length (m)
	N: Number of tunnels (nos.)
	A: 0.35 x DTP - 2.28
(2) Headrace channel	
VEC = {(B+2H)+B} x H x 1/2 x LT	VEC: Excavation volume (m^3)
VCC = 0.35 x (B+2.83xH) x LT	VCC: Concrete volume (m^3)
RSC = 0.05 x VCC	RSC: Reinforcing bar (ton)
	B: Channel bottom width (m)
	H: Channel depth (m)
	LT: Channel length (m)
6. SURGE TANK/HEAD TANK	
(1) Surge tank	
VES = 0.86 x $(DST + 2 x t)^2$ x HST x N	VES: Excavation volume (m^3)
VCS = 0.94 x {$(DST+2 x t)^2$ - DST^2} x HST x N	VCS: Concrete volume (m^3)
RSS = 0.05 x VCS	RSS: Reinforcing bar (ton)
	DST: Diameter of surge tank (m)
	HST: Height of surge tank (m)
	t: Lining thickness (m) = 1.2-0.8/$DST^{1/2}$
	N: No. of surge tanks (nos.)
(2) Head tank	
(i) Head tank	
VEH = 1,200 x $Qp^{0.61}$	VEH: Excavation volume (m^3)
VCH = 400 x $Qp^{0.61}$	VCH: Concrete volume (m^3)

Table VI.6.1 EMPIRICAL FORMULA FOR WORK QUANTITY (4/5)

QUANTITY FORMULA	SYMBOLS	
RSH = 0.03 x VCH	RSH:	Reinforcing bar (ton)
WGH = 0.5 x Qp	WGH:	Weight of gates (ton)
WSH = 0.2 x Qp	WSH:	Weight of trashracks (ton)
	Qp:	Max. plant discharge (m^3/s)
(ii) Spillout conduit		
$VED = 12 \times DCD^{1.50} \times LD$	VED:	Excavation volume (m^3)
$VCD = 3.6 \times DCD^{0.96} \times LD$	VCD:	Concrete volume m^3)
RSD = 0.015 x VCD	RSD:	Reinforcing bar (ton)
WCD = 0.18 x DCD x LD	WCD:	Weight of conduit (ton)
	DCD:	Diameter of conduit (m)
	LD:	Length of conduit (m)
7. PENSTOCK		
(1) Pressure shaft		
$VEP = 1.90 \times DIAP^{1.92} \times LP \times Np$	VEP:	Pressure shaft excavation (m^3)
$VCP = 1.12 \times DIAP^{1.84} \times LP \times Np$	VCP:	Concrete (m^3)
RSP = 0.012 x VCP	RSP:	Reinforcing bar (ton)
	DIAP:	Diameter of penstock
	LP:	Length of penstock line (m)
	Np:	Number of penstock lines (nos.)
(2) Open-air penstock		
$VEA = 10.50 \times DIAP^{1.85} \times LP \times Np$	VEA:	Open excavation (m^3)
$VCA = 3.40 \times DIAP^{1.16} \times LP \times Np$	VCA:	Concrete volume (m^3)
RSA = 0.015 x VCA	RSA:	Reinforcing bar (ton)
	DIAP:	Diameter of penstock (m)
	LP:	Length of penstock line (m)
	Np:	Number of penstock lines (nos.)
(3) Steel liner		
$WT = W_1 + W_2$	WT:	Weight of steel liner (ton)
$W_1 = 24.649 \times (Tmin^2 + DIAP \times T) \times L_1 \times N_P$	W_1:	Weight of upper part (ton)
$W_2 = 24.649 \times (T^2 + DIAP \times T) \times L_2 \times N_P$	W_2:	Weight of lower part (ton)
$Tmin. = \frac{DIAP + 800}{400} \geq 6mm$	DIAP:	Average diameter of penstock (m)
$H_B = \frac{2 \times (Tmin. - \varepsilon) \times \sigma}{DIAP}$	Lp:	Total length of penstock (m)
$ht = 0.72 \times (Q_p/N_t)^{1/3} \times \{(LT \times I)^{1/2} + (LT \times I)^{1/3}\}$	L_1:	Length of penstock where the shell of min. thickness is used. (m)
If $H_0 + ht > H_B$, then $L_1 = 0$	L_2:	$Lp - L_1$ (m)
	L_0:	Length of upper horizontal part (m)

Table VI.6.1 EMPIRICAL FORMULA FOR WORK QUANTITY (5/5)

QUANTITY FORMULA	SYMBOLS
If $H_0 + ht \leq H_B$, then $L1 = L_0 + \frac{H_B-(ht+H_0)}{HGROS-H_0} \times L_3$	L_3: Length of inclined part (m) Np: Number of penstock lines (nos.)
If $HGROS + PR < H_B$, then $L_2=0$, $L_1 = Lp$	Tmin. : Minimum thickness of conduit shell (cm)
$H_A = \frac{H_B + HGROS + PR}{2}$	H_B: Head bearable by min. thickness of conduit shell (m)
$T = \frac{H_A \times DIAP}{(2 \times \sigma)} + \varepsilon$	ε : Allowance for thickness = 0.15 cm
	σ : Allowable strength = 0.9 x 1200 kg/cm^2
	ht: Surcharge depth due to surging (m)
	Q_p: Max. plant discharge (m^3/s)
	N_t: No. of tailrace tunnels (nos.)
	LT: Length of headrace tunnel (m)
	I : Hydraulic gradient of headrace tunnel, I ≒ 1 / 700
	T : Steel pipe thickness for L2 portion (m)
	H_o: Statical head below FSL at the upper end of penstock, expressed as H_o= 1.5 DIAT + ht + RD DIAT: Diameter of headrace tunnel (m) RD: Reservoir drawdown depth(m)
	HGROS: Gross head between FSL and TWL(m)
	H_A: Average pressure for lower part (m)
	PR: Max. pressure rise, assumed herein to be 25% of HGROS (m)
8. POWERHOUSE	
(1) Superstructure $VB_1 = 23 \times (P/H_e^{1/2})^{0.7}$	VB_1: Volume of main building (m^3) P: Installed capacity (kW) H_e: Effective head (m)
(2) Substructure $VEB = 21 \times Qp \times H_e^{2/3} \times N^{1/2}$ $VCB = 8 \times Qp \times H_e^{2/3} \times N^{1/2}$ $RSB = 0.052 \times VCB$	VEB: Excavation volume (m^3) VCB: Concrete volume (m^3) RSB: Reinforcing bar (ton) Qp: Max. plant discharge (m^3/s) H_e: Effective head (m) N: No. of units (nos.)
(3) Generating equipment	
(i) Turbine Francis turbine $WT = 0.2597 \times (kW/H_e^{1/2})^{0.8496}$ Kaplan turbine $WT = 0.2827 \times (kW/H_e^{1/2})^{0.8682}$	WT: Weight of turbine (ton) kW: Turbine output (kW) He: Effective head (m)
(ii) Generator $WG = 11.491 \times (kVA/N)^{0.6776}$	WG: Weight of generator (ton) kVA: Generator output (kVA) N: Rotational speed (rpm)

Table VI.6.2 UNIT PRICES FOR MAJOR WORKS (1/2)

Work Item	Unit of Q'ty	Standard Unit Price (US$)	Remarks
1. General			
Open-cut	cu. m	7	
Reinforcing bar	ton	1,100	
2. Storage dam			
a. Dam			
Dam embankment			
– Rock fill dam	cu. m	12	
Blanket grout	m	5	
b. Spillway			
Concrete	cu. m	85	
Gate	ton	4,000	
c. River diversion works			
Tunnel excavation	cu. m	100- 80	Variable by dia.
Lining concrete	cu. m	165-140	Variable by dia.
3. River diversion dam			
Concrete	cu. m	80	
Gate	ton	4,800	
4. Intake			
Concrete	cu. m	140	
Gate	ton	4,800	
Tashrack	ton	2,600	
5. Sand trap basin			
Concrete	cu. m	140	
Gate	ton	4,800	
Trashrack	ton	2,600	
6. Headrace			
a. Tunnel			
Tunnel excavation	cu. m	100- 80	Variable by dia.
Lining concrete	cu. m	165-140	Variable by dia.
b. Open channel			
Concrete	cu. m	140	
7. Surge tank/Head tank			
a. Surge tank			
Shaft excavation	cu. m	100	
Lining concrete	cu. m	160	
b. Head tank			
(1) Head tank			
Concrete	cu. m	140	
Trashrack	ton	2,600	
Gate	ton	4,800	
(2) Spillout conduit			
Concrete	cu. m	82	
Steel pipe	ton	2,100	

Table VI.6.2 UNIT PRICES FOR MAJOR WORKS (2/2)

Work Item	Unit of Q'ty	Standard Unit Price (US$)	Remarks
8. Penstock			
a. Pressure shaft penstock			
Shaft excavation	cu. m	130-100	Variable by dia.
Backfill concrete	cu. m	164	
Steel liner	ton	2,100	
b. Open-air penstock			
Concrete	cu. m	82	
Steel pipe	ton	2,100	
9. Power house (Open-air power house)			
Concrete	cu. m	140	
Superstructure	cu. m	180	Space expressed by volume
Generating equipment			
Turbine	ton	11,000	
Generator	ton	9,500	
10. Outdoor switchyard			
a. Switch gear			
138kv	bay	1,636,000	
69kv	bay	1,027,000	
34.5kv	bay	235,000	
23kv	bay	200,000	
b. Power transformer			
16.6 MVA	Unit	753,660	
11. Transmission line			
138 kv	km	209,970	Double circuit
69 kv	km	140,130	Double circuit
34.5kv	km	64,089	Single circuit
23 kv	km	79,119	Double circuit
23 kv	km	53,406	Single circuit
12. Access road			
New construction road	km	200,000	
Improvement of existing road	km	90,000	
Bridge	m	5,000	
13. Relocation road			
Road (Effective width w=4.0m)	km	200,000	
Road (Effective width w=7.2m)	km	270,000	
Bridge	m	5,000	
14. Compensation			
a. House	No.	7,350	
b. Land			
Urbanized	sq. km	1,725,000	Scheme 3 and 6
Cultivated	sq. km	575,000	Scheme 5
Forest and non-cultivated land	sq. km	115,000	Other schemes

Table VI.7.1 INVENTORY OF OPTIMUM SCALE FOR IDENTIFIED SCHEMES (1 /16)

(i) Scheme identification information	: - No. of scheme		: 1
	- Name of scheme		: Salto Pilao (1)
	- Name of river		: Itajai
(ii) Hydrological and topographic information	: - Catchment area	(sq.km)	: 5,597
	- Average basin mean rainfall	(mm)	: 1,530
	- Average runoff for the critical period from April 1949 to November 1956	(cu.m/sec)	: 91.1
	- Key stream gauge		: Rio do Sul
(iii) Scheme information			
a) Type of development			: Run-of-river
b) Development ratio			: 0.7
c) Reservoir/pondage	: - Full supply level/ normal operating level	(EL.m)	: 330
	- Minimum operating level	(EL.m)	: —
	- Average operating Level	(EL.m)	: —
	- Gross storage volume	(mil. cu.m)	: 14.5
	- Active storage volume	(mil. cu.m)	: —
	- Dead storage volume	(mil. cu.m)	: —
	- Sediment volume	(mil. cu.m)	: —
d) Dam	: - Type of dam		: Concrete dam
	- Crest elevation	(EL.m)	: 332
	- Crest length	(m)	: 275
	- Dam height	(m)	: 18
	- Embankment volume	(mil. cu.m)	: —
	- Concrete volume	(cu.m)	: 37,600
e) Waterway	: - Number	(nos.)	: 1
	- Tunnel length	(km)	: 6.65
	- Channel length	(km)	: —
	- Diameter of tunnel	(m)	: 5.2
f) Discharge and head	: - Maximum plant discharge	(cu.m/sec)	: 71.9
	- Firm discharge	(cu.m/sec)	: 50.3
	- Effective head	(m)	: 199
	- Tailwater level	(EL.m)	: 113
g) Transmission line	: - Length	(km)	: 7
	- kV		: 138
	- Destination sub-station		: Transmission line (Rio do Sul II - Blumenau)
h) Access road	: - New access road	(km)	: 0.9
	- Improvement of existing road	(km)	: 2.5
i) Power	: - Installed capacity	(MW)	: 117.8
	- Firm energy	(GWh)	: 721.3
	- Guaranteed energy	(GWh)	: 649.1
	- Secondary energy	(GWh)	: 69.5
j) Preliminary cost	: - Total construction cost	(mil. US$)	: 114.6
	- Cost per kW	US$/kW)	: 973.3
	- Cost per MWh	(US$/MWh)	: 158.9
	- Unit cost of guaranteed energy	(US$/MWh)	: 16.7
(iv) Other information	: - Submerged area	(sq.km)	: 4.65
	- Submerged houses	(nos.)	: 74
	- Submerged farm land	(sq.km)	: 0.18
	- Relocation road length	(km)	: 2
	- Bridge to be replaced	(m)	: 20

Table VI.7.1 INVENTORY OF OPTIMUM SCALE FOR IDENTIFIED SCHEMES (2 /16)

(i)	Scheme identification information	- No. of scheme		: 2
		- Name of scheme		: Salto Pilao (2)
		- Name of river		: Itajai
(ii)	Hydrological and topographic information	- Catchment area	(sq.km)	: 5,597
		- Average basin mean rainfall	(mm)	: 1,530
		- Average runoff for the critical period from April 1949 to November 1956	(cu.m/sec)	: 91.1
		- Key stream gauge		: Rio do Sul
(iii)	Scheme information			
	a) Type of development			: Run-of-river
	b) Development ratio			: 0.8
	c) Reservoir/pondage	- Full supply level/ normal operating level	(EL.m)	: 330
		- Minimum operating level	(EL.m)	: —
		- Average operating Level	(EL.m)	: —
		- Gross storage volume	(mil. cu.m)	: 14.5
		- Active storage volume	(mil. cu.m)	: —
		- Dead storage volume	(mil. cu.m)	: —
		- Sediment volume	(mil. cu.m)	: —
	d) Dam	- Type of dam		: Concrete dam
		- Crest elevation	(EL.m)	: 332
		- Crest length	(m)	: 275
		- Dam height	(m)	: 18
		- Embankment volume	(mil. cu.m)	: —
		- Concrete volume	(cu.m)	: 38,900
	e) Waterway	- Number	(nos.)	: 1
		- Tunnel length	(km)	: 4.9
		- Channel length	(km)	: —
		- Diameter of tunnel	(m)	: 4.6
	f) Discharge and head	- Maximum plant discharge	(cu.m/sec)	: 52.6
		- Firm discharge	(cu.m/sec)	: 42.1
		- Effective head	(m)	: 155
		- Tailwater level	(EL.m)	: 160
	g) Transmission line	- Length	(km)	: 1
		- kV		: 138
		- Destination sub-station		: Transmission line (Rio do Sul II - Blumenau)
	h) Access road	- New access road	(km)	: 2.3
		- Improvement of existing road	(km)	: 2.5
	i) Power	- Installed capacity	(MW)	: 67.1
		- Firm energy	(GWh)	: 470.0
		- Guaranteed energy	(GWh)	: 423.0
		- Secondary energy	(GWh)	: 31.2
	j) Preliminary cost	- Total construction cost	(mil. US$)	: 80.7
		- Cost per kW	US$/kW)	: 1,202.3
		- Cost per MWh	(US$/MWh)	: 171.7
		- Unit cost of guaranteed energy	(US$/MWh)	: 18.5
(iv)	Other information	- Submerged area	(sq.km)	: 4.65
		- Submerged houses	(nos.)	: 74
		- Submerged farm land	(sq.km)	: 0.18
		- Relocation road length	(km)	: 2
		- Bridge to be replaced	(m)	: 20

Table VI.7.1 INVENTORY OF OPTIMUM SCALE FOR IDENTIFIED SCHEMES (3 /16)

(i)	Scheme identification information	- No. of scheme		: 3
		- Name of scheme		: Ibirama
		- Name of river		: Itajai
(ii)	Hydrological and topographic information	- Catchment area	(sq.km)	: 9,041
		- Average basin mean rainfall	(mm)	: 1,510
		- Average runoff for the critical period from April 1949 to November 1956	(cu.m/sec)	: 130.1
		- Key stream gauge		: Apiuna
(iii)	Scheme information			
	a) Type of development			: Run-of-river
	b) Development ratio			: 0.8
	c) Reservoir/pondage	- Full supply level/ normal operating level	(EL.m)	: 137
		- Minimum operating level	(EL.m)	: —
		- Average operating Level	(EL.m)	: —
		- Gross storage volume	(mil. cu.m)	: 5
		- Active storage volume	(mil. cu.m)	: —
		- Dead storage volume	(mil. cu.m)	: —
		- Sediment volume	(mil. cu.m)	: —
	d) Dam	- Type of dam		: Concrete dam
		- Crest elevation	(EL.m)	: 139
		- Crest length	(m)	: 276
		- Dam height	(m)	: 23
		- Embankment volume	(mil. cu.m)	: —
		- Concrete volume	(cu.m)	: 62,600
	e) Waterway	- Number	(nos.)	: 1
		- Tunnel length	(km)	: 9.7
		- Channel length	(km)	: —
		- Diameter of tunnel	(m)	: 5.3
	f) Discharge and head	- Maximum plant discharge	(cu.m/sec)	: 78.6
		- Firm discharge	(cu.m/sec)	: 62.8
		- Effective head	(m)	: 38
		- Tailwater level	(EL.m)	: 82
	g) Transmission line	- Length	(km)	: 1
		- kV		: 138
		- Destination sub-station		: Transmission line (Rio do Sul II - Blumenau)
	h) Access road	- New access road	(km)	: 6.0
		- Improvement of existing road	(km)	: 8.0
	i) Power	- Installed capacity	(MW)	: 24.6
		- Firm energy	(GWh)	: 172.1
		- Guaranteed energy	(GWh)	: 154.9
		- Secondary energy	(GWh)	: 32.4
	j) Preliminary cost	- Total construction cost	(mil. US$)	: 121.4
		- Cost per kW	US$/kW)	: 4,938.6
		- Cost per MWh	(US$/MWh)	: 705.5
		- Unit cost of guaranteed energy	(US$/MWh)	: 77.0
(iv)	Other information	- Submerged area	(sq.km)	: 0.75
		- Submerged houses	(nos.)	: 10
		- Submerged farm land	(sq.km)	: 0.08
		- Relocation road length	(km)	: 5
		- Bridge to be replaced	(m)	: 40

Table VI.7.1 INVENTORY OF OPTIMUM SCALE FOR IDENTIFIED SCHEMES (4 /16)

(i)	Scheme identification information	- No. of scheme		: 4
		- Name of scheme		: Subida
		- Name of river		: Itajai
(ii)	Hydrological and topographic information	- Catchment area	(sq.km)	: 9,147
		- Average basin mean rainfall	(mm)	: 1,510
		- Average runoff for the critical period from April 1949 to November 1956	(cu.m/sec)	: 131.6
		- Key stream gauge		: Apiuna
(iii)	Scheme information			
	a) Type of development			: Run-of-river
	b) Development ratio			: 0.8
	c) Reservoir/pondage	- Full supply level/ normal operating level	(EL.m)	: 105
		- Minimum operating level	(EL.m)	: —
		- Average operating Level	(EL.m)	: —
		- Gross storage volume	(mil. cu.m)	: 3
		- Active storage volume	(mil. cu.m)	: —
		- Dead storage volume	(mil. cu.m)	: —
		- Sediment volume	(mil. cu.m)	: —
	d) Dam	- Type of dam		: Concrete dam
		- Crest elevation	(EL.m)	: 107
		- Crest length	(m)	: 165
		- Dam height	(m)	: 19
		- Embankment volume	(mil. cu.m)	: —
		- Concrete volume	(cu.m)	: 24,800
	e) Waterway	- Number	(nos.)	: 1
		- Tunnel length	(km)	: 5.3
		- Channel length	(km)	: —
		- Diameter of tunnel	(m)	: 5.3
	f) Discharge and head	- Maximum plant discharge	(cu.m/sec)	: 79.5
		- Firm discharge	(cu.m/sec)	: 63.5
		- Effective head	(m)	: 14
		- Tailwater level	(EL.m)	: 82
	g) Transmission line	- Length	(km)	: 0.7
		- kV		: 69
		- Destination sub-station		: Transmission line (Ibirama - Indaial)
	h) Access road	- New access road	(km)	: 4.5
		- Improvement of existing road	(km)	: 8.0
	i) Power	- Installed capacity	(MW)	: 9.2
		- Firm energy	(GWh)	: 64.1
		- Guaranteed energy	(GWh)	: 57.7
		- Secondary energy	(GWh)	: 12.1
	j) Preliminary cost	- Total construction cost	(mil. US$)	: 74.7
		- Cost per kW	US$/kW)	: 8,156.9
		- Cost per MWh	(US$/MWh)	: 1,165.1
		- Unit cost of guaranteed energy	(US$/MWh)	: 128.5
(iv)	Other information	- Submerged area	(sq.km)	: 0.6
		- Submerged houses	(nos.)	: 28
		- Submerged farm land	(sq.km)	: 0.04
		- Relocation road length	(km)	: 2
		- Bridge to be replaced	(m)	: 100

Table VI.7.1 INVENTORY OF OPTIMUM SCALE FOR IDENTIFIED SCHEMES (5 /16)

(i)	*Scheme identification information*	- No. of scheme		: 5
		- Name of scheme		: Ascurra
		- Name of river		: Itajai
(ii)	Hydrological and topographic information	- Catchment area	(sq.km)	: 9,586
		- Average basin mean rainfall	(mm)	: 1,510
		- Average runoff for the critical period from April 1949 to November 1956	(cu.m/sec)	: 137.9
		- Key stream gauge		: Apiuna
(iii)	Scheme information			
	a) Type of development			: Run-of-river
	b) Development ratio			: 0.7
	c) Reservoir/pondage	- *Full supply level/* normal operating level	(EL.m)	: 80
		- Minimum operating level	(EL.m)	: —
		- Average operating Level	(EL.m)	: —
		- Gross storage volume	(mil. cu.m)	: 35
		- Active storage volume	(mil. cu.m)	: —
		- Dead storage volume	(mil. cu.m)	: —
		- Sediment volume	(mil. cu.m)	: —
	d) Dam	- Type of dam		: Concrete dam
		- Crest elevation	(EL.m)	: 82
		- Crest length	(m)	: 195
		- Dam height	(m)	: 17
		- Embankment volume	(mil. cu.m)	: —
		- Concrete volume	(cu.m)	: 20,900
	e) Waterway	- Number	(nos.)	: 1
		- Tunnel length	(km)	: 3.3
		- Channel length	(km)	: —
		- Diameter of tunnel	(m)	: 6.1
	f) Discharge and head	- Maximum plant discharge	(cu.m/sec)	: 113
		- Firm discharge	(cu.m/sec)	: 79.1
		- Effective head	(m)	: 6
		- Tailwater level	(EL.m)	: 68
	g) Transmission line	- Length	(km)	: 0.2
		- kV		: 69
		- Destination sub-station		: Transmission line (Ibirama - Indaial)
	h) Access road	- New access road	(km)	: 0.8
		- Improvement of existing road	(km)	: —
	i) Power	- Installed capacity	(MW)	: 5.6
		- Firm energy	(GWh)	: 34.2
		- Guaranteed energy	(GWh)	: 30.8
		- Secondary energy	(GWh)	: 8.5
	j) Preliminary cost	- Total construction cost	(mil. US$)	: 75.2
		- Cost per kW	US$/kW)	: 13,473.8
		- Cost per MWh	(US$/MWh)	: 2,198.4
		- Unit cost of guaranteed energy	(US$/MWh)	: 243.7
(iv)	Other information	- Submerged area	(sq.km)	: 8
		- Submerged houses	(nos.)	: 123
		- Submerged farm land	(sq.km)	: 1.75
		- Relocation road length	(km)	: 2.5
		- Bridge to be replaced	(m)	: 100

Table VI.7.1 INVENTORY OF OPTIMUM SCALE FOR IDENTIFIED SCHEMES (6 /16)

(i)	Scheme identification information	- No. of scheme		: 6
		- Name of scheme		: Indaial
		- Name of river		: Itajai
(ii)	Hydrological and topographic information	- Catchment area	(sq.km)	: 11,493
		- Average basin mean rainfall	(mm)	: 1,500
		- Average runoff for the critical period from April 1949 to November 1956	(cu.m/sec)	: 177.1
		- Key stream gauge		: Indaial
(iii)	Scheme information			
	a) Type of development			: Run-of-river
	b) Development ratio			: 0.8
	c) Reservoir/pondage	- Full supply level/ normal operating level	(EL.m)	: 54
		- Minimum operating level	(EL.m)	: —
		- Average operating Level	(EL.m)	: —
		- Gross storage volume	(mil. cu.m)	: 3.3
		- Active storage volume	(mil. cu.m)	: —
		- Dead storage volume	(mil. cu.m)	: —
		- Sediment volume	(mil. cu.m)	: —
	d) Dam	- Type of dam		: Concrete dam
		- Crest elevation	(EL.m)	: 61
		- Crest length	(m)	: 160
		- Dam height	(m)	: 16
		- Embankment volume	(mil. cu.m)	: —
		- Concrete volume	(cu.m)	: 14,900
	e) Waterway	- Number	(nos.)	: 1
		- Tunnel length	(km)	: —
		- Channel length	(km)	: 2.4
		- Diameter of tunnel	(m)	: —
	f) Discharge and head	- Maximum plant discharge	(cu.m/sec)	: 110.7
		- Firm discharge	(cu.m/sec)	: 88.5
		- Effective head	(m)	: 11.5
		- Tailwater level	(EL.m)	: 39
	g) Transmission line	- Length	(km)	: 0.2
		- kV		: 69
		- Destination sub-station		: Transmission line (Indaial - Salto)
	h) Access road	- New access road	(km)	: —
		- Improvement of existing road	(km)	: —
	i) Power	- Installed capacity	(MW)	: 10.5
		- Firm energy	(GWh)	: 73.4
		- Guaranteed energy	(GWh)	: 66.0
		- Secondary energy	(GWh)	: 11.5
	j) Preliminary cost	- Total construction cost	(mil. US$)	: 57.1
		- Cost per kW	US$/kW)	: 5,448.4
		- Cost per MWh	(US$/MWh)	: 778.3
		- Unit cost of guaranteed energy	(US$/MWh)	: 85.5
(iv)	Other information	- Submerged area	(sq.km)	: 0.9
		- Submerged houses	(nos.)	: 15
		- Submerged farm land	(sq.km)	: 0.04
		- Relocation road length	(km)	: 6
		- Bridge to be replaced	(m)	: 130

Table VI.7.1 INVENTORY OF OPTIMUM SCALE FOR IDENTIFIED SCHEMES (7 /16)

(i)	Scheme identification information	- No. of scheme		: 7
		- Name of scheme		: Dalbergia
		- Name of river		: Itajai do Norte
(ii)	Hydrological and topographic information	- Catchment area	(sq.km)	: 3,212
		- Average basin mean rainfall	(mm)	: 1,520
		- Average runoff for the critical period from April 1949 to November 1956	(cu.m/sec)	: 38.7
		- Key stream gauge		: Ibirama
(iii)	Scheme information			
	a) Type of development			: Run-of-river
	b) Development ratio			: 0.7
	c) Reservoir/pondage	- Full supply level/ normal operating level	(EL.m)	: 215
		- Minimum operating level	(EL.m)	: —
		- Average operating Level	(EL.m)	: —
		- Gross storage volume	(mil. cu.m)	: 1.85
		- Active storage volume	(mil. cu.m)	: —
		- Dead storage volume	(mil. cu.m)	: —
		- Sediment volume	(mil. cu.m)	: —
	d) Dam	- Type of dam		: Concrete dam
		- Crest elevation	(EL.m)	: 217
		- Crest length	(m)	: 218
		- Dam height	(m)	: 21
		- Embankment volume	(mil. cu.m)	: —
		- Concrete volume	(cu.m)	: 45,300
	e) Waterway	- Number	(nos.)	: 1
		- Tunnel length	(km)	: 8.65
		- Channel length	(km)	: —
		- Diameter of tunnel	(m)	: 3.6
	f) Discharge and head	- Maximum plant discharge	(cu.m/sec)	: 27.6
		- Firm discharge	(cu.m/sec)	: 19.3
		- Effective head	(m)	: 70
		- Tailwater level	(EL.m)	: 128
	g) Transmission line	- Length	(km)	: 2
		- kV		: 23
		- Destination sub-station		: Ibirama
	h) Access road	- New access road	(km)	: 1.2
		- Improvement of existing road	(km)	: 7.5
	i) Power	- Installed capacity	(MW)	: 15.9
		- Firm energy	(GWh)	: 97.5
		- Guaranteed energy	(GWh)	: 87.7
		- Secondary energy	(GWh)	: 14.2
	j) Preliminary cost	- Total construction cost	(mil. US$)	: 58.5
		- Cost per kW	US$/kW)	: 3,680
		- Cost per MWh	(US$/MWh)	: 600.5
		- Unit cost of guaranteed energy	(US$/MWh)	: 65.7
(iv)	Other information	- Submerged area	(sq.km)	: 1.1
		- Submerged houses	(nos.)	: 6
		- Submerged farm land	(sq.km)	: 0.04
		- Relocation road length	(km)	: 2.5
		- Bridge to be replaced	(m)	: 5

Table VI.7.1 INVENTORY OF OPTIMUM SCALE FOR IDENTIFIED SCHEMES (8 /16)

(i)	Scheme identification information	- No. of scheme		: 8
		- Name of scheme		: Barra da Pratinha
		- Name of river		: Itajai do Norte
(ii)	Hydrological and topographic information	- Catchment area	(sq.km)	: 1,405
		- Average basin mean rainfall	(mm)	: 1,620
		- Average runoff for the critical period from April 1949 to November 1956	(cu.m/sec)	: 18.0
		- Key stream gauge		: Ibirama
(iii)	Scheme information			
	a) Type of development			: Reservoir
	b) Draft rate			: 0.6
	c) Reservoir/pondage	- Full supply level/ normal operating level	(EL.m)	: 394.0
		- Minimum operating level	(EL.m)	: 360.7
		- Average operating Level	(EL.m)	: 382.9
		- Gross storage volume	(mil. cu.m)	: 161.6
		- Active storage volume	(mil. cu.m)	: 132.9
		- Dead storage volume	(mil. cu.m)	: 17.5
		- Sediment volume	(mil. cu.m)	: 11.2
	d) Dam	- Type of dam		: Rock fill dam
		- Crest elevation	(EL.m)	: 400
		- Crest length	(m)	: 650
		- Dam height	(m)	: 80
		- Embankment volume	(mil. cu.m)	: 4.9
		- Concrete volume	(cu.m)	: —
	e) Waterway	- Number	(nos.)	: 1
		- Tunnel length	(km)	: 0.2
		- Channel length	(km)	: —
		- Diameter of tunnel	(m)	: 3.3
	f) Discharge and head	- Maximum plant discharge	(cu.m/sec)	: 21.6
		- Firm discharge	(cu.m/sec)	: 10.8
		- Effective head	(m)	: 53.4
		- Tailwater level	(EL.m)	: 326
	g) Transmission line	- Length	(km)	: 50
		- kV		: 34.5
		- Destination sub-station		: Itaiopolis
	h) Access road	- New access road	(km)	: —
		- Improvement of existing road	(km)	: 6.5
	i) Power	- Installed capacity	(MW)	: 9.5
		- Firm energy	(GWh)	: 41.6
		- Guaranteed energy	(GWh)	: 37.4
		- Secondary energy	(GWh)	: 20.8
	j) Preliminary cost	- Total construction cost	(mil. US$)	: 161.4
		- Cost per kW	US$/kW)	: 17,001.4
		- Cost per MWh	(US$/MWh)	: 3,881.6
		- Unit cost of guaranteed energy	(US$/MWh)	: 429.6
(iv)	Other information	- Submerged area	(sq.km)	: 6.3
		- Submerged houses	(nos.)	: 37
		- Submerged farm land	(sq.km)	: —
		- Relocation road length	(km)	: 28
		- Bridge to be replaced	(m)	: 150

Table VI.7.1 INVENTORY OF OPTIMUM SCALE FOR IDENTIFIED SCHEMES (9 /16)

(i)	Scheme identification information	- No. of scheme		: 9
		- Name of scheme		: Barra das Pombas
		- Name of river		: Itajai do Norte
(ii)	Hydrological and topographic information	- Catchment area	(sq.km)	: 979
		- Average basin mean rainfall	(mm)	: 1,670
		- Average runoff for the critical period from April 1949 to November 1956	(cu.m/sec)	: 12.9
		- Key stream gauge		: Ibirama
(iii)	Scheme information			
	a) Type of development			: Reservoir
	b) Draft rate			: 1.0
	c) Reservoir/pondage	- Full supply level/ normal operating level	(EL.m)	: 482.6
		- Minimum operating level	(EL.m)	: 457.6
		- Average operating Level	(EL.m)	: 474.3
		- Gross storage volume	(mil. cu.m)	: 666.0
		- Active storage volume	(mil. cu.m)	: 416.0
		- Dead storage volume	(mil. cu.m)	: 242.2
		- Sediment volume	(mil. cu.m)	: 7.8
	d) Dam	- Type of dam		: Rock fill dam
		- Crest elevation	(EL.m)	: 488.6
		- Crest length	(m)	: 421.6
		- Dam height	(m)	: 88.6
		- Embankment volume	(mil. cu.m)	: 5.1
		- Concrete volume	(cu.m)	: —
	e) Waterway	- Number	(nos.)	: 1
		- Tunnel length	(km)	: 0.2
		- Channel length	(km)	: —
		- Diameter of tunnel	(m)	: 3.5
	f) Discharge and head	- Maximum plant discharge	(cu.m/sec)	: 25.8
		- Firm discharge	(cu.m/sec)	: 12.9
		- Effective head	(m)	: 66.3
		- Tailwater level	(EL.m)	: 405
	g) Transmission line	- Length	(km)	: 28
		- kV		: 34.5
		- Destination sub-station		: Itaiopolis
	h) Access road	- New access road	(km)	: 12
		- Improvement of existing road	(km)	: 17
	i) Power	- Installed capacity	(MW)	: 14.1
		- Firm energy	(GWh)	: 61.7
		- Guaranteed energy	(GWh)	: 55.5
		- Secondary energy	(GWh)	: 11.2
	j) Preliminary cost	- Total construction cost	(mil. US$)	: 179.3
		- Cost per kW	US$/kW)	: 12,730.1
		- Cost per MWh	(US$/MWh)	: 2,906.4
		- Unit cost of guaranteed energy	(US$/MWh)	: 323.8
(iv)	Other information	- Submerged area	(sq.km)	: 21.3
		- Submerged houses	(nos.)	: 21
		- Submerged farm land	(sq.km)	: —
		- Relocation road length	(km)	: 18
		- Bridge to be replaced	(m)	: 1,700

Table VI.7.1 INVENTORY OF OPTIMUM SCALE FOR IDENTIFIED SCHEMES (10 /16)

(i)	Scheme identification information	- No. of scheme		: 10
		- Name of scheme		: Timbo
		- Name of river		: Benedito
(ii)	Hydrological and topographic information	- Catchment area	(sq.km)	: 765
		- Average basin mean rainfall	(mm)	: 1,510
		- Average runoff for the critical period from April 1949 to November 1956	(cu.m/sec)	: 15.5
		- Key stream gauge		: Timbo
(iii)	Scheme information			
	a) Type of development			: Reservoir
	b) Draft rate			: 0.4
	c) Reservoir/pondage	- Full supply level/ normal operating level	(EL.m)	: 113.1
		- Minimum operating level	(EL.m)	: 95.5
		- Average operating Level	(EL.m)	: 107.2
		- Gross storage volume	(mil. cu.m)	: 23.1
		- Active storage volume	(mil. cu.m)	: 13.8
		- Dead storage volume	(mil. cu.m)	: 3.2
		- Sediment volume	(mil. cu.m)	: 6.1
	d) Dam	- Type of dam		: Rock fill dam
		- Crest elevation	(EL.m)	: 119.1
		- Crest length	(m)	: 493.7
		- Dam height	(m)	: 54.1
		- Embankment volume	(mil. cu.m)	: 1.7
		- Concrete volume	(cu.m)	: —
	e) Waterway	- Number	(nos.)	: 1
		- Tunnel length	(km)	: 0.1
		- Channel length	(km)	: —
		- Diameter of tunnel	(m)	: 2.7
	f) Discharge and head	- Maximum plant discharge	(cu.m/sec)	: 12.1
		- Firm discharge	(cu.m/sec)	: 6.0
		- Effective head	(m)	: 38.2
		- Tailwater level	(EL.m)	: 67
	g) Transmission line	- Length	(km)	: 5
		- kV		: 23
		- Destination sub-station		: Timbo
	h) Access road	- New access road	(km)	: —
		- Improvement of existing road	(km)	: —
	i) Power	- Installed capacity	(MW)	: 3.8
		- Firm energy	(GWh)	: 16.7
		- Guaranteed energy	(GWh)	: 15.0
		- Secondary energy	(GWh)	: 8.3
	j) Preliminary cost	- Total construction cost	(mil. US$)	: 62.3
		- Cost per kW	US$/kW)	: 16,383.1
		- Cost per MWh	(US$/MWh)	: 3,740.4
		- Unit cost of guaranteed energy	(US$/MWh)	: 413.8
(iv)	Other information	- Submerged area	(sq.km)	: 1
		- Submerged houses	(nos.)	: 50
		- Submerged farm land	(sq.km)	: 0.1
		- Relocation road length	(km)	: 8.5
		- Bridge to be replaced	(m)	: —

Table VI.7.1 INVENTORY OF OPTIMUM SCALE FOR IDENTIFIED SCHEMES (11 /16)

(i) Scheme identification information	- No. of scheme		: 11
	- Name of scheme		: Benedito Novo
	- Name of river		: Benedito
(ii) Hydrological and topographic information	- Catchment area	(sq.km)	: 586
	- Average basin mean rainfall	(mm)	: 1,510
	- Average runoff for the critical period from April 1949 to November 1956	(cu.m/sec)	: 11.3
	- Key stream gauge		: Timbo
(iii) Scheme information			
a) Type of development			: Run-of-river
b) Development ratio			: 0.6
c) Reservoir/pondage	- Full supply level/ normal operating level	(EL.m)	: 277
	- Minimum operating level	(EL.m)	: —
	- Average operating Level	(EL.m)	: —
	- Gross storage volume	(mil. cu.m)	: 0.3
	- Active storage volume	(mil. cu.m)	: —
	- Dead storage volume	(mil. cu.m)	: —
	- Sediment volume	(mil. cu.m)	: —
d) Dam	- Type of dam		: Concrete dam
	- Crest elevation	(EL.m)	: 279
	- Crest length	(m)	: 157
	- Dam height	(m)	: 23
	- Embankment volume	(mil. cu.m)	: —
	- Concrete volume	(cu.m)	: 38,700
e) Waterway	- Number	(nos.)	: 1
	- Tunnel length	(km)	: 1.9
	- Channel length	(km)	: —
	- Diameter of tunnel	(m)	: 2.8
f) Discharge and head	- Maximum plant discharge	(cu.m/sec)	: 13.9
	- Firm discharge	(cu.m/sec)	: 8.4
	- Effective head	(m)	: 109
	- Tailwater level	(EL.m)	: 160
g) Transmission line	- Length	(km)	: 14
	- kV		: 23
	- Destination sub-station		: Timbo
h) Access road	- New access road	(km)	: 2.0
	- *Improvement of existing road*	*(km)*	: —
i) Power	- Installed capacity	(MW)	: 12.5
	- Firm energy	(GWh)	: 65.7
	- Guaranteed energy	(GWh)	: 59.1
	- Secondary energy	(GWh)	: 11.7
j) Preliminary cost	- Total construction cost	(mil. US$)	: 26.1
	- Cost per kW	(US$/kW)	: 2,088.0
	- Cost per MWh	(US$/MWh)	: 397.3
	- Unit cost of guaranteed energy	(US$/MWh)	: 42.5
(iv) Other information	- Submerged area	(sq.km)	: 0.18
	- Submerged houses	(nos.)	: 4
	- Submerged farm land	(sq.km)	: —
	- Relocation road length	(km)	: 1
	- Bridge to be replaced	(m)	: 10

Table VI.7.1 INVENTORY OF OPTIMUM SCALE FOR IDENTIFIED SCHEMES (12 /16)

(i)	Scheme identification information	- No. of scheme		: 12
		- Name of scheme		: Alto Benedito Novo
		- Name of river		: Benedito
(ii)	Hydrological and topographic information	- Catchment area	(sq.km)	: 473
		- Average basin mean rainfall	(mm)	: 1,520
		- Average runoff for the critical period from April 1949 to November 1956	(cu.m/sec)	: 9.7
		- Key stream gauge		: Timbo
(iii)	Scheme information			
	a) Type of development			: Run-of-river
	b) Development ratio			: 0.5
	c) Reservoir/pondage	- Full supply level/ normal operating level	(EL.m)	: 430
		- Minimum operating level	(EL.m)	: —
		- Average operating Level	(EL.m)	: —
		- Gross storage volume	(mil. cu.m)	: 0.9
		- Active storage volume	(mil. cu.m)	: —
		- Dead storage volume	(mil. cu.m)	: —
		- Sediment volume	(mil. cu.m)	: —
	d) Dam	- Type of dam		: Concrete dam
		- Crest elevation	(EL.m)	: 432
		- Crest length	(m)	: 90
		- Dam height	(m)	: 19
		- Embankment volume	(mil. cu.m)	: —
		- Concrete volume	(cu.m)	: 16,000
	e) Waterway	- Number	(nos.)	: 1
		- Tunnel length	(km)	: 1.5
		- Channel length	(km)	: —
		- Diameter of tunnel	(m)	: 2.9
	f) Discharge and head	- Maximum plant discharge	(cu.m/sec)	: 14.7
		- Firm discharge	(cu.m/sec)	: 7.3
		- Effective head	(m)	: 107
		- Tailwater level	(EL.m)	: 316
	g) Transmission line	- Length	(km)	: 18
		- kV		: 23
		- Destination sub-station		: Timbo
	h) Access road	- New access road	(km)	: 1.6
		- Improvement of existing road	(km)	: —
	i) Power	- Installed capacity	(MW)	: 12.9
		- Firm energy	(GWh)	: 56.7
		- Guaranteed energy	(GWh)	: 51.0
		- Secondary energy	(GWh)	: 10.5
	j) Preliminary cost	- Total construction cost	(mil. US$)	: 36.0
		- Cost per kW	(US$/kW)	: 2,790.7
		- Cost per MWh	(US$/MWh)	: 634.9
		- Unit cost of guaranteed energy	(US$/MWh)	: 69.2
(iv)	Other information	- Submerged area	(sq.km)	: 0.17
		- Submerged houses	(nos.)	: 6
		- Submerged farm land	(sq.km)	: 0.01
		- Relocation road length	(km)	: —
		- Bridge to be replaced	(m)	: 50

Table VI.7.1 INVENTORY OF OPTIMUM SCALE FOR IDENTIFIED SCHEMES (13 /16)

(i)	Scheme identification information	- No. of scheme		: 13
		- Name of scheme		: Doutor Pedrinho
		- Name of river		: Benedito
(ii)	Hydrological and topographic information	- Catchment area	(sq.km)	: 161
		- Average basin mean rainfall	(mm)	: 1,550
		- Average runoff for the critical period from April 1949 to November 1956	(cu.m/sec)	: 3.3
		- Key stream gauge		: Timbo
(iii)	Scheme information			
	a) Type of development			: Reservoir
	b) Draft rate			: 0.8
	c) Reservoir/pondage	- Full supply level/ normal operating level	(EL.m)	: 572.7
		- Minimum operating level	(EL.m)	: 552.8
		- Average operating Level	(EL.m)	: 566.1
		- Gross storage volume	(mil. cu.m)	: 44.9
		- Active storage volume	(mil. cu.m)	: 29.8
		- Dead storage volume	(mil. cu.m)	: 13.8
		- Sediment volume	(mil. cu.m)	: 1.3
	d) Dam	- Type of dam		: Rock fill dam
		- Crest elevation	(EL.m)	: 578.7
		- Crest length	(m)	: 493.7
		- Dam height	(m)	: 53.7
		- Embankment volume	(mil. cu.m)	: 2.1
		- Concrete volume	(cu.m)	: —
	e) Waterway	- Number	(nos.)	: 1
		- Tunnel length	(km)	: 0.2
		- Channel length	(km)	: —
		- Diameter of tunnel	(m)	: 2.5
	f) Discharge and head	- Maximum plant discharge	(cu.m/sec)	: 5.1
		- Firm discharge	(cu.m/sec)	: 2.6
		- Effective head	(m)	: 33.6
		- Tailwater level	(EL.m)	: 530
	g) Transmission line	- Length	(km)	: 5
		- kV		: 23
		- Destination sub-station		: Timbo
	h) Access road	- New access road	(km)	: —
		- Improvement of existing road	(km)	: 5.0
	i) Power	- Installed capacity	(MW)	: 1.4
		- Firm energy	(GWh)	: 6.2
		- Guaranteed energy	(GWh)	: 5.6
		- Secondary energy	(GWh)	: 2.0
	j) Preliminary cost	- Total construction cost	(mil. US$)	: 67.8
		- Cost per kW	US$/kW)	: 47,882.5
		- Cost per MWh	(US$/MWh)	: 10,932.1
		- Unit cost of guaranteed energy	(US$/MWh)	: 1,222.0
(iv)	Other information	- Submerged area	(sq.km)	: 1.9
		- Submerged houses	(nos.)	: 13
		- Submerged farm land	(sq.km)	: 0.1
		- Relocation road length	(km)	: 8.0
		- Bridge to be replaced	(m)	: —

Table VI.7.1 INVENTORY OF OPTIMUM SCALE FOR IDENTIFIED SCHEMES (14 /16)

(i)	Scheme identification information	- No. of scheme		: 14
		- Name of scheme		: Trombudo Central (1)
		- Name of river		: Trombudo
(ii)	Hydrological and topographic information	- Catchment area	(sq.km)	: 293
		- Average basin mean rainfall	(mm)	: 1,550
		- Average runoff for the critical period from April 1949 to November 1956	(cu.m/sec)	: 5.7
		- Key stream gauge		: Taio
(iii)	Scheme information			
	a) Type of development			: Reservoir
	b) Draft rate			: 0.9
	c) Reservoir/pondage	- Full supply level/ normal operating level	(EL.m)	: 382.4
		- Minimum operating level	(EL.m)	: 372.1
		- Average operating Level	(EL.m)	: 379.0
		- Gross storage volume	(mil. cu.m)	: 158.6
		- Active storage volume	(mil. cu.m)	: 95.1
		- Dead storage volume	(mil. cu.m)	: 61.2
		- Sediment volume	(mil. cu.m)	: 2.3
	d) Dam	- Type of dam		: Rock fill dam
		- Crest elevation	(EL.m)	: 388.4
		- Crest length	(m)	: 346
		- Dam height	(m)	: 38.4
		- Embankment volume	(mil. cu.m)	: 1.0
		- Concrete volume	(cu.m)	: —
	e) Waterway	- Number	(nos.)	: 1
		- Tunnel length	(km)	: 0.2
		- Channel length	(km)	: —
		- Diameter of tunnel	(m)	: 2.5
	f) Discharge and head	- Maximum plant discharge	(cu.m/sec)	: 10.3
		- Firm discharge	(cu.m/sec)	: 5.1
		- Effective head	(m)	: 24.5
		- Tailwater level	(EL.m)	: 353
	g) Transmission line	- Length	(km)	: 5
		- kV		: 23
		- Destination sub-station		: Trombudo Central
	h) Access road	- New access road	(km)	: —
		- Improvement of existing road	(km)	: —
	i) Power	- Installed capacity	(MW)	: 2.1
		- Firm energy	(GWh)	: 9.1
		- Guaranteed energy	(GWh)	: 8.1
		- Secondary energy	(GWh)	: 1.6
	j) Preliminary cost	- Total construction cost	(mil. US$)	: 44.7
		- Cost per kW	US$/kW)	: 21,608.1
		- Cost per MWh	(US$/MWh)	: 4,933.4
		- Unit cost of guaranteed energy	(US$/MWh)	: 551.2
(iv)	Other information	- Submerged area	(sq.km)	: 12.8
		- Submerged houses	(nos.)	: 183
		- Submerged farm land	(sq.km)	: 1.28
		- Relocation road length	(km)	: 11
		- Bridge to be replaced	(m)	: —

Table VI.7.1 INVENTORY OF OPTIMUM SCALE FOR IDENTIFIED SCHEMES (15/16)

(i)	Scheme identification information	- No. of scheme		: 15
		- Name of scheme		: Trombudo Central (2)
		- Name of river		: Trombudo
(ii)	Hydrological and topographic information	- Catchment area	(sq.km)	: 117
		- Average basin mean rainfall	(mm)	: 1,550
		- Average runoff for the critical period from April 1949 to November 1956	(cu.m/sec)	: 2.2
		- Key stream gauge		: Taio
(iii)	Scheme information			
	a) Type of development			: Reservoir
	b) Draft rate			: 1.0
	c) Reservoir/pondage	- Full supply level/ normal operating level	(EL.m)	: 383.8
		- Minimum operating level	(EL.m)	: 376.4
		- Average operating Level	(EL.m)	: 381.3
		- Gross storage volume	(mil. cu.m)	: 146.4
		- Active storage volume	(mil. cu.m)	: 61.6
		- Dead storage volume	(mil. cu.m)	: 83.9
		- Sediment volume	(mil. cu.m)	: 0.9
	d) Dam	- Type of dam		: Rock fill dam
		- Crest elevation	(EL.m)	: 389.8
		- Crest length	(m)	: 597.6
		- Dam height	(m)	: 44.8
		- Embankment volume	(mil. cu.m)	: 1.5
		- Concrete volume	(cu.m)	: —
	e) Waterway	- Number	(nos.)	: 1
		- Tunnel length	(km)	: 0.18
		- Channel length	(km)	: —
		- Diameter of tunnel	(m)	: 2.5
	f) Discharge and head	- Maximum plant discharge	(cu.m/sec)	: 4.4
		- Firm discharge	(cu.m/sec)	: 2.2
		- Effective head	(m)	: 29.3
		- Tailwater level	(EL.m)	: 350
	g) Transmission line	- Length	(km)	: 5
		- kV		: 23
		- Destination sub-station		: Trombudo Central
	h) Access road	- New access road	(km)	: —
		- Improvement of existing road	(km)	: —
	i) Power	- Installed capacity	(MW)	: 1.1
		- Firm energy	(GWh)	: 4.6
		- Guaranteed energy	(GWh)	: 4.2
		- Secondary energy	(GWh)	: 0.5
	j) Preliminary cost	- Total construction cost	(mil. US$)	: 53.9
		- Cost per kW	US$/kW)	: 50,828.1
		- Cost per MWh	(US$/MWh)	: 11,604.6
		- Unit cost of guaranteed energy	(US$/MWh)	: 1,299.7
(iv)	Other information	- Submerged area	(sq.km)	: 9.6
		- Submerged houses	(nos.)	: 188
		- Submerged farm land	(sq.km)	: 1.44
		- Relocation road length	(km)	: 13.2
		- Bridge to be replaced	(m)	: —

Table VI.7.1 INVENTORY OF OPTIMUM SCALE FOR IDENTIFIED SCHEMES (16 /16)

(i)	Scheme identification information	- No. of scheme		: 16
		- Name of scheme		: Botuvera
		- Name of river		: Itajai Mirim
(ii)	Hydrological and topographic information	- Catchment area	(sq.km)	: 625
		- Average basin mean rainfall	(mm)	: 1,560
		- Average runoff for the critical period from April 1949 to November 1956	(cu.m/sec)	: 10.0
		- Key stream gauge		: Brusque
(iii)	Scheme information			
	a) Type of development			: Reservoir
	b) Draft rate			: 0.7
	c) Reservoir/pondage	- Full supply level/ normal operating level	(EL.m)	: 159
		- Minimum operating level	(EL.m)	: 139.8
		- Average operating Level	(EL.m)	: 152.6
		- Gross storage volume	(mil. cu.m)	: 91.2
		- Active storage volume	(mil. cu.m)	: 49.5
		- Dead storage volume	(mil. cu.m)	: 36.7
		- Sediment volume	(mil. cu.m)	: 5.0
	d) Dam	- Type of dam		: Rock fill dam
		- Crest elevation	(EL.m)	: 165
		- Crest length	(m)	: 267.6
		- Dam height	(m)	: 70
		- Embankment volume	(mil. cu.m)	: 1.8
		- Concrete volume	(cu.m)	: —
	e) Waterway	- Number	(nos.)	: 1
		- Tunnel length	(km)	: 0.2
		- Channel length	(km)	: —
		- Diameter of tunnel	(m)	: 2.8
	f) Discharge and head	- Maximum plant discharge	(cu.m/sec)	: 14
		- Firm discharge	(cu.m/sec)	: 7
		- Effective head	(m)	: 51.6
		- Tailwater level	(EL.m)	: 99
	g) Transmission line	- Length	(km)	: 37
		- kV		: 23
		- Destination sub-station		: Brusque
	h) Access road	- New access road	(km)	: 4
		- Improvement of existing road	(km)	: —
	i) Power	- Installed capacity	(MW)	: 6.0
		- Firm energy	(GWh)	: 26.1
		- Guaranteed energy	(GWh)	: 23.5
		- Secondary energy	(GWh)	: 10.8
	j) Preliminary cost	- Total construction cost	(mil. US$)	: 73.9
		- Cost per kW	US$/kW)	: 12,410.6
		- Cost per MWh	(US$/MWh)	: 2,833.5
		- Unit cost of guaranteed energy	(US$/MWh)	: 313.1
(iv)	Other information	- Submerged area	(sq.km)	: 3.1
		- Submerged houses	(nos.)	: 38
		- Submerged farm land	(sq.km)	: 0.16
		- Relocation road length	(km)	: 7.8
		- Bridge to be replaced	(m)	: —

Table VI.9.1 CONSTRUCTION COST FOR SALTO PILAO (1) SCHEME

Work Item	Unit	Unit Price (US$)	Quantity	Amount (US$x1000)
I. Direct Cost				
1. Dam				
(1) Excavation	cu.m	7	15,800	111
(2) Concrete(Mass)	cu.m	80	30,850	2,468
(3) Concrete(Structure)	cu.m	140	2,060	288
(4) Reinforcing bar	ton	1,100	83	91
(5) Bridge for Maintenance	L.S	-		26
(6) Spillway Gate	ton	4,800	935	4,488
(7) River Diversion Works	L.S	-		2,230
(8) Miscellaneous Work	L.S	-		149
Sub-total				9,852
2. Intake				
(1) Excavation	cu.m	7	4,840	34
(2) Concrete	cu.m	140	1,740	244
(3) Reinforcing bar	ton	1,100	70	77
(4) Intake Gate	ton	4,800	78	374
(5) Trashrack	ton	2,600	43	112
(6) Miscellaneous Work	L.S	-		18
Sub-total				858
3. Headrace tunnel				
(1) Tunnel Excavation	cu.m	80	250,800	20,064
(2) Lining Concrete	cu.m	140	80,030	11,204
(3) Reinforcing bar	ton	1,100	2,300	2,530
(4) Work adit	L.S	-		1,350
(5) Miscellaneous Work	L.S	-		1,690
Sub-total				36,838
4. Surge Tank				
(1) Shaft Excavation	cu.m	100	20,570	2,057
(2) Lining concrete	cu.m	160	3,770	603
(3) Reinforcing bar	ton	1,100	190	209
(4) Surge Tank Gate	ton	4,800	85	408
(5) Miscellaneous Work	L.S	-		143
Sub-total				3,421
5. Penstock				
(1) Shaft Excavation	cu.m	100	13,560	1,356
(2) Backfill concrete	cu.m	164	7,190	1,179
(3) Steel Liner	ton	2,100	1,710	3,591
(4) Work adit	L.S	-		200
(5) Miscellaneous Work	L.S	-		127
Sub-total				6,453
6. Power Station				
(1) Excavation	cu.m	7	73,140	512
(2) Concrete	cu.m	140	27,860	3,900
(3) Reinforcing bar	ton	1,100	1,450	1,595
(4) Superstructure (Main)	cu.m	180	19,100	3,438
(5) Superstructure (Appurtenant)	L.S	-		172
(6) Generating Equipment	L.S	-		24,820
(7) T/L&S/S	L.S	-		4,741
(8) Miscellaneous Work	L.S	-		300
Sub-total				39,479
7. Access Road				
(1) New Construction Road	Km	200,000	2	400
(2) Improvement of Existing Road	Km	90,000	2.5	225
(3) Bridge	m	5,000	20	100
(4) Miscellaneous Work	L.S	-		36
Sub-total				761
Total of Item I				97,662
II. Compensation Cost				
1. Relocation Road				
(1) Road	km	270,000	2	540
(2) Bridge	m	5,000	20	100
Sub-total				640
2. Land and house				
(1) Land	sq.km	115,000	1.3	150
(2) House	nos.	7,350	74	544
Sub-total				693
Total of Item II				1,333
III. Administration Cost				4,883
IV. Engineering Service Cost				4,060
V. Physical Contingency				14,649
VI. Grand Total				122,587

Table VI.9.2 CONSTRUCTION COST FOR SALTO PILAO (2) SCHEME

Work Item	Unit	Unit Price (US$)	Quantity	Amount (US$x1000)
I. Direct Cost				
1. Dam				
(1) Excavation	cu.m	7	15,800	111
(2) Concrete(Mass)	cu.m	80	31,300	2,504
(3) Concrete(Structure)	cu.m	140	1,700	238
(4) Reinforcing bar	ton	1,100	68	75
(5) Bridge for Maintenance	L.S	-		29
(6) Spillway Gate	ton	4,800	855	4,104
(7) River Diversion Works	L.S	-		2,580
(8) Miscellaneous Work	L.S	-		148
Sub-total				9,788
2. Intake				
(1) Excavation	cu.m	7	3,890	27
(2) Concrete	cu.m	140	1,400	196
(3) Reinforcing bar	ton	1,100	56	62
(4) Intake Gate	ton	4,800	56	269
(5) Trashrack	ton	2,600	32	83
(6) Miscellaneous Work	L.S	-		14
Sub-total				651
3. Headrace tunnel				
(1) Tunnel Excavation	cu.m	81	145,700	11,802
(2) Lining Concrete	cu.m	141	46,260	6,523
(3) Reinforcing bar	ton	1,100	1,050	1,155
(4) Work adit	L.S	-		600
(5) Miscellaneous Work	L.S	-		974
Sub-total				21,053
4. Surge Tank				
(1) Shaft Excavation	cu.m	100	13,960	1,396
(2) Lining concrete	cu.m	160	2,840	454
(3) Reinforcing bar	ton	1,100	140	154
(4) Surge Tank Gate	ton	4,800	60	288
(5) Miscellaneous Work	L.S	-		100
Sub-total				2,393
5. Penstock				
(1) Shaft Excavation	cu.m	100	14,110	1,411
(2) Backfill concrete	cu.m	164	7,520	1,233
(3) Steel Liner	ton	2,100	1,550	3,255
(4) Work adit	L.S	-		300
(5) Miscellaneous Work	L.S	-		132
Sub-total				6,331
6. Power Station				
(1) Excavation	cu.m	7	45,380	318
(2) Concrete	cu.m	140	17,290	2,421
(3) Reinforcing bar	ton	1,100	900	990
(4) Superstructure (Main)	cu.m	180	16,100	2,898
(5) Superstructure (Appurtenant)	L.S	-		145
(6) Generating Equipment	L.S	-		17,120
(7) T/L&S/S	L.S	-		3,481
(8) Miscellaneous Work	L.S	-		186
Subtotal				27,559
7. Access Road				
(1) New Construction Road	Km	200,000	2.5	500
(2) Improvement of Existing Road	Km	90,000	2.5	225
(3) Bridge	m	5,000	20	100
(4) Miscellaneous Work	L.S	-		41
Sub-total				866
Total of Item I				68,642
II. Compensation Cost				
1. Relocation Road				
(1) Road	km	270,000	2	540
(2) Bridge	m	5,000	20	100
Sub-total				640
2. Compensation				
(1) Land	sq.km	115,000	1.3	150
(2) House	nos.	7,350	74	544
Sub-total				693
Total of Item II				1,333
III. Administration Cost				3,432
IV. Engineering Service Cost				3,480
V. Physical Contingency				10,296
VI. Grand Total				87,183

Table VI.9.3 CONSTRUCTION COST FOR DALBERGIA SCHEME

Work Item	Unit	Unit Price (US$)	Quantity	Amount (US$x1000)
I. Direct Cost				
1. Dam				
(1) Excavation	cu.m	7	22,400	157
(2) Concrete(Mass)	cu.m	80	32,250	2,580
(3) Concrete(Structure)	cu.m	140	1,700	238
(4) Reinforcing bar	ton	1,100	68	75
(5) Bridge for Maintenance	L.S	-		27
(6) Spillway Gate	ton	4,800	645	3,096
(7) River Diversion Works	L.S	-		2,840
(8) Miscellaneous Work	L.S	-		154
Sub-total				9,166
2. Intake				
(1) Excavation	cu.m	7	2,490	17
(2) Concrete	cu.m	140	900	126
(3) Reinforcing bar	ton	1,100	36	40
(4) Intake Gate	ton	4,800	30	144
(5) Trashrack	ton	2,600	16	42
(6) Miscellaneous Work	L.S	-		9
Sub-total				378
3. Headrace tunnel				
(1) Tunnel Excavation	cu.m	84	158,900	13,348
(2) Lining Concrete	cu.m	148	49,970	7,396
(3) Reinforcing bar	ton	1,100	820	902
(4) Work adit	L.S	-		1,900
(5) Miscellaneous Work	L.S	-		1,082
Sub-total				24,627
4. Surge Tank				
(1) Shaft Excavation	cu.m	100	8,560	856
(2) Lining concrete	cu.m	160	2,140	342
(3) Reinforcing bar	ton	1,100	110	121
(4) Surge Tank Gate	ton	4,800	40	192
(5) Miscellaneous Work	L.S	-		66
Sub-total				1,577
5. Penstock				
(1) Shaft Excavation	cu.m	108	6,890	744
(2) Backfill concrete	cu.m	164	3,720	610
(3) Steel Liner	ton	2,100	420	882
(4) Work adit	L.S	-		600
(5) Miscellaneous Work	L.S	-		68
Sub-total				2,904
6. Power Station				
(1) Excavation	cu.m	7	13,920	97
(2) Concrete	cu.m	140	5,310	743
(3) Reinforcing bar	ton	1,100	280	308
(4) Superstructure (Main)	cu.m	180	10,370	1,867
(5) Superstructure (Appurtenant)	L.S	-		131
(6) Generating Equipment	L.S	-		6,500
(7) T/L&S/S	L.S	-		942
(8) Miscellaneous Work	L.S	-		57
Sub-total				10,646
7. Access Road				
(1) New Construction Road	Km	200,000	3.3	660
(2) Improvement of Existing Road	Km	90,000	7.5	675
(3) Bridge	m	5,000	0	0
(4) Miscellaneous Work	L.S	-		67
Sub-total				1,402
Total of Item I				50,700
II. Compensation Cost				
1. Relocation Road				
(1) Road	km	200,000	2.5	500
(2) Bridge	m	5,000	5	25
Sub-total				525
2. Compensation				
(1) Land	sq.km	115,000	0.5	58
(2) House	nos.	7,350	6	44
Sub-total				102
Total of Item II				627
III. Administration Cost				2,535
IV. Engineering Service Cost				3,760
V. Physical Contingency				7,605
VI. Grand Total				65,227

Table VI.9.4 CONSTRUCTION COST FOR BENEDITO NOVO SCHEME

Work Item	Unit	Unit Price (US$)	Quantity	Amount (US$x1000)
I. Direct Cost				
1. Dam				
(1) Excavation	cu.m	7	22,000	154
(2) Concrete(Mass)	cu.m	80	26,100	2,088
(3) Concrete(Structure)	cu.m	140	1,170	164
(4) Reinforcing bar	ton	1,100	47	52
(5) Bridge for Maintenance	L.S	-		12
(6) Spillway Gate	ton	4,800	250	1,200
(7) River Diversion Works	L.S	-		640
(8) Miscellaneous Work	L.S	-		123
Sub-total				4,433
2. Intake				
(1) Excavation	cu.m	7	1,560	11
(2) Concrete	cu.m	140	560	78
(3) Reinforcing bar	ton	1,100	22	24
(4) Intake Gate	ton	4,800	14	67
(5) Trashrack	ton	2,600	8	21
(6) Miscellaneous Work	L.S	-		6
Sub-total				207
3. Headrace tunnel				
(1) Tunnel Excavation	cu.m	92	22,200	2,042
(2) Lining Concrete	cu.m	158	7,600	1,201
(3) Reinforcing bar	ton	1,100	107	118
(4) Work adit	L.S	-		0
(5) Miscellaneous Work	L.S	-		168
Sub-total				3,529
4. Surge Tank				
(1) Shaft Excavation	cu.m	100	2,950	295
(2) Lining concrete	cu.m	160	870	139
(3) Reinforcing bar	ton	1,100	44	48
(4) Surge Tank Gate	ton	4,800		0
(5) Miscellaneous Work	L.S	-		24
Sub-total				507
5. Penstock				
(1) Shaft Excavation	cu.m	120	3,230	388
(2) Backfill concrete	cu.m	164	1,780	292
(3) Steel Liner	ton	2,100	230	483
(4) Work adit	L.S	-		200
(5) Miscellaneous Work	L.S	-		34
Sub-total				1,396
6. Power Station				
(1) Excavation	cu.m	7	9,600	67
(2) Concrete	cu.m	140	3,660	512
(3) Reinforcing bar	ton	1,100	190	209
(4) Superstructure (Main)	cu.m	180	8,780	1,580
(5) Superstructure (Appurtenant)	L.S	-		126
(6) Generating Equipment	L.S	-		4,800
(7) T/L&S/S	L.S	-		1,140
(8) Miscellaneous Work	L.S	-		39
Sub-total				8,475
7. Access Road				
(1) New Construction Road	Km	200,000	1.4	280
(2) Improvement of Existing Road	Km	90,000	0	0
(3) Bridge	m	5,000	0	0
(4) Miscellaneous Work	L.S	-		14
Sub-total				294
Total of Item I				18,841
II. Compensation Cost				
1. Relocation Road				
(1) Road	km	200,000	1	200
(2) Bridge	m	5,000	10	50
Sub-total				250
2. Compensation				
(1) Land	sq.km	115,000	0.2	23
(2) House	nos.	7,350	4	29
Sub-total				52
Total of Item II				302
III. Administration Cost				942
IV. Engineering Service Cost				3,480
V. Physical Contingency				2,826
VI. Grand Total				26,392

Table VI.9.5 CONSTRUCTION COST FOR ALTO BENEDITO NOVO SCHEME

Work Item	Unit	Unit Price (US$)	Quantity	Amount (US$x1000)
I. Direct Cost				
1. Dam				
(1) Excavation	cu.m	7	28,000	196
(2) Concrete(Mass)	cu.m	80	12,000	960
(3) Concrete(Structure)	cu.m	140	1,100	154
(4) Reinforcing bar	ton	1,100	44	48
(5) Bridge for Maintenance	L.S	-		10
(6) Spillway Gate	ton	4,800	210	1,008
(7) River Diversion Works	L.S	-		930
(8) Miscellaneous Work	L.S	-		68
Sub-total				3,375
2. Intake				
(1) Excavation	cu.m	7	1,630	11
(2) Concrete	cu.m	140	590	83
(3) Reinforcing bar	ton	1,100	24	26
(4) Intake Gate	ton	4,800	15	72
(5) Trashrack	ton	2,600	9	23
(6) Miscellaneous Work	L.S	-		6
Sub-total				222
3. Headrace tunnel				
(1) Tunnel Excavation	cu.m	91	20,250	1,843
(2) Lining Concrete	cu.m	157	6,310	991
(3) Reinforcing bar	ton	1,100	90	99
(4) Work adit	L.S	-		0
(5) Miscellaneous Work	L.S	-		147
Sub-total				3,079
4. Surge Tank				
(1) Shaft Excavation	cu.m	100	3,130	313
(2) Lining concrete	cu.m	160	900	144
(3) Reinforcing bar	ton	1,100	45	50
(4) Surge Tank Gate	ton	4,800		0
(5) Miscellaneous Work	L.S	-		25
Sub-total				532
5. Penstock				
(1) Shaft Excavation	cu.m	120	4,410	529
(2) Backfill concrete	cu.m	164	2,430	399
(3) Steel Liner	ton	2,100	330	693
(4) Work adit	L.S	-		400
(5) Miscellaneous Work	L.S	-		46
Sub-total				2,067
6. Power Station				
(1) Excavation	cu.m	7	9,980	70
(2) Concrete	cu.m	140	3,800	532
(3) Reinforcing bar	ton	1,100	200	220
(4) Land Slide Protection Work	L.S	-		10,000
(5) Superstructure (Main)	cu.m	180	8,780	1,580
(6) Superstructure (Appurtenant)	L.S	-		126
(7) Generating Equipment	L.S	-		5,000
(8) T/L&S/S	L.S	-		1,353
(9) Miscellaneous Work	L.S	-		41
Sub-total				18,923
7. Access Road				
(1) New Construction Road	Km	200,000	2.1	420
(2) Improvement of Existing Road	Km	90,000	0	0
(3) Bridge	m	5,000	10	50
(4) Miscellaneous Work	L.S	-		24
Sub-total				494
Total of Item I				28,691
II. Compensation Cost				
1. Relocation Road				
(1) Road	km	200,000	0	0
(2) Bridge	m	5,000	50	250
Sub-total				250
2. Compensation				
(1) Land	sq.km	115,000	0.2	23
(2) House	nos.	7,350	6	44
Sub-total				67
Total of Item II				317
III. Administration Cost				1,435
IV. Engineering Service Cost				3,480
V. Physical Contingency				4,304
VI. Grand Total				38,226

Table VI.9.6 INVENTORY OF HYDROPOWER POTENTIAL FOR THE SCHEMES SELECTED BY FIRST SCREENING (1/5)

(i)	Scheme identification information	- No. of scheme		: 1
		- Name of scheme		: Salto Pilao (1)
		- Name of river		: Itajai
(ii)	Hydrological and topographic information	- Catchment area	(sq.km)	: 5,597
		- Average basin mean rainfall	(mm)	: 1,530
		- Average runoff for the critical period from April 1949 to November 1956	(cu.m/sec)	: 91.1
		- Key stream gauge		: Rio do Sul
(iii)	Scheme information			
	a) Type of development			: Run-of-river
	b) Development ratio			: 0.7
	c) Reservoir/pondage	- Full supply level/ normal operating level	(EL.m)	: 330
		- Minimum operating level	(EL.m)	: —
		- Average operating Level	(EL.m)	: —
		- Gross storage volume	(mil. cu.m)	: 14.5
		- Active storage volume	(mil. cu.m)	: —
		- Dead storage volume	(mil. cu.m)	: —
		- Sediment volume	(mil. cu.m)	: —
	d) Dam	- Type of dam		: Concrete dam
		- Crest elevation	(EL.m)	: 332
		- Crest length	(m)	: 270
		- Dam height	(m)	: 18
		- Embankment volume	(mil. cu.m)	: —
		- Concrete volume	(cu.m)	: 32,910
	e) Waterway	- Number	(nos.)	: 1
		- Tunnel length	(km)	: 6.65
		- Channel length	(km)	: —
		- Diameter of tunnel	(m)	: 5.2
	f) Discharge and head	- Maximum plant discharge (Qp)	(cu.m/sec)	: 71.9
		- Firm discharge (Qf)	(cu.m/sec)	: 50.3
		- Effective head for Qp	(m)	: 200.5
		- Effective head for Qf	(m)	: 208.9
		- Tailwater level	(EL.m)	: 113
	g) Transmission line	- Length	(km)	: 7
		- kV		: 138
		- Destinated sub-station		: Transmission line (Rio do Sul II - Blumenau)
	h) Access road	- New access road	(km)	: 2.0
		- Improvement of existing road	(km)	: 2.5
	i) Power	- Installed capacity	(MW)	: 118.7
		- Firm energy	(GWh)	: 757.7
		- Guaranteed energy	(GWh)	: 682.0
		- Secondary energy	(GWh)	: 66.0
	j) Preliminary cost	- Total construction cost	(mil. US$)	: 122.6
		- Cost per kW	US$/kW)	: 1,032.7
		- Cost per MWh	(US$/MWh)	: 161.8
		- Unit cost of guaranteed energy	(US$/MWh)	: 17.2
(iv)	Other information	- Submerged area	(sq.km)	: 4.65
		- Submerged houses	(nos.)	: 74
		- Submerged farm land	(sq.km)	: 0.18
		- Relocation road length	(km)	: 2
		- Bridge to be replaced	(m)	: 20

Table VI.9.6 INVENTORY OF HYDROPOWER POTENTIAL FOR THE SCHEMES SELECTED BY FIRST SCREENING (2/5)

(i)	Scheme identification information	- No. of scheme		: 2
		- Name of scheme		: Salto Pilao (2)
		- Name of river		: Itajai
(ii)	Hydrological and topographic information	- Catchment area	(sq.km)	: 5,597
		- Average basin mean rainfall	(mm)	: 1,530
		- Average runoff for the critical period from April 1949 to November 1956	(cu.m/sec)	: 91.1
		- Key stream gauge		: Rio do Sul
(iii)	Scheme information			
	a) Type of development			: Run-of-river
	b) Development ratio			: 0.8
	c) Reservoir/pondage	- Full supply level/ normal operating level	(EL.m)	: 330
		- Minimum operating level	(EL.m)	: —
		- Average operating Level	(EL.m)	: —
		- Gross storage volume	(mil. cu.m)	: 14.5
		- Active storage volume	(mil. cu.m)	: —
		- Dead storage volume	(mil. cu.m)	: —
		- Sediment volume	(mil. cu.m)	: —
	d) Dam	- Type of dam		: Concrete dam
		- Crest elevation	(EL.m)	: 332
		- Crest length	(m)	: 270
		- Dam height	(m)	: 18
		- Embankment volume	(mil. cu.m)	: —
		- Concrete volume	(cu.m)	: 33,000
	e) Waterway	- Number	(nos.)	: 1
		- Tunnel length	(km)	: 4.9
		- Channel length	(km)	: —
		- Diameter of tunnel	(m)	: 4.6
	f) Discharge and head	- Maximum plant discharge (Qp)	(cu.m/sec)	: 52.6
		- Firm discharge (Qf)	(cu.m/sec)	: 42.1
		- Effective head for Qp	(m)	: 156.6
		- Effective head for Qf	(m)	: 161.4
		- Tailwater level	(EL.m)	: 160
	g) Transmission line	- Length	(km)	: 1
		- kV		: 138
		- Destinated sub-station		: Transmission line (Rio do Sul II - Blumenau)
	h) Access road	- New access road	(km)	: 2.5
		- Improvement of existing road	(km)	: 2.5
	i) Power	- Installed capacity	(MW)	: 67.8
		- Firm energy	(GWh)	: 490.0
		- Guaranteed energy	(GWh)	: 441.0
		- Secondary energy	(GWh)	: 27.9
	j) Preliminary cost	- Total construction cost	(mil. US$)	: 87.2
		- Cost per kW	US$/kW)	: 1,285.9
		- Cost per MWh	(US$/MWh)	: 177.9
		- Unit cost of guaranteed energy	(US$/MWh)	: 19.9
(iv)	Other information	- Submerged area	(sq.km)	: 4.65
		- Submerged houses	(nos.)	: 74
		- Submerged farm land	(sq.km)	: 0.18
		- Relocation road length	(km)	: 2
		- Bridge to be replaced	(m)	: 20

Table VI.9.6 INVENTORY OF HYDROPOWER POTENTIAL FOR THE SCHEMES SELECTED BY FIRST SCREENING (3/5)

(i)	Scheme identification information	- No. of scheme		: 7
		- Name of scheme		: Dalbergia
		- Name of river		: Itajai do Norte
(ii)	Hydrological and topographic information	- Catchment area	(sq.km)	: 3,212
		- Average basin mean rainfall	(mm)	: 1,520
		- Average runoff for the critical period from April 1949 to November 1956	(cu.m/sec)	: 38.7
		- Key stream gauge		: Ibirama
(iii)	Scheme information			
	a) Type of development			: Run-of-river
	b) Development ratio			: 0.7
	c) Reservoir/pondage	- Full supply level/ normal operating level	(EL.m)	: 215
		- Minimum operating level	(EL.m)	: —
		- Average operating Level	(EL.m)	: —
		- Gross storage volume	(mil. cu.m)	: 1.85
		- Active storage volume	(mil. cu.m)	: —
		- Dead storage volume	(mil. cu.m)	: —
		- Sediment volume	(mil. cu.m)	: —
	d) Dam	- Type of dam		: Concrete dam
		- Crest elevation	(EL.m)	: 217
		- Crest length	(m)	: 210
		- Dam height	(m)	: 21
		- Embankment volume	(mil. cu.m)	: —
		- Concrete volume	(cu.m)	: 33,950
	e) Waterway	- Number	(nos.)	: 1
		- Tunnel length	(km)	: 8.60
		- Channel length	(km)	: —
		- Diameter of tunnel	(m)	: 3.6
	f) Discharge and head	- Maximum plant discharge (Qp)	(cu.m/sec)	: 27.6
		- Firm discharge (Qf)	(cu.m/sec)	: 19.3
		- Effective head for Qp	(m)	: 70
		- Effective head for Qf	(m)	: 78.7
		- Tailwater level	(EL.m)	: 128
	g) Transmission line	- Length	(km)	: 2
		- kV		: 23
		- Destinated sub-station		: Ibirama
	h) Access road	- New access road	(km)	: 3.3
		- Improvement of existing road	(km)	: 7.5
	i) Power	- Installed capacity	(MW)	: 15.9
		- Firm energy	(GWh)	: 109.5
		- Guaranteed energy	(GWh)	: 98.6
		- Secondary energy	(GWh)	: 11.7
	j) Preliminary cost	- Total construction cost	(mil. US$)	: 65.2
		- Cost per kW	US$/kW)	: 4102.3
		- Cost per MWh	(US$/MWh)	: 595.5
		- Unit cost of guaranteed energy	(US$/MWh)	: 65.6
(iv)	Other information	- Submerged area	(sq.km)	: 1.1
		- Submerged houses	(nos.)	: 6
		- Submerged farm land	(sq.km)	: 0.04
		- Relocation road length	(km)	: 2.5
		- Bridge to be replaced	(m)	: 5

Table VI.9.6 INVENTORY OF HYDROPOWER POTENTIAL FOR THE SCHEMES SELECTED BY FIRST SCREENING (4/5)

(i)	Scheme identification information	- No. of scheme		: 11
		- Name of scheme		: Benedito Novo
		- Name of river		: Benedito
(ii)	Hydrological and topographic information	- Catchment area	(sq.km)	: 586
		- Average basin mean rainfall	(mm)	: 1,510
		- Average runoff for the critical period from April 1949 to November 1956	(cu.m/sec)	: 11.3
		- Key stream gauge		: Timbo
(iii)	Scheme information			
	a) Type of development			: Run-of-river
	b) Development ratio			: 0.6
	c) Reservoir/pondage	- Full supply level/ *normal operating level*	(EL.m)	: 277
		- Minimum operating level	(EL.m)	: —
		- Average operating Level	(EL.m)	: —
		- Gross storage volume	(mil. cu.m)	: 0.3
		- Active storage volume	(mil. cu.m)	: —
		- Dead storage volume	(mil. cu.m)	: —
		- Sediment volume	(mil. cu.m)	: —
	d) Dam	- Type of dam		: Concrete dam
		- Crest elevation	(EL.m)	: 279
		- Crest length	(m)	: 170
		- Dam height	(m)	: 23
		- Embankment volume	(mil. cu.m)	: —
		- Concrete volume	(cu.m)	: 27,270
	e) Waterway	- Number	(nos.)	: 1
		- Tunnel length	(km)	: 1.9
		- Channel length	(km)	: —
		- Diameter of tunnel	(m)	: 2.8
	f) Discharge and head	- Maximum plant discharge (Qp)	(cu.m/sec)	: 13.9
		- Firm discharge (Qf)	(cu.m/sec)	: 8.4
		- Effective head for Qp	(m)	: 112.2
		- Effective head for Qf	(m)	: 115.3
		- Tailwater level	(EL.m)	: 160
	g) Transmission line	- Length	(km)	: 14
		- kV		: 23
		- Destinated sub-station		: Timbo
	h) Access road	- New access road	(km)	: 1.4
		- Improvement of existing road	(km)	: —
	i) Power	- Installed capacity	(MW)	: 12.8
		- Firm energy	(GWh)	: 69.8
		- Guaranteed energy	(GWh)	: 62.9
		- Secondary energy	(GWh)	: 11.1
	j) Preliminary cost	- Total construction cost	(mil. US$)	: 26.4
		- Cost per kW	(US$/kW)	: 2,061.9
		- Cost per MWh	(US$/MWh)	: 377.9
		- Unit cost of guaranteed energy	(US$/MWh)	: 40.6
(iv)	Other information	- Submerged area	(sq.km)	: 0.18
		- Submerged houses	(nos.)	: 4
		- Submerged farm land	(sq.km)	: —
		- Relocation road length	(km)	: 1
		- Bridge to be replaced	(m)	: 10

Table VI.9.6 INVENTORY OF HYDROPOWER POTENTIAL FOR THE SCHEMES SELECTED BY FIRST SCREENING (5/5)

(i)	Scheme identification information	- No. of scheme		: 12
		- Name of scheme		: Alto Benedito Novo
		- Name of river		: Benedito
(ii)	Hydrological and topographic information	- Catchment area	(sq.km)	: 473
		- Average basin mean rainfall	(mm)	: 1,520
		- Average runoff for the critical period from April 1949 to November 1956	(cu.m/sec)	: 9.7
		- Key stream gauge		: Timbo
(iii)	Scheme information			
	a) Type of development			: Run-of-river
	b) Development ratio			: 0.5
	c) Reservoir/pondage	- Full supply level/ normal operating level	(EL.m)	: 430
		- Minimum operating level	(EL.m)	: —
		- Average operating Level	(EL.m)	: —
		- Gross storage volume	(mil. cu.m)	: 0.9
		- Active storage volume	(mil. cu.m)	: —
		- Dead storage volume	(mil. cu.m)	: —
		- Sediment volume	(mil. cu.m)	: —
	d) Dam	- Type of dam		: Concrete dam
		- Crest elevation	(EL.m)	: 432
		- Crest length	(m)	: 90
		- Dam height	(m)	: 19
		- Embankment volume	(mil. cu.m)	: —
		- Concrete volume	(cu.m)	: 13,100
	e) Waterway	- Number	(nos.)	: 1
		- Tunnel length	(km)	: 1.65
		- Channel length	(km)	: —
		- Diameter of tunnel	(m)	: 2.9
	f) Discharge and head	- Maximum plant discharge (Qp)	(cu.m/sec)	: 14.7
		- Firm discharge (Qf)	(cu.m/sec)	: 7.3
		- Effective head for Qp	(m)	: 109.2
		- Effective head for Qf	(m)	: 112.8
		- Tailwater level	(EL.m)	: 316
	g) Transmission line	- Length	(km)	: 18
		- kV		: 23
		- Destinated sub-station		: Timbo
	h) Access road	- New access road	(km)	: 2.1
		- Improvement of existing road	(km)	: —
	i) Power	- Installed capacity	(MW)	: 13.2
		- Firm energy	(GWh)	: 59.4
		- Guaranteed energy	(GWh)	: 53.4
		- Secondary energy	(GWh)	: 11.1
	j) Preliminary cost	- Total construction cost	(mil. US$)	: 38.2
		- Cost per kW	(US$/kW)	: 2,895.9
		- Cost per MWh	(US$/MWh)	: 643.8
		- Unit cost of guaranteed energy	(US$/MWh)	: 70.1
(iv)	Other information	- Submerged area	(sq.km)	: 0.17
		- Submerged houses	(nos.)	: 6
		- Submerged farm land	(sq.km)	: 0.01
		- Relocation road length	(km)	: —
		- Bridge to be replaced	(m)	: 50

FIGURES

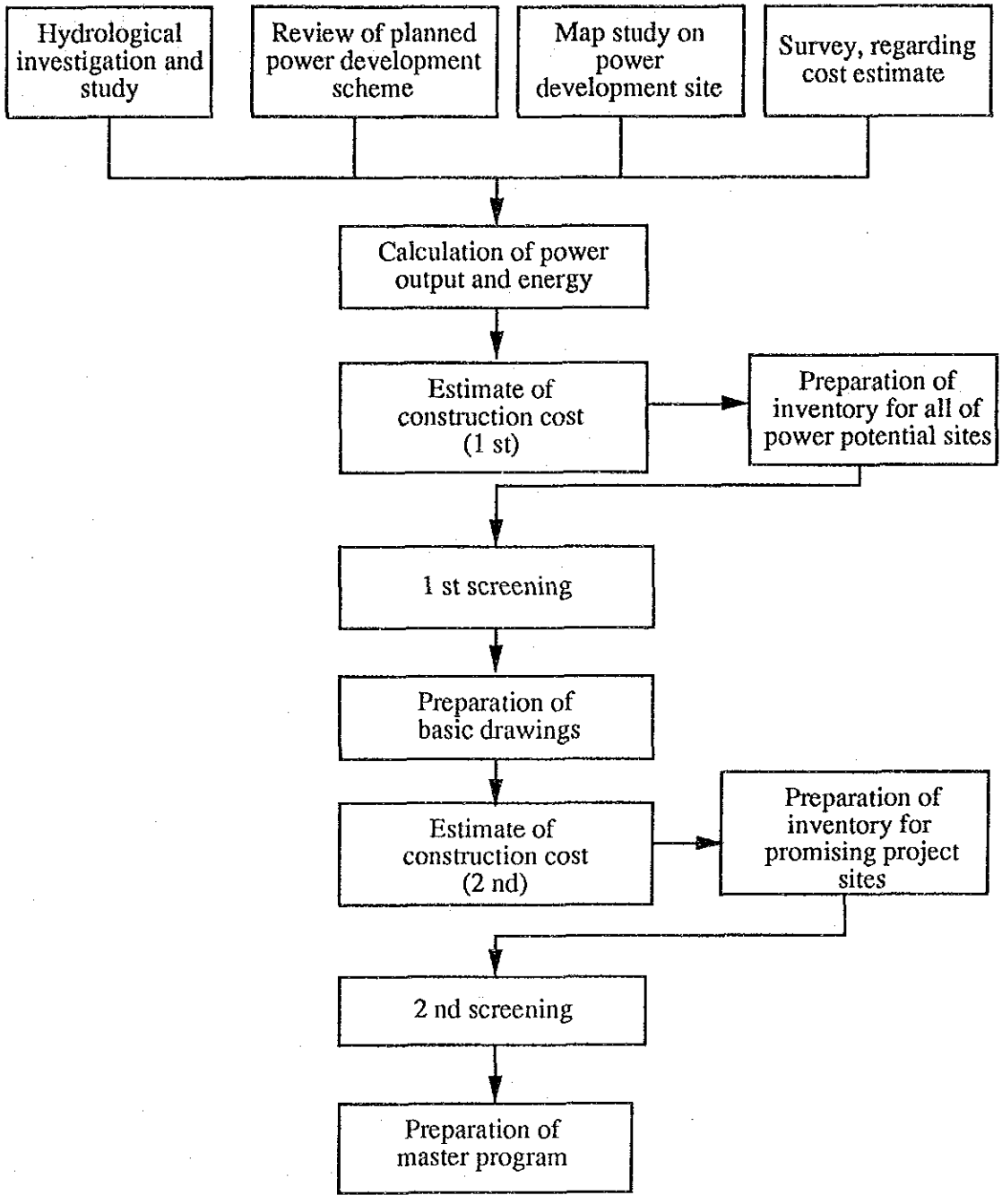
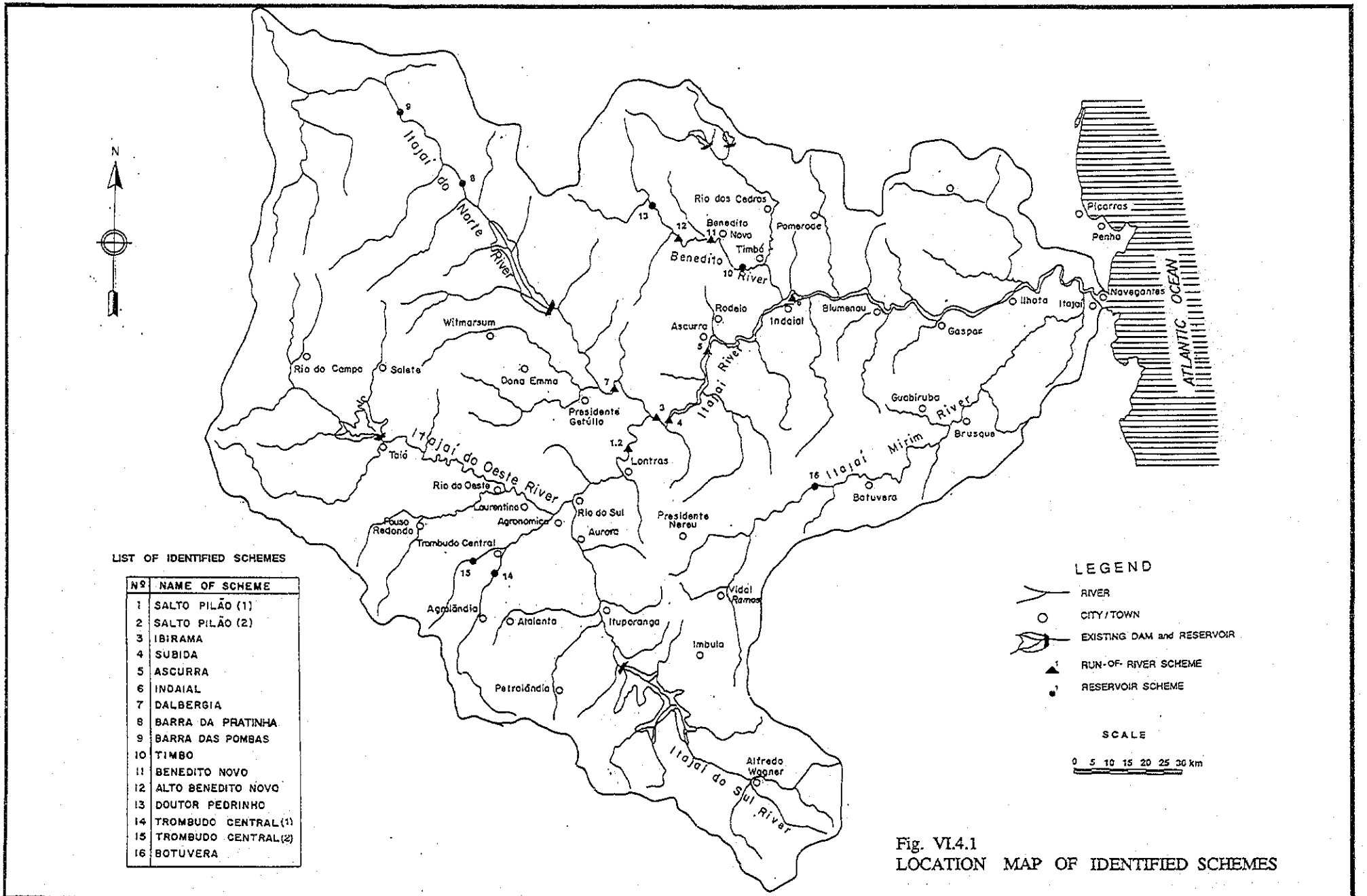


Fig. VI.2.1 GENERAL WORK FLOW OF STUDY



LIST OF IDENTIFIED SCHEMES

Nº	NAME OF SCHEME
1	SALTO PILÃO (1)
2	SALTO PILÃO (2)
3	IBIRAMA
4	SUBIDA
5	ASCURRA
6	INDAIAL
7	DALBERGIA
8	BARRA DA PRATINHA
9	BARRA DAS POMBAS
10	TIMBO
11	BENEDITO NOVO
12	ALTO BENEDITO NOVO
13	DOUTOR PEDRINHO
14	TROMBUDO CENTRAL (1)
15	TROMBUDO CENTRAL (2)
16	BOTUVERA

Fig. VI.4.1
LOCATION MAP OF IDENTIFIED SCHEMES

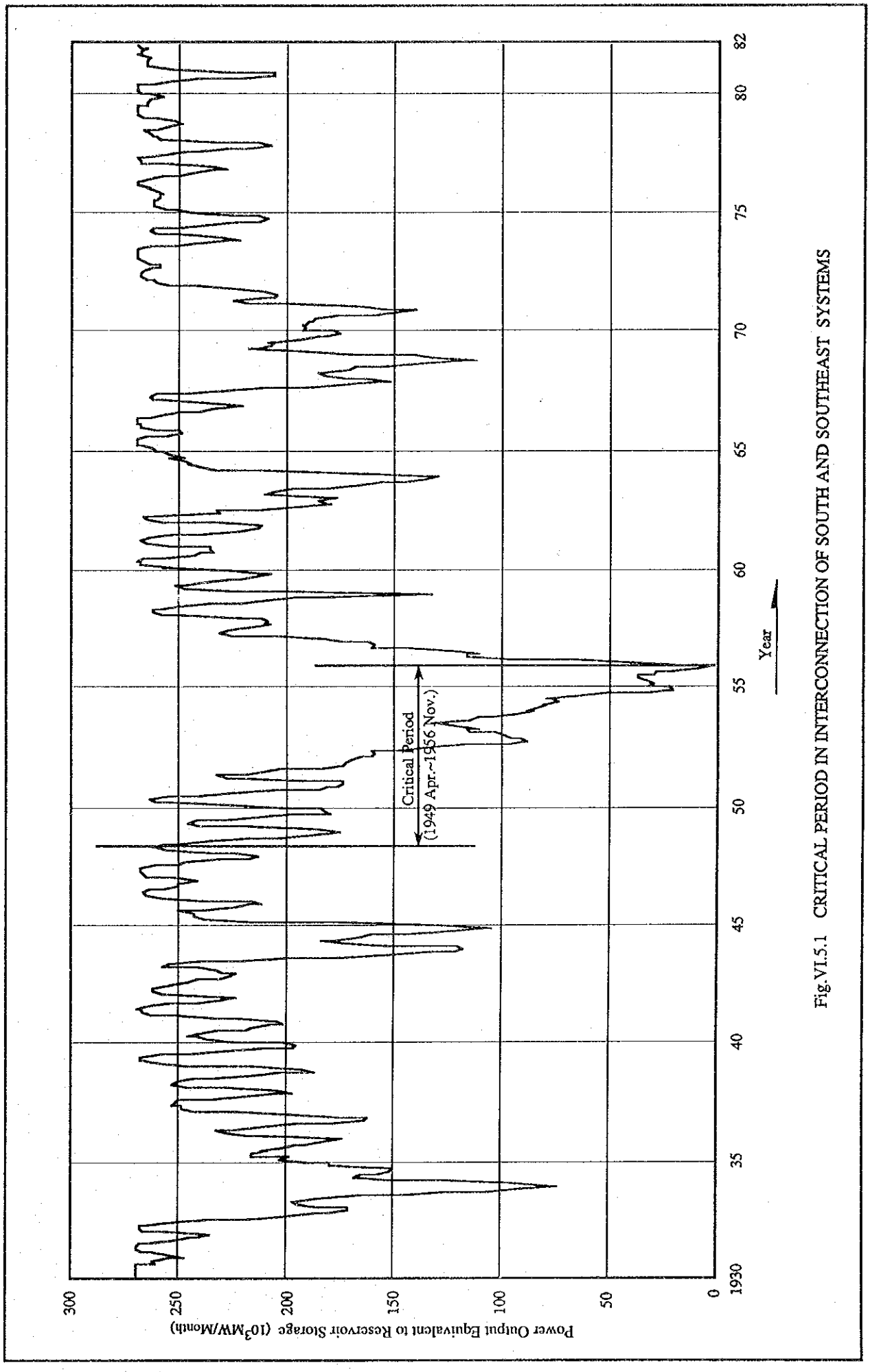
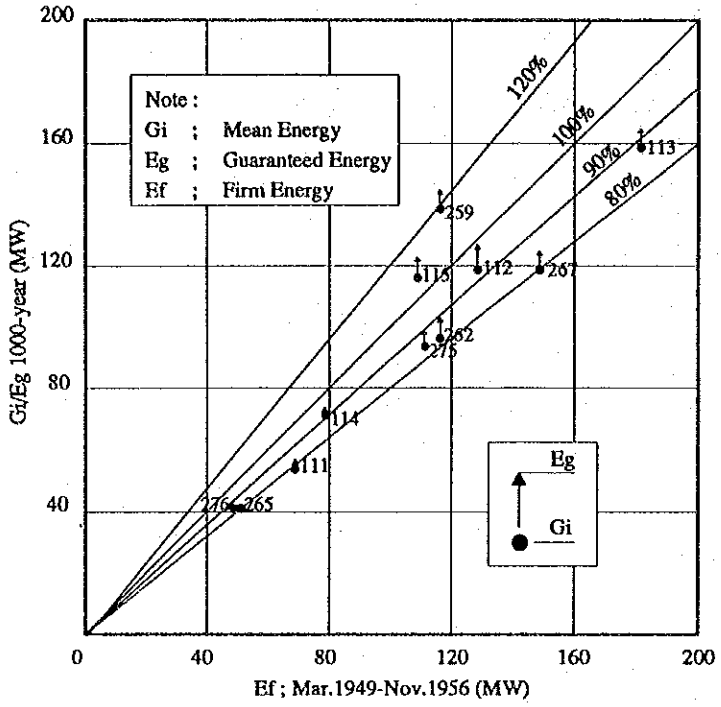
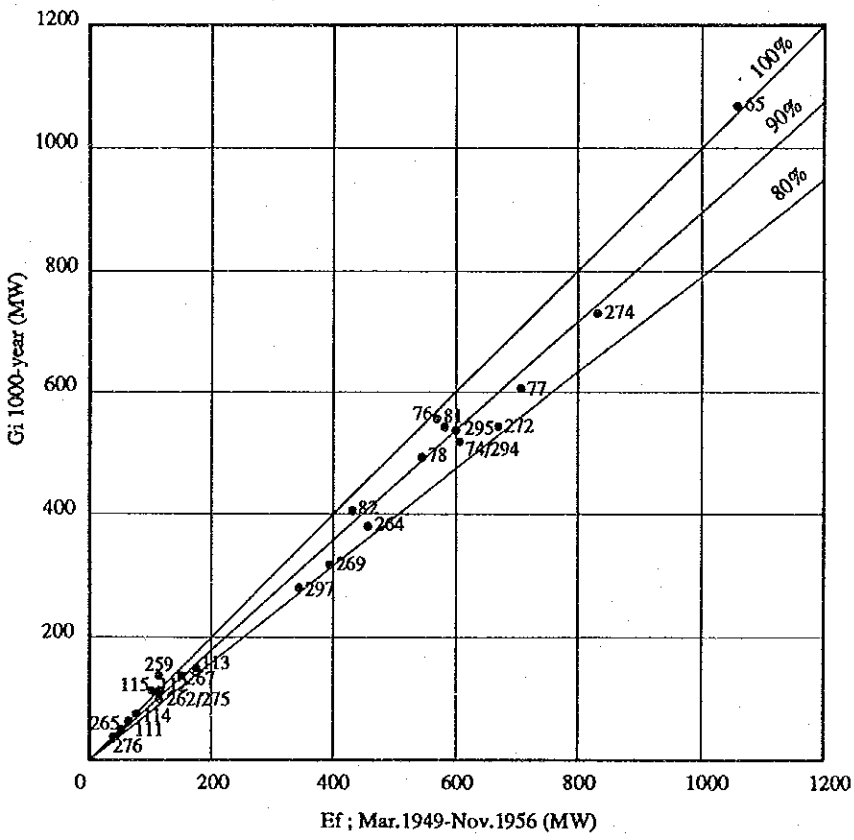


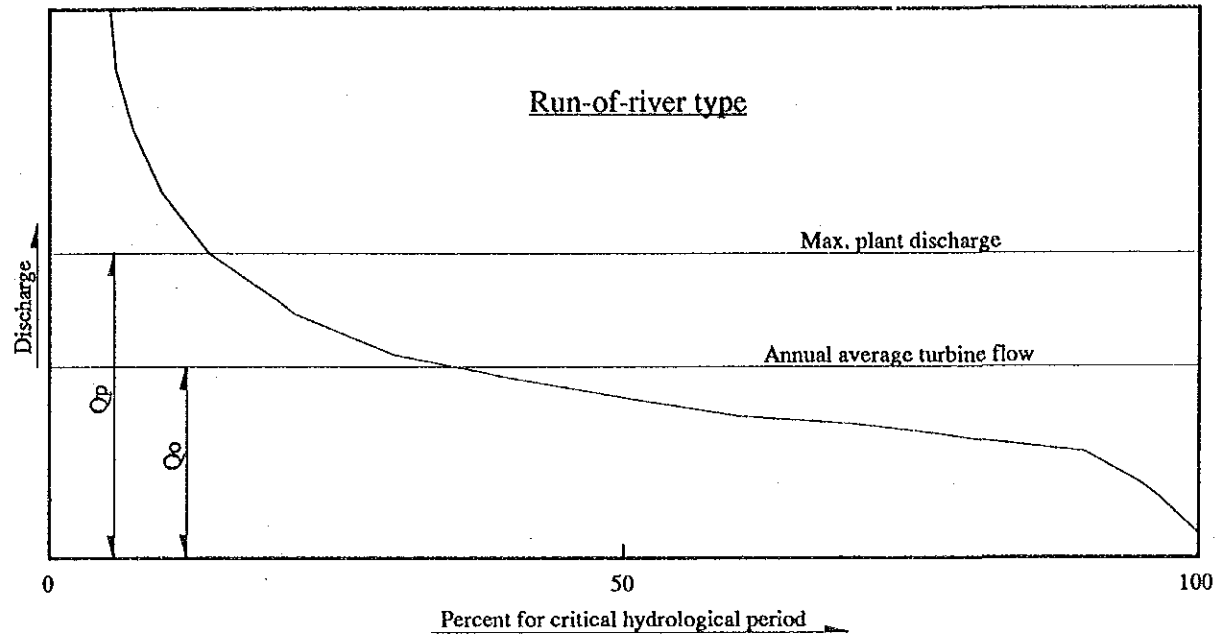
Fig.VI.5.1 CRITICAL PERIOD IN INTERCONNECTION OF SOUTH AND SOUTHEAST SYSTEMS

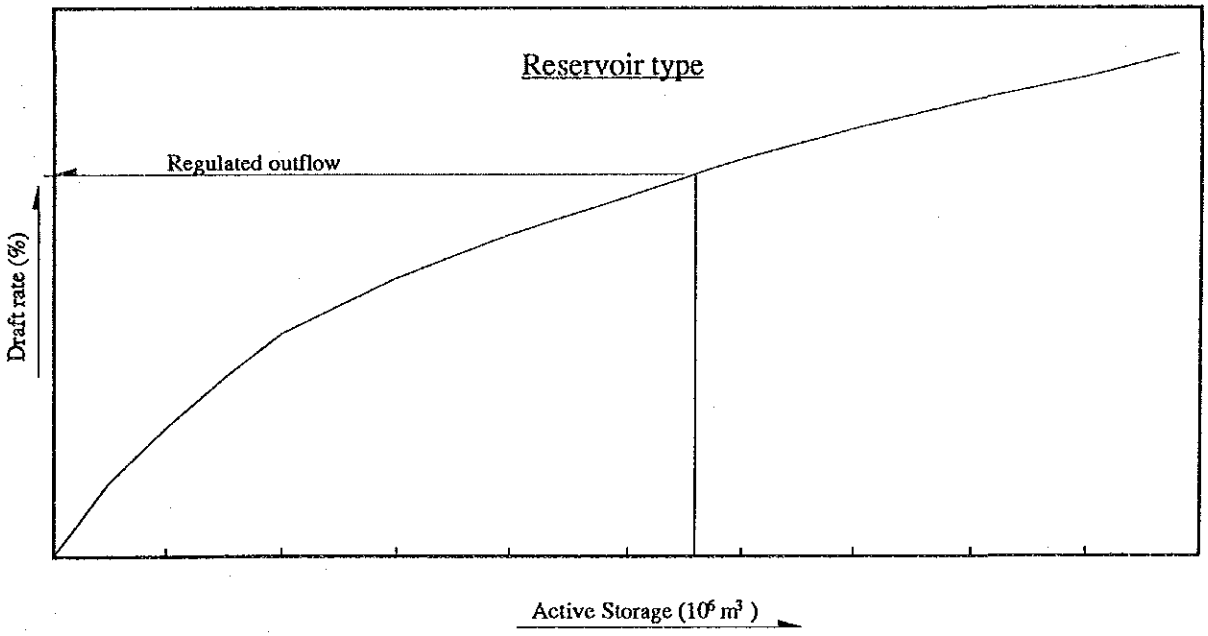




Note ; Figures show the number code of station.

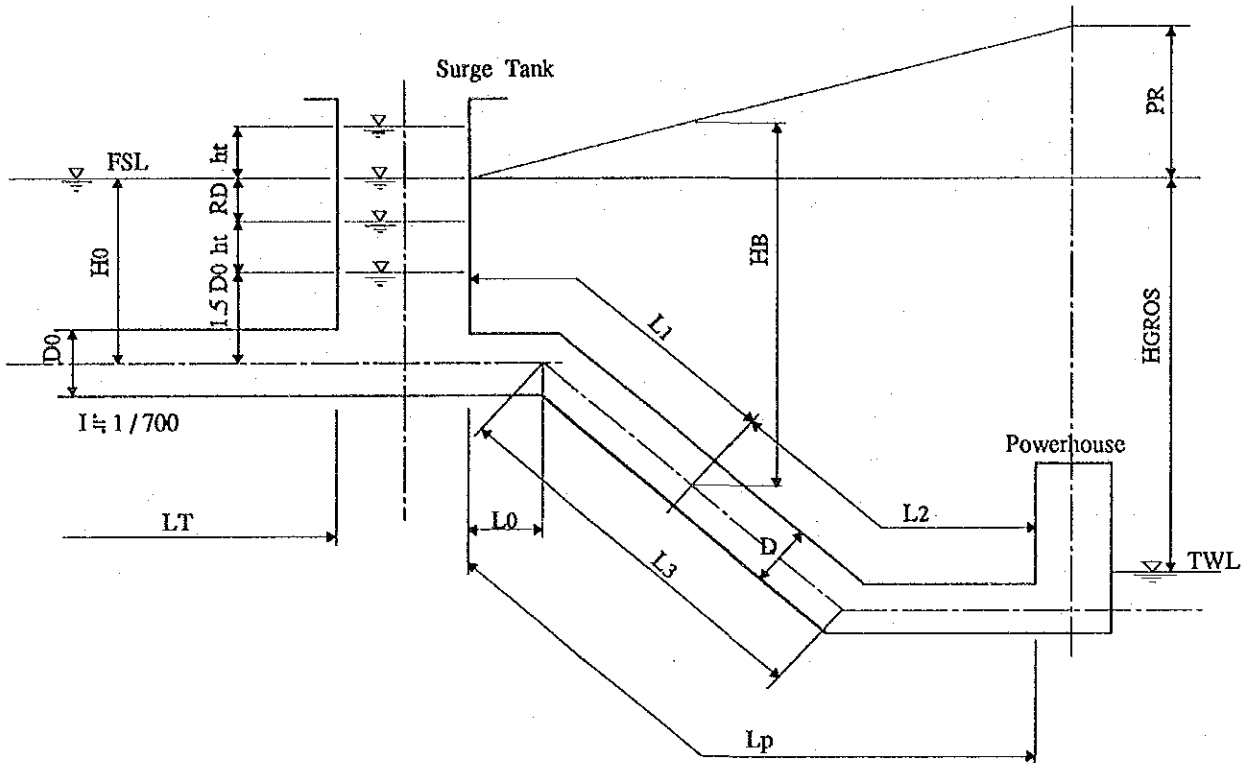
Fig. VI.5.2 FIRM ENERGY BASED ON CRITICAL MAR.1949-NOV.1956 RECORD V.S. MEAN ENERGY PROBABLY OCCURING LESS THAN FIVE % BASED ON 1000-YEAR SYNTHETIC FLOW





Note; Draft rate means the ratio of firm discharge to mean discharge in critical period.

Fig. VI.5.3 MONTHLY FLOW DURATION AND DRAFT CURVE



FSL : Full supply level of reservoir (EL. m)

TWL : Tailwater level (EL. m)

Qp : Max. plant discharge (m^3/s)

D0 : Diameter of headrace tunnel (m)

D : Diameter of penstock (m)

I : Hydraulic gradient of headrace tunnel ≒ 1 / 700

RD : Reservoir drawdown depth (m)

ht : Surcharge depth due to surging - proximate (m)

HB : Head bearable by minimum thickness of conduit shell (m)

HGROS: Gross head (m)

PR : Maximum pressure rise (m)

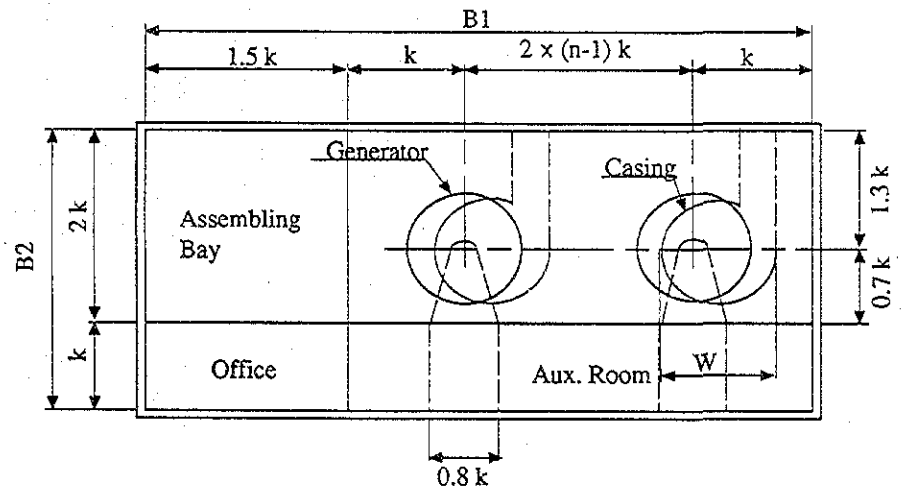
LT : Length of headrace tunnel (m)

LP : Length of penstock line (m)

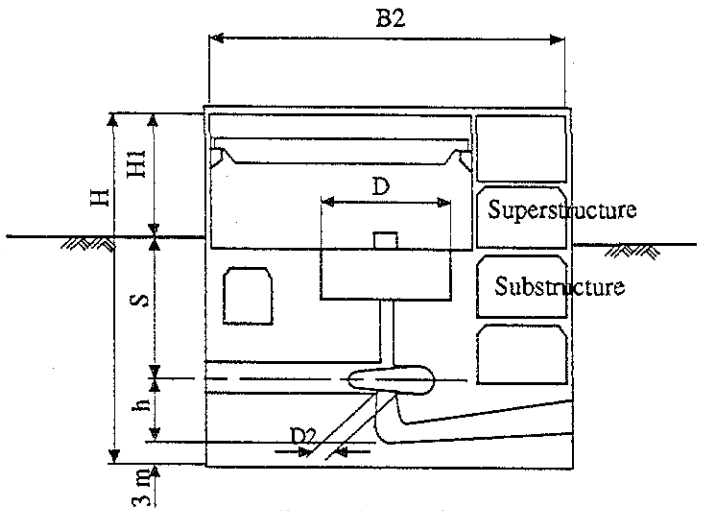
L1 : Length of penstock where shell of min. thickness of conduit shell is applied (m)

L2 : Length of penstock in which thickness of conduit shell is ditermined by water pressure (m)

Fig. VI.6.1 TYPICAL LAYOUT OF PRESSURE SHAFT ASSSUMED FOR PRELIMINARY COST ESTIMATE



Powerhouse Plan



Powerhouse Section

1. Powerhouse Length and Width

$$B1 = 1.5 \times k + 2 \times n \times k$$
$$B2 = 3 \times k$$
$$k = D = 8 \times He^{-0.08} \times Pinst.^{0.13}$$

where,

B1	:	Powerhouse length (m)
B2	:	Powerhouse width (m)
n	:	Generator nos.
D	:	Generator dia. (m)
W	:	Turbine casing width (m)
Pinst.	:	Installed power capacity (MW)
He	:	Effective head (m)

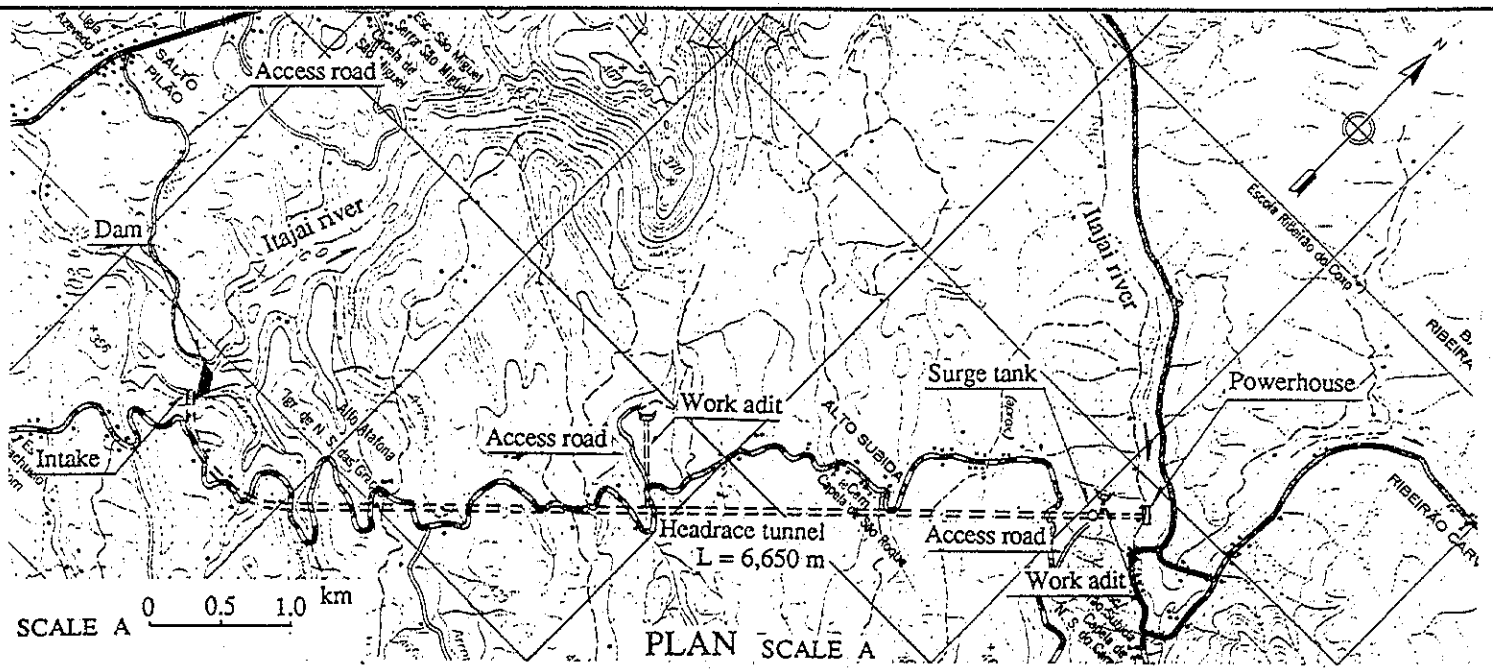
2. Powerhouse Height

$$H1 = Pinst^{0.21} + 5$$
$$S = 0.8367 \times Pinst.^{0.1767} + 0.287 \times Pinst.^{0.2769}$$
$$h = 2.7 \times D2$$
$$D2 = D1 \times (0.04478 \times Ns^{0.6091})$$
$$D1 = 84.6 \times ku \times Hd^{0.5} / N$$
$$ku = 0.834 - 10.66 / Ns$$
$$Ns = 2419 / He^{0.489}$$

where,

H1	:	Superstructure height (m)
S	:	Height from casing center to floor (m)
h	:	Height from casing center to draft tube bottom (m)
Pinst.	:	Installed power capacity (KW)
D2	:	Runner outlet diameter (m)
D1	:	Runner inlet diameter (m)
ku	:	Runner circumference speed coefficient
Ns	:	Specific speed (m-kw)
N	:	Revolution speed = 400 RPM

Fig. VI.9.1 SKELTON MAP OF POWERHOUSE AND GENERAL EQUATION TO ESTIMATE POWERHOUSE DIMENSION



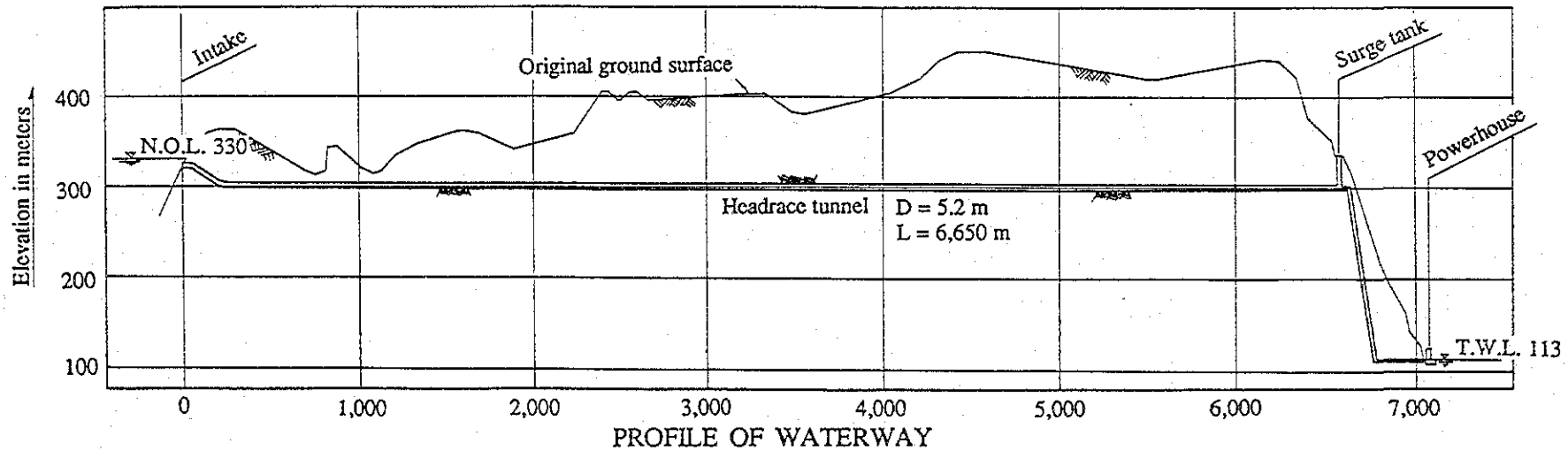
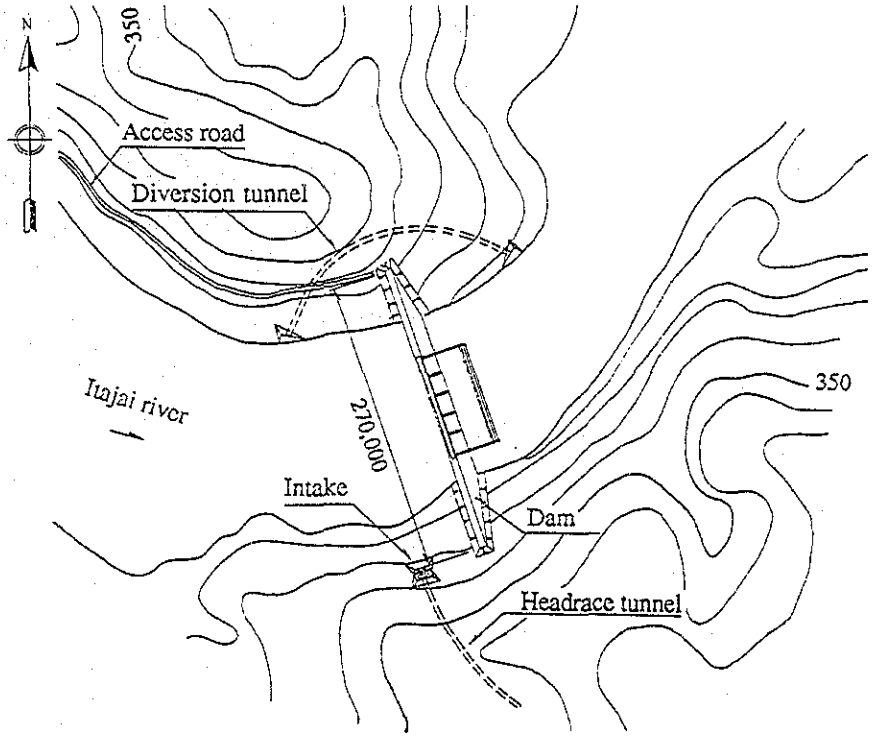
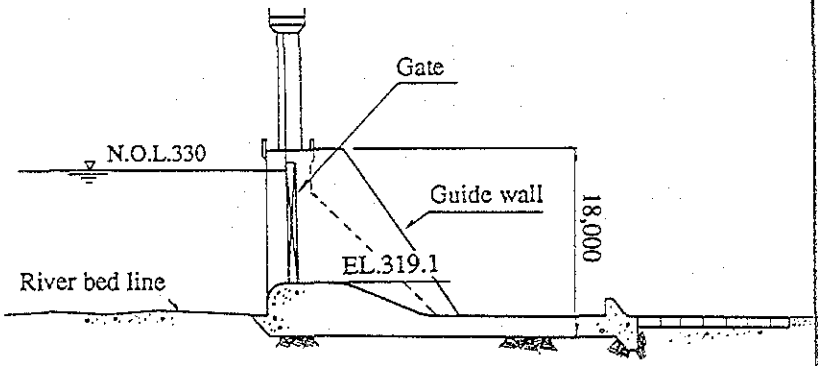


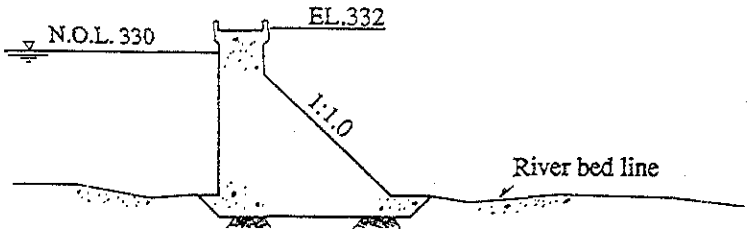
Fig. VI.9.2 GENERAL LAYOUT FOR SALTO PILAO (1) SCHEME (1/3)



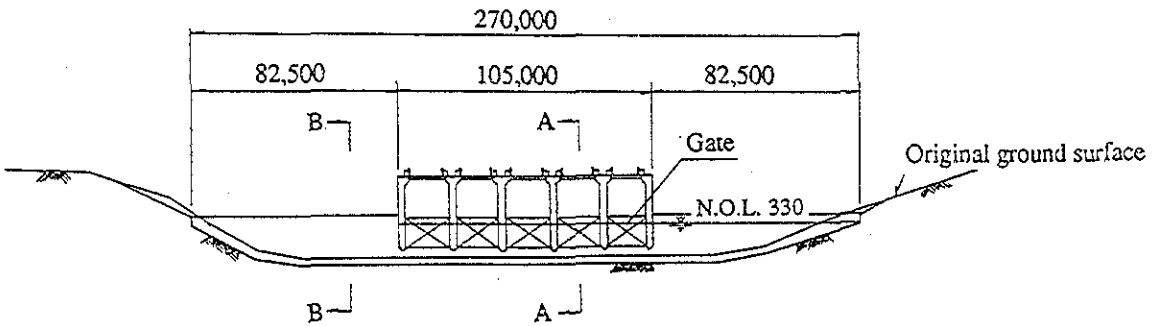
PLAN SCALE A



SECTION A-A
SCALE C



SECTION B-B
SCALE C



UPSTREAM ELEVATION
SCALE B

SCALE A 0 100 200 m
SCALE B 0 50 100 m
SCALE C 0 10 20 m

Fig. VI.9.2 GENERAL LAYOUT FOR SALTO PILAO (1) SCHEME (2/3)

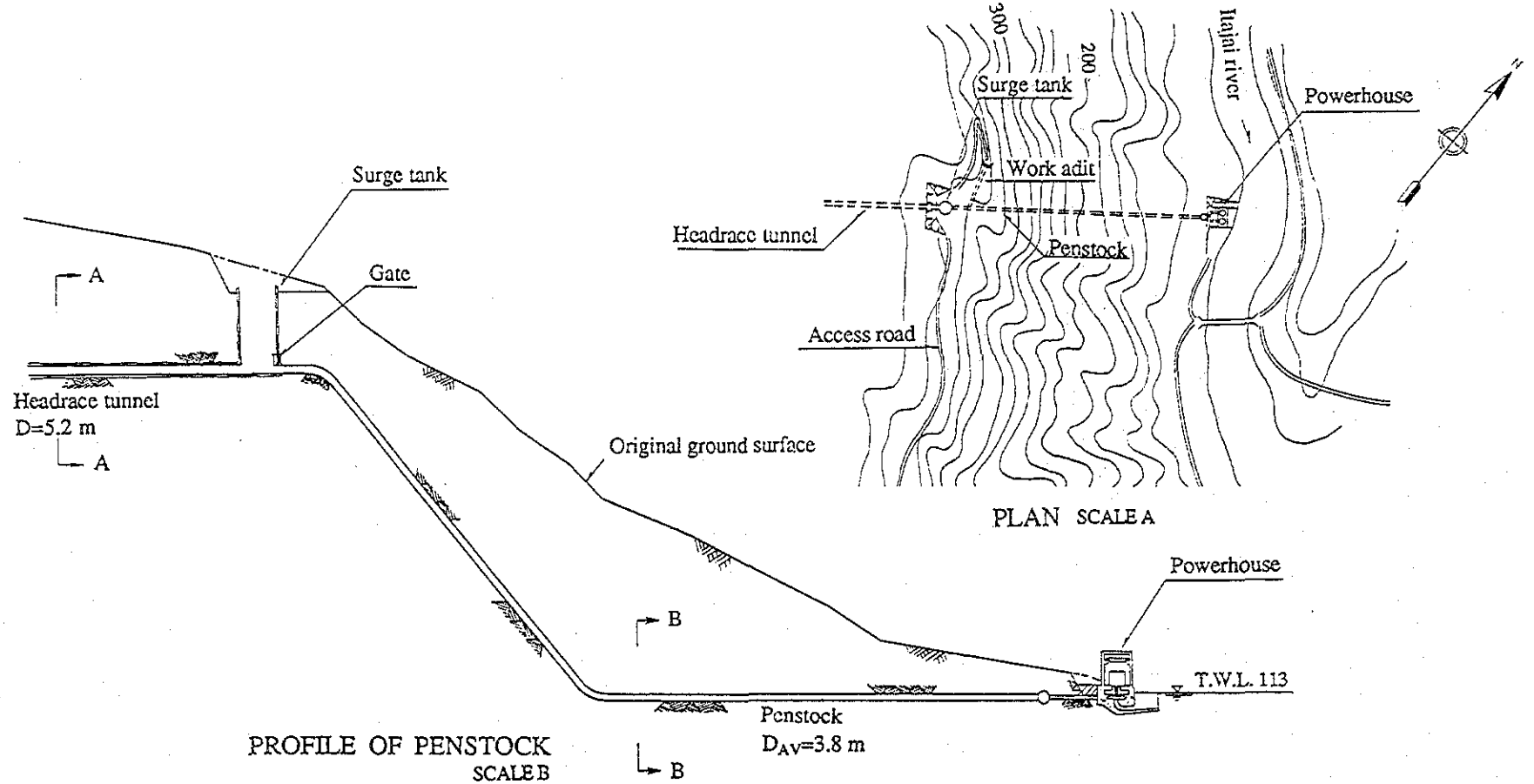
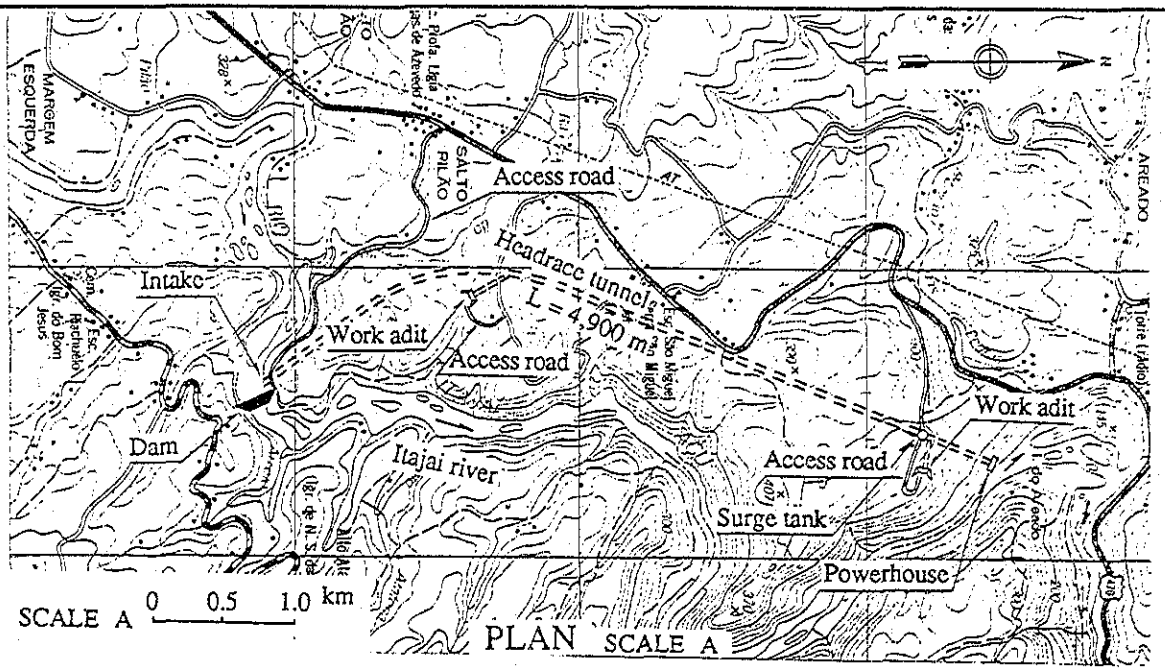


Fig. VI.9.2 GENERAL LAYOUT FOR SALTO PILAO (1) SCHEME (3/3)



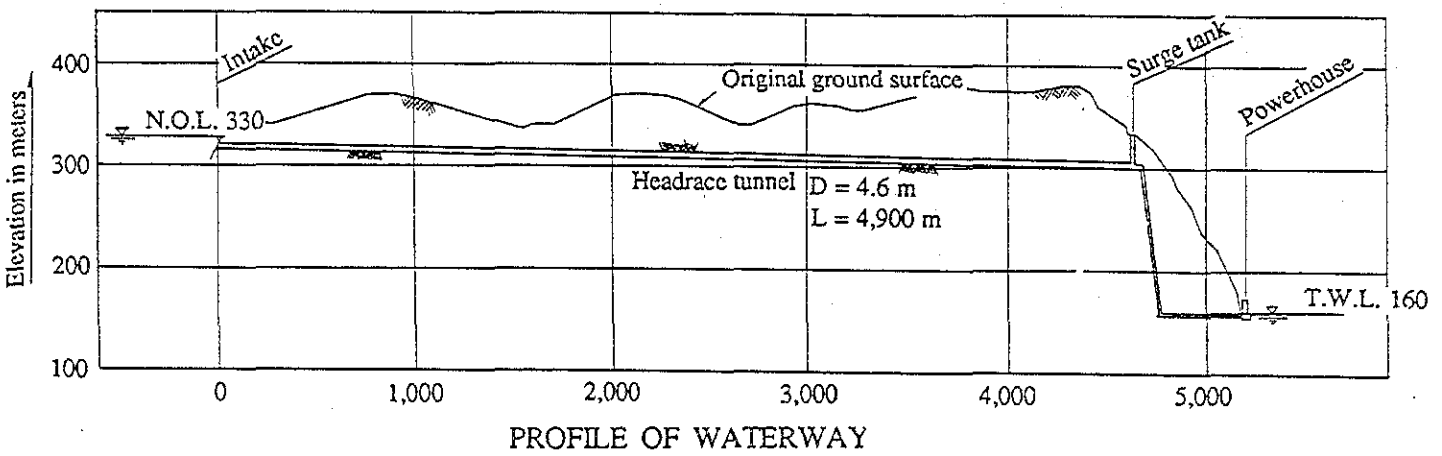
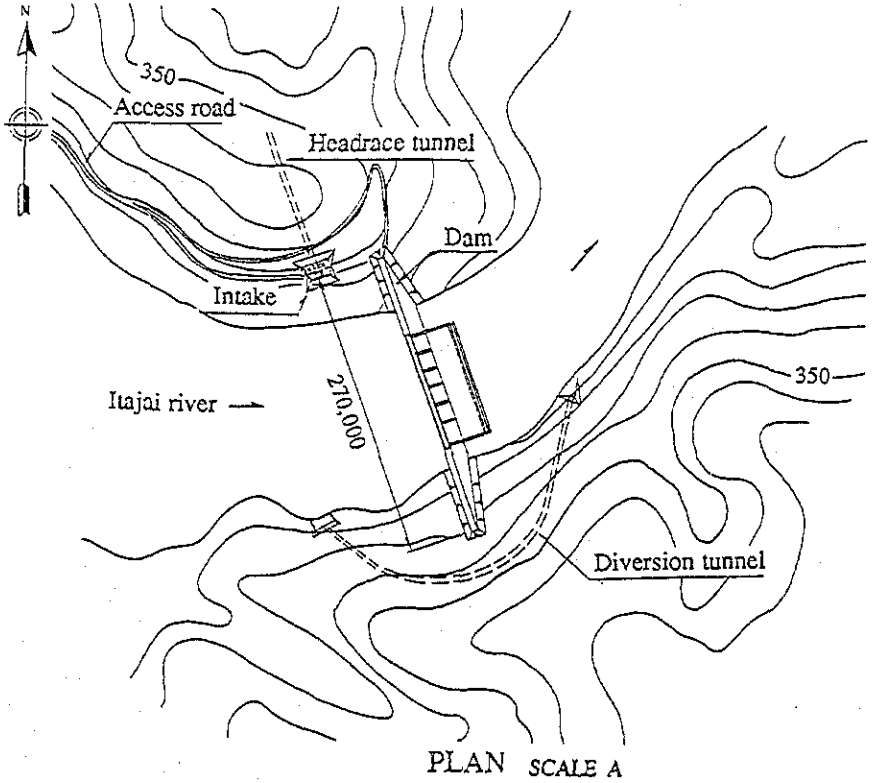
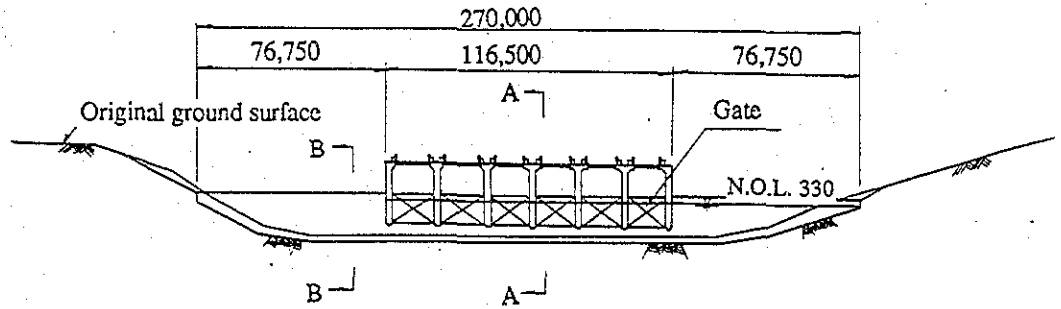


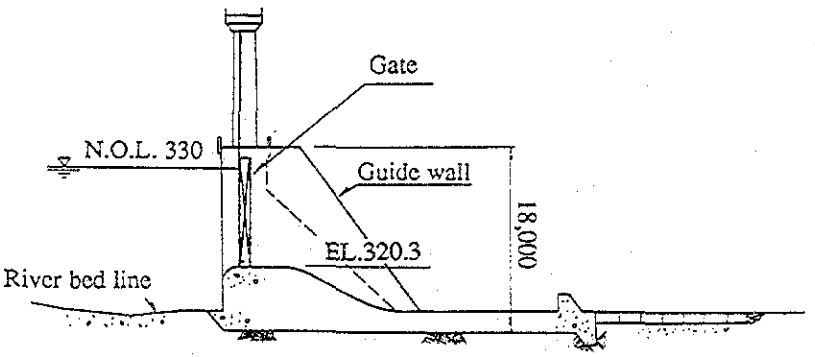
Fig. VI.9.3 GENERAL LAYOUT FOR SALTO PILAO (2) SCHEME (1/3)



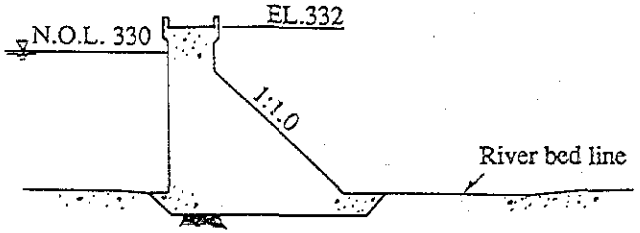
PLAN SCALE A



UPSTREAM ELEVATION
SCALE B



SECTION A-A
SCALE C



SECTION B-B
SCALE C

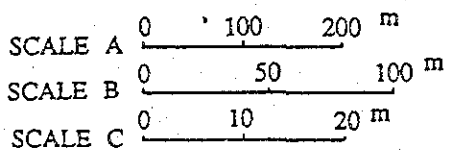


Fig. VI.9.3 GENERAL LAYOUT FOR SALTO PILAO (2) SCHEME (2/3)

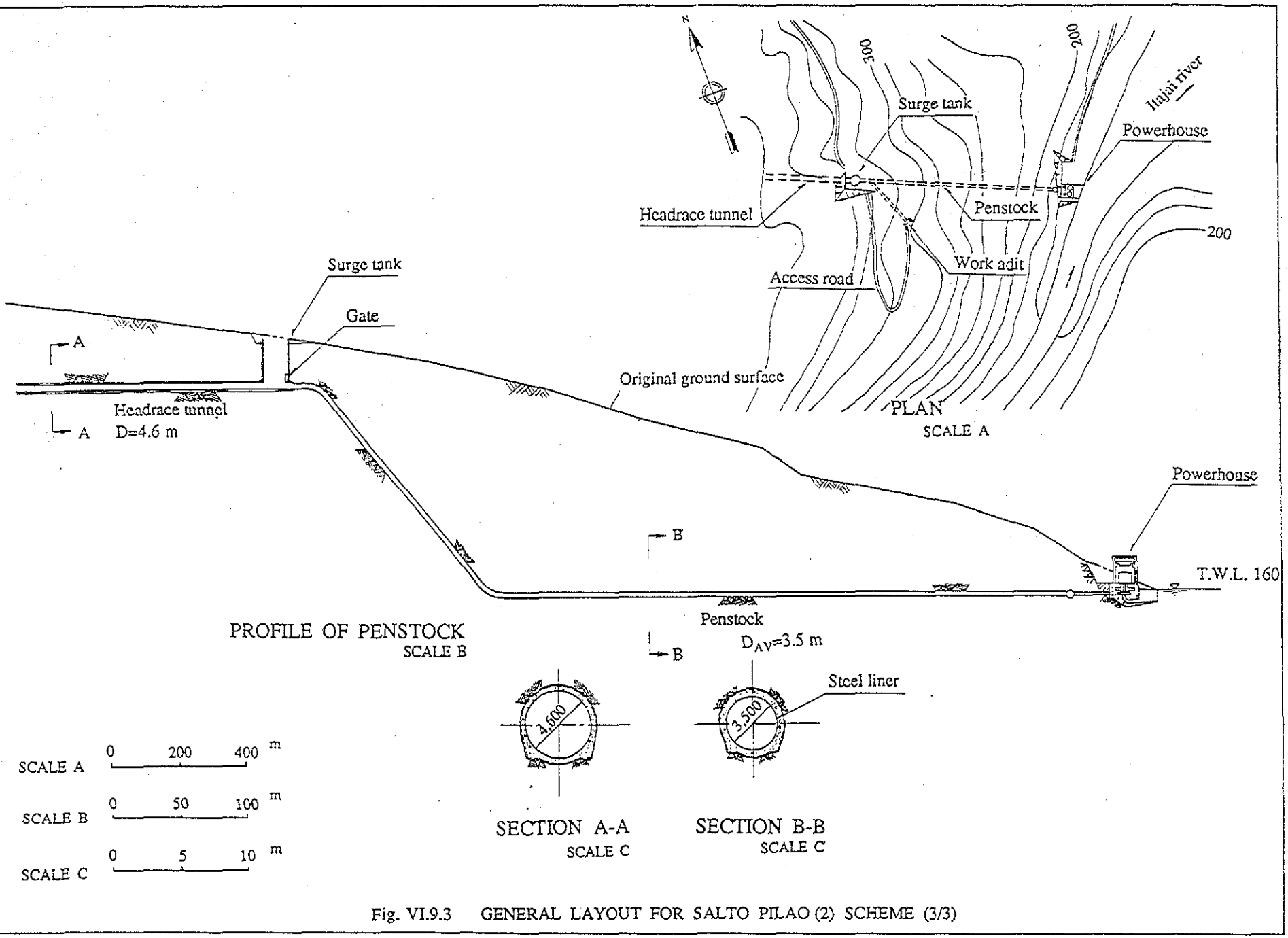
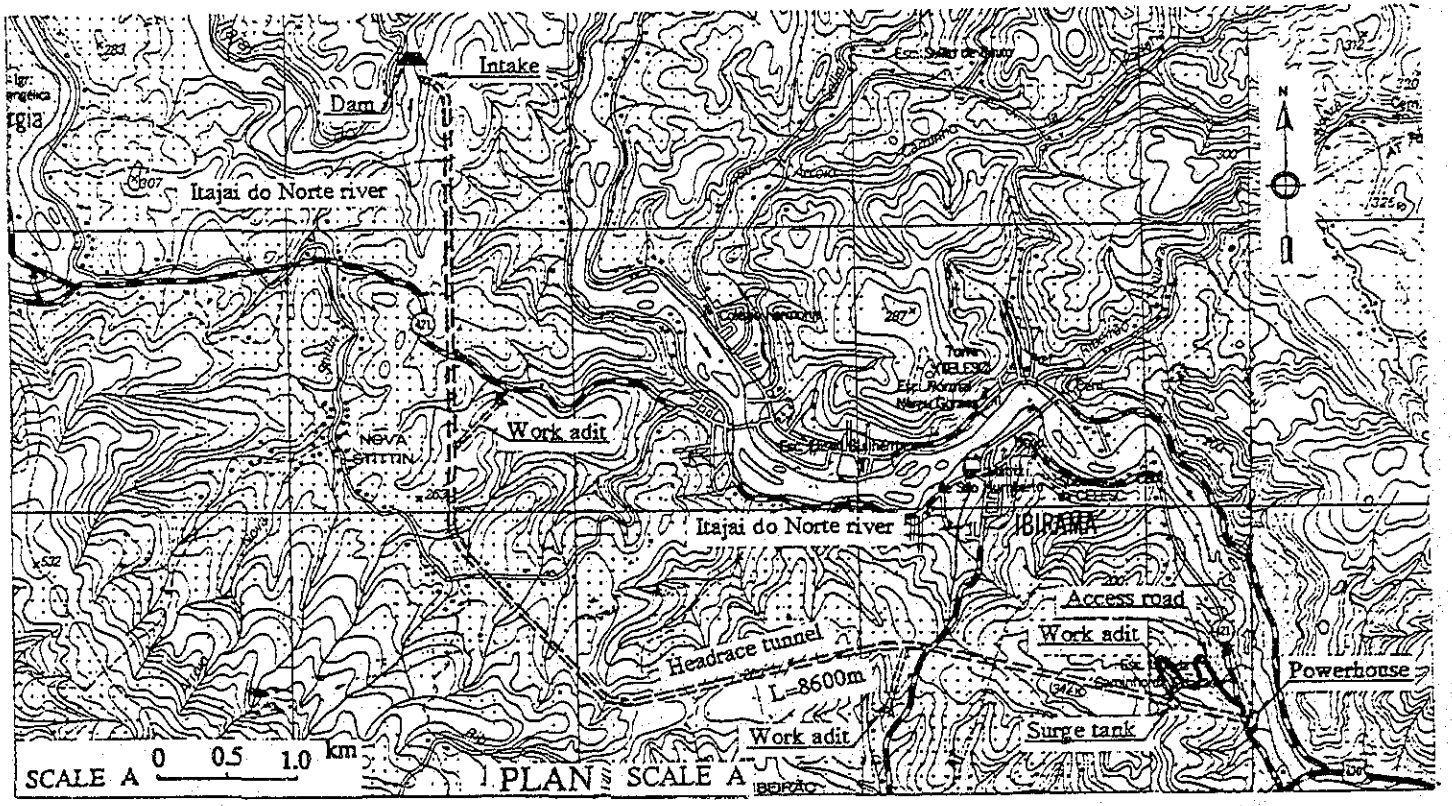


Fig. VI.9.3 GENERAL LAYOUT FOR SALTO PILAO (2) SCHEME (3/3)



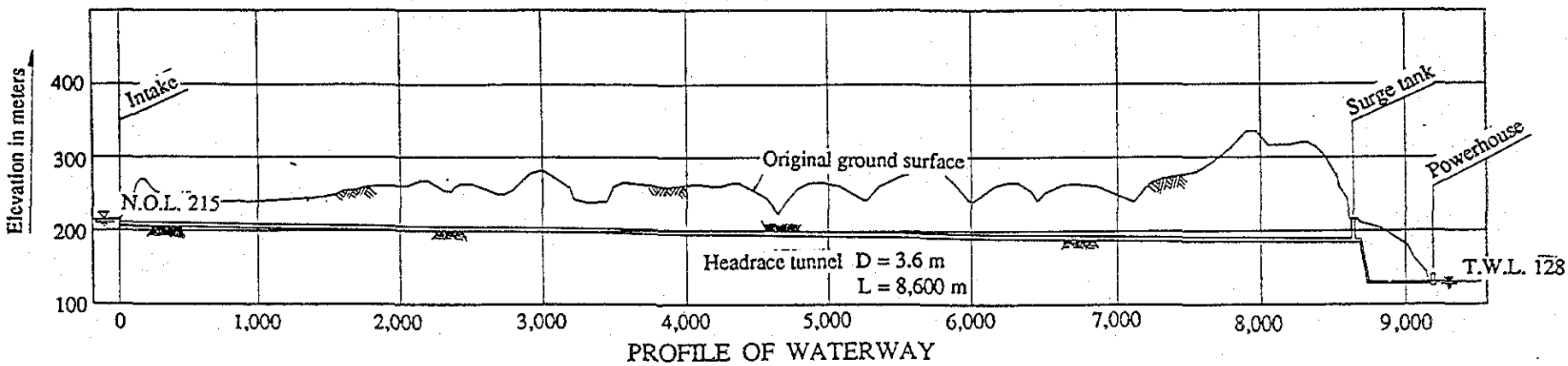
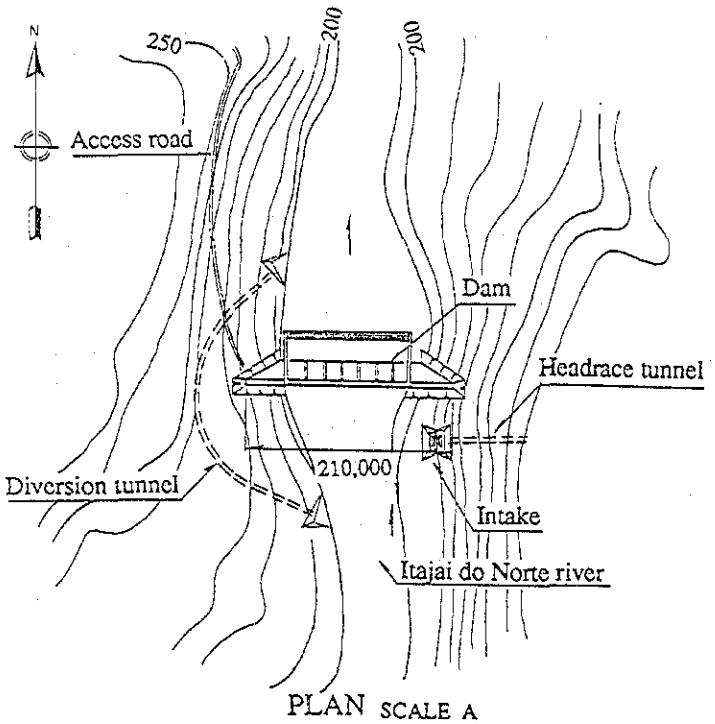
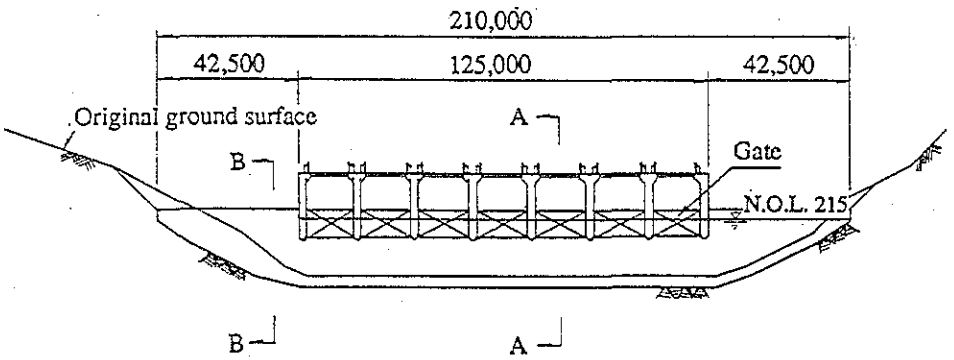


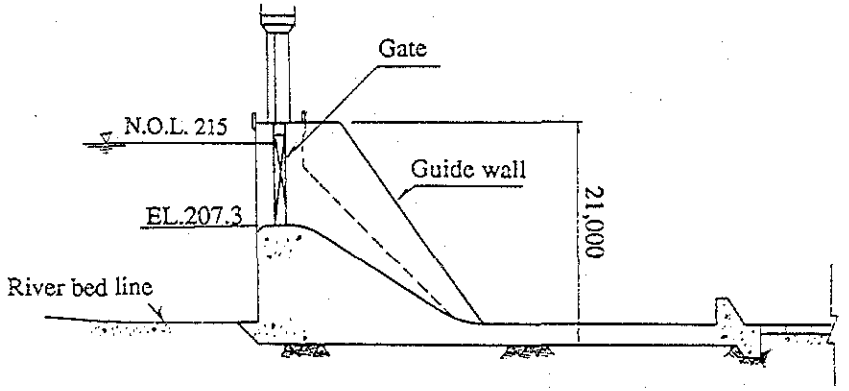
Fig. VI.9.4 GENERAL LAYOUT FOR DALBERGIA SCHEME (1/3)



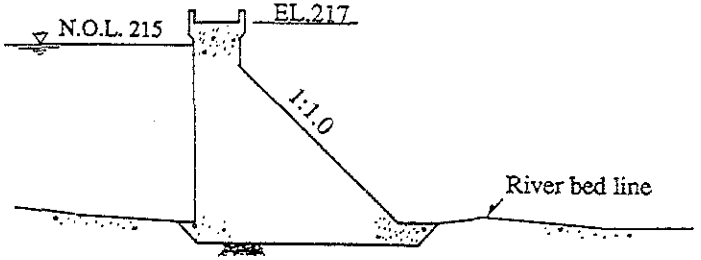
PLAN SCALE A



UPSTREAM ELEVATION
SCALE B



SECTION A-A
SCALE C



SECTION B-B
SCALE C

SCALE A 0 100 200 m
SCALE B 0 50 100 m
SCALE C 0 10 20 m

Fig. VI.9.4 GENERAL LAYOUT FOR DALBERGIA SCHEME (2/3)

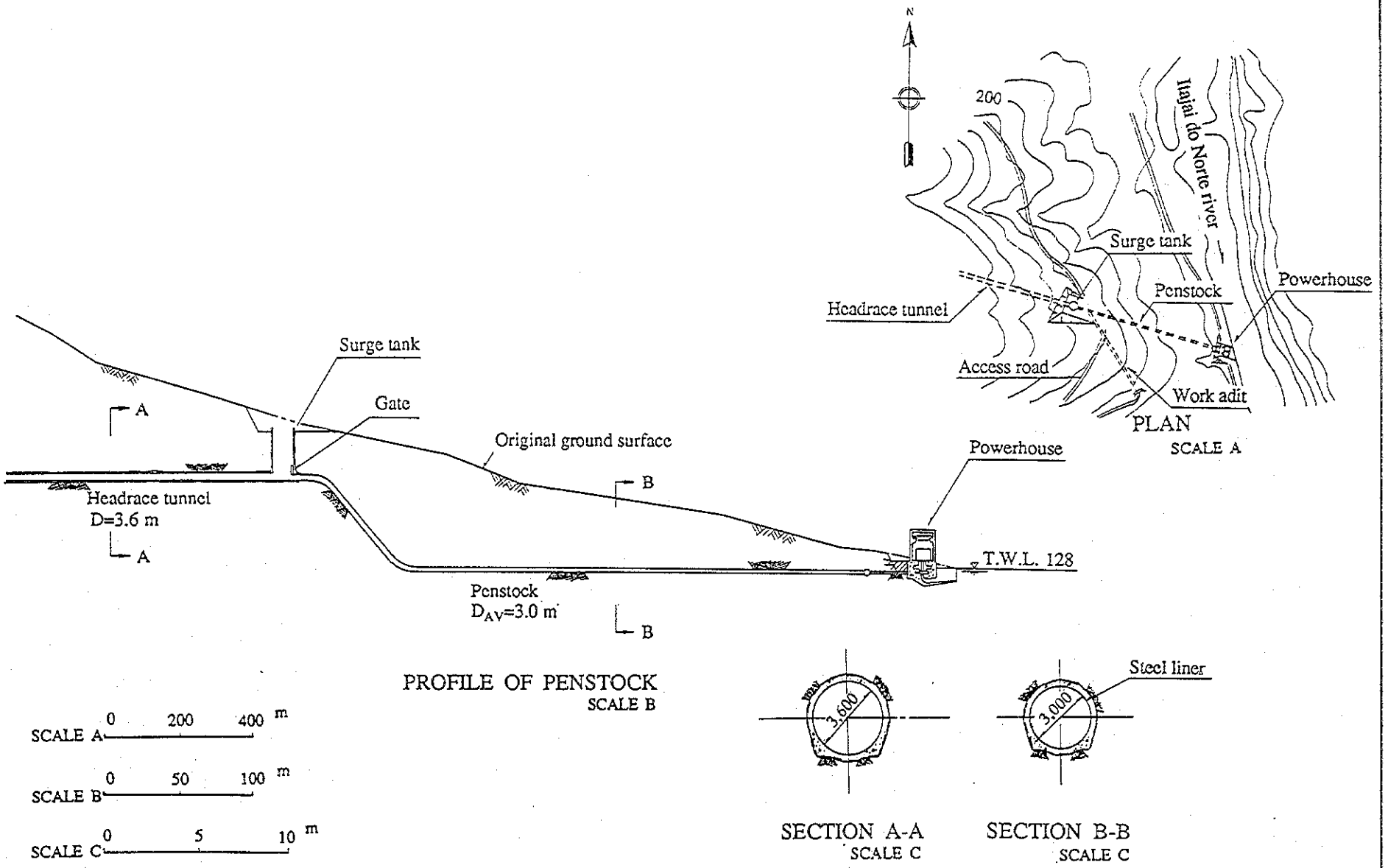
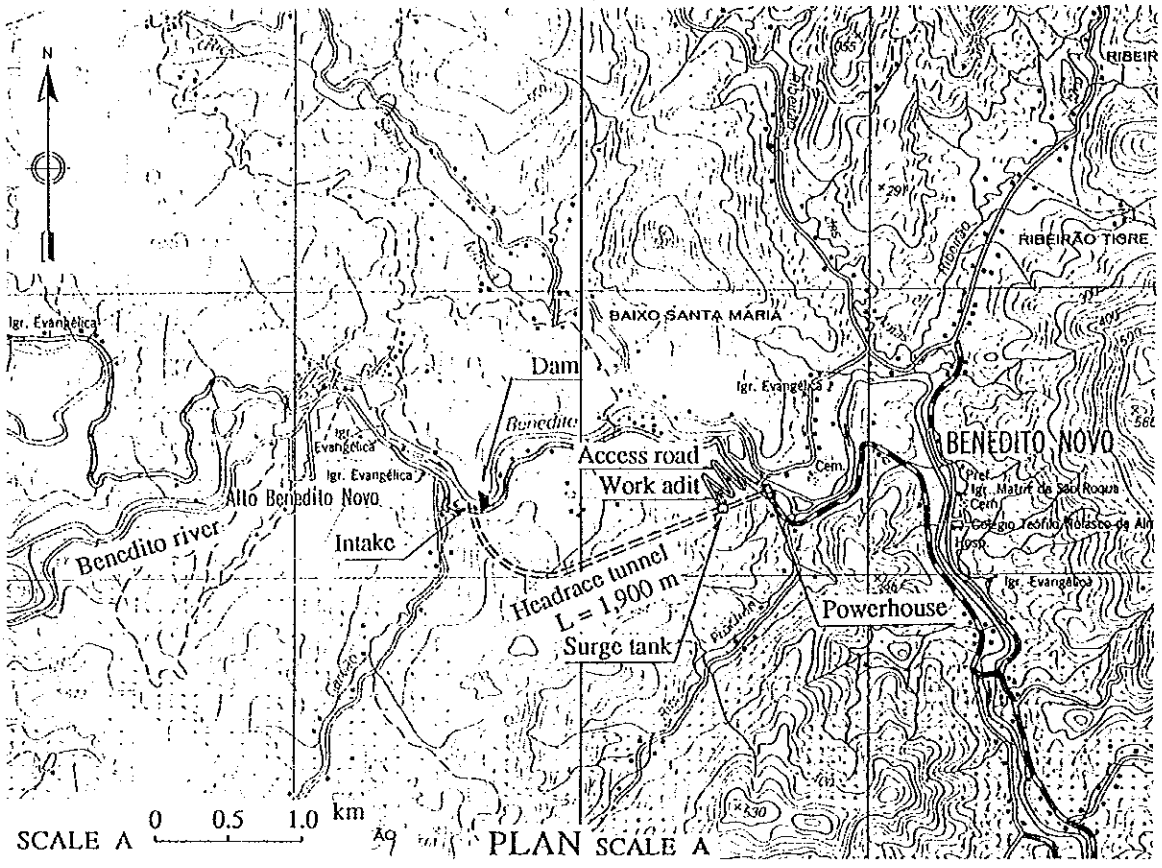
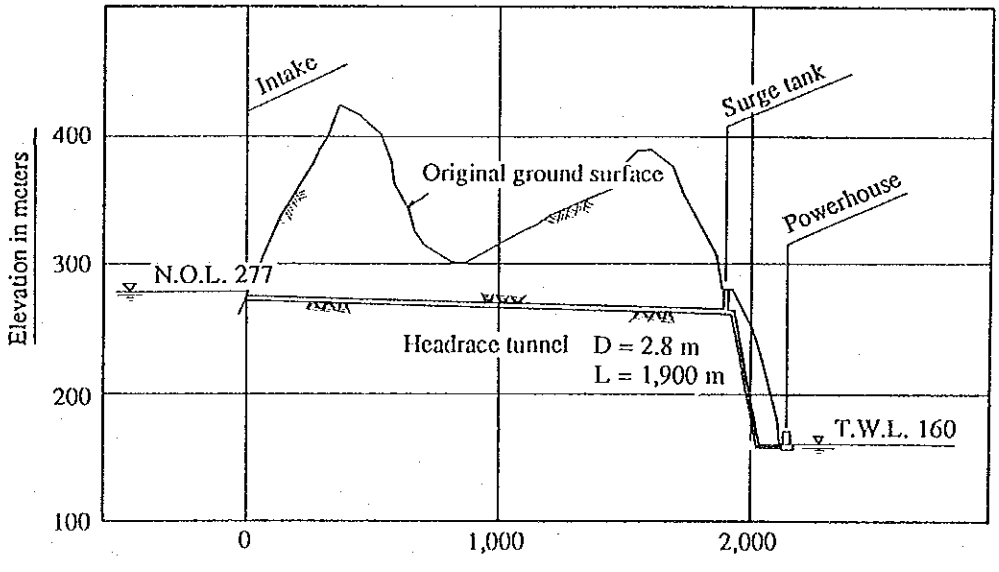


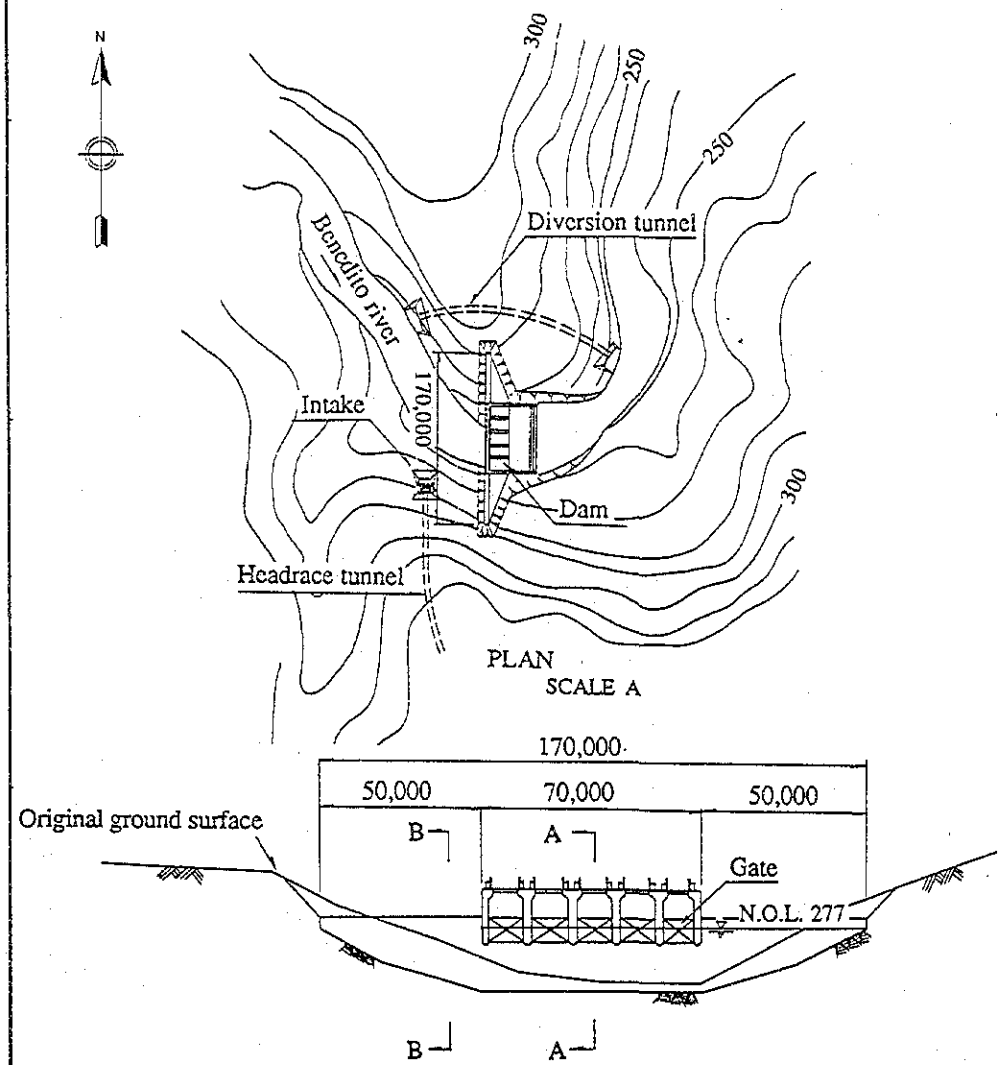
Fig. VI.9.4 GENERAL LAYOUT FOR DALBERGIA SCHEME (3/3)

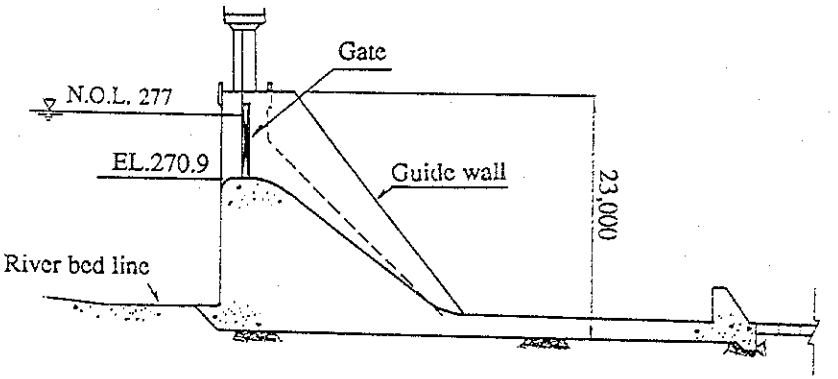


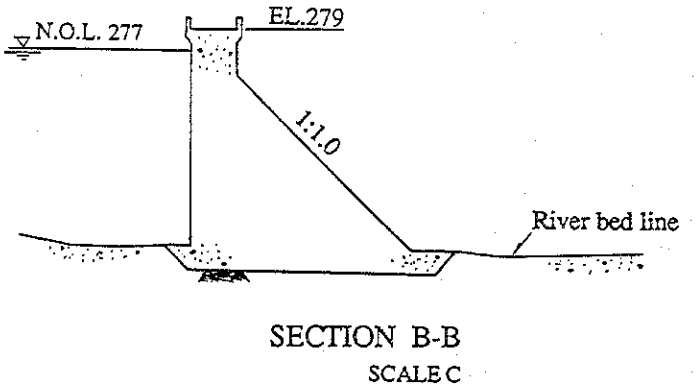


PROFILE OF WATERWAY

Fig. VI.9.5 GENERAL LAYOUT FOR BENEDITO NOVO SCHEME (1/3)





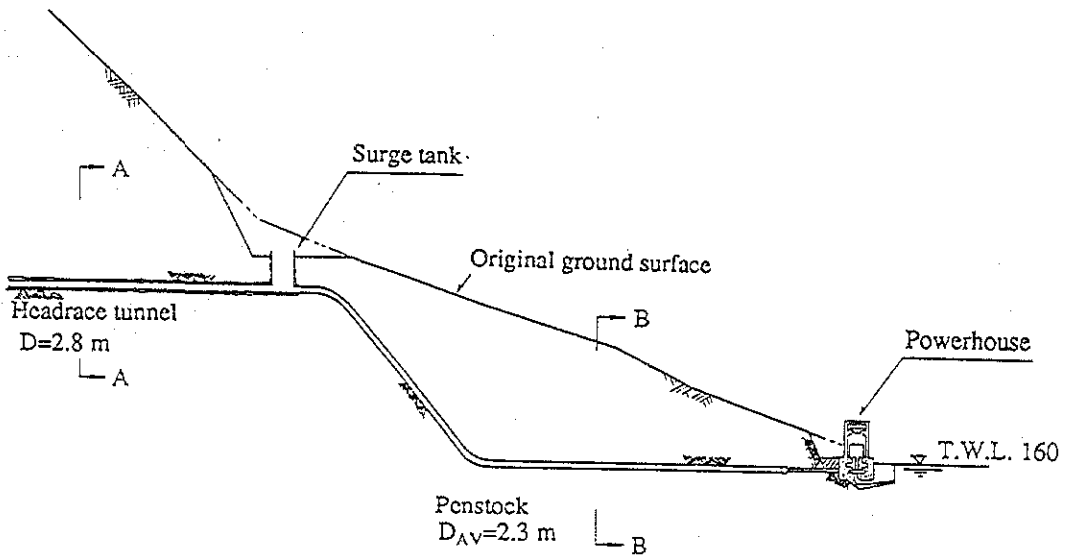


SCALE A 0 100 200 m

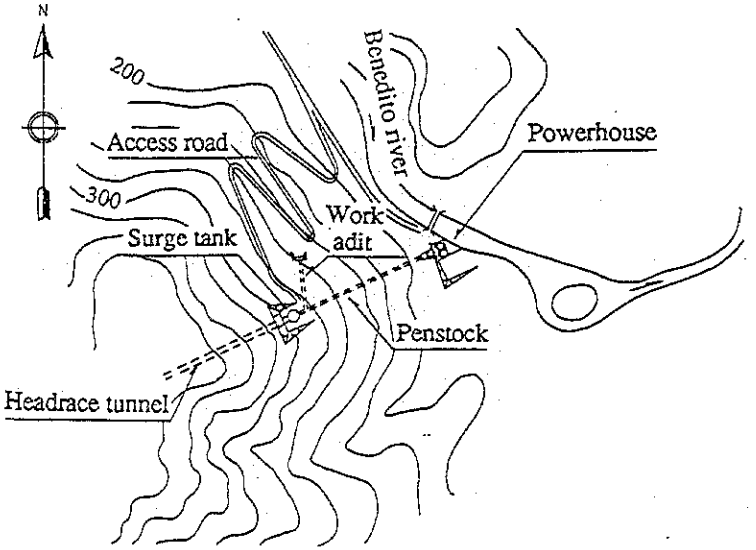
SCALE B 0 50 100 m

SCALE C 0 10 20 m

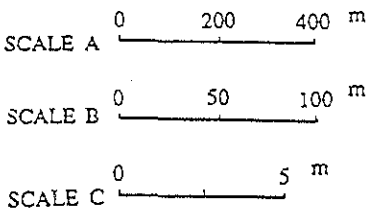
Fig. VI.9.5 GENERAL LAYOUT FOR BENEDITO NOVO SCHEME (2/3)

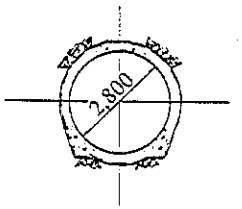


PROFILE OF PENSTOCK
SCALE B

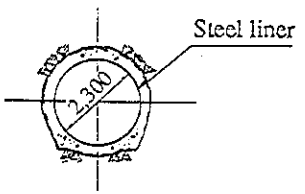


PLAN
SCALE A



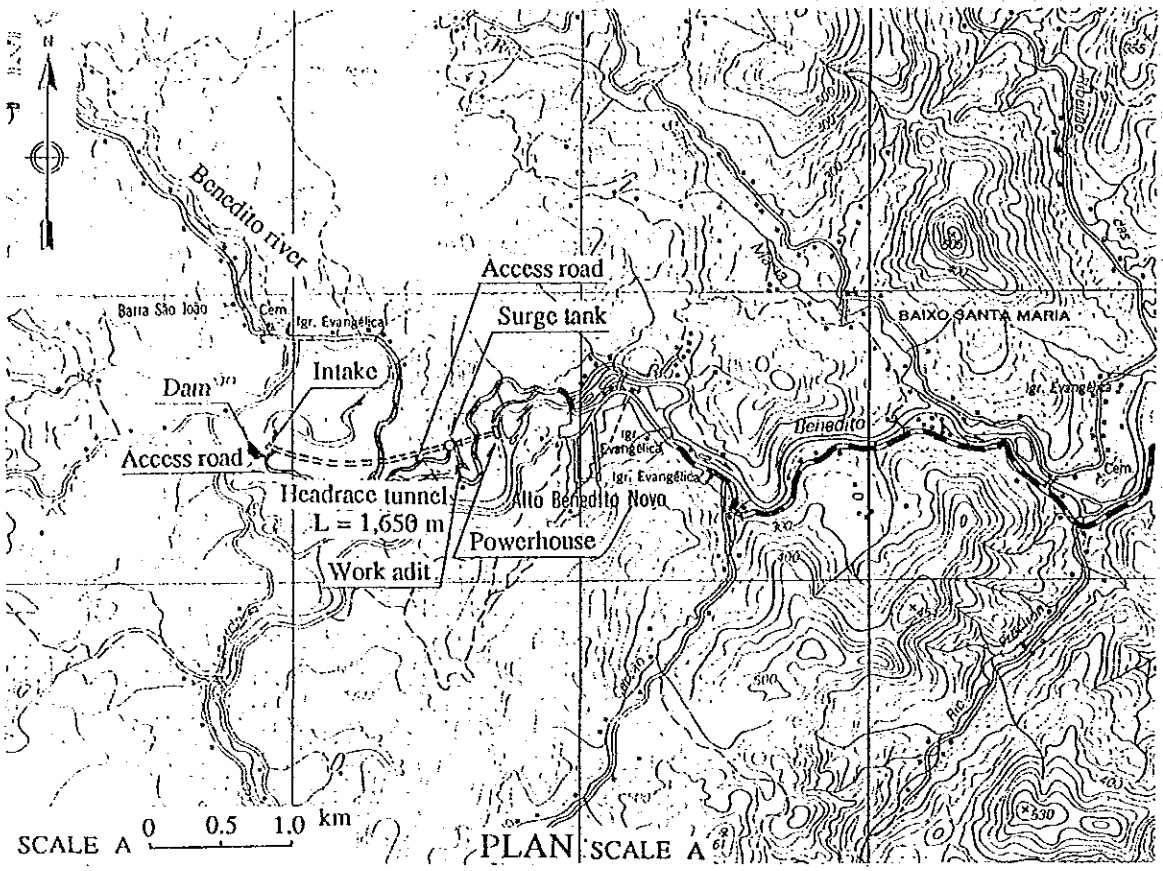


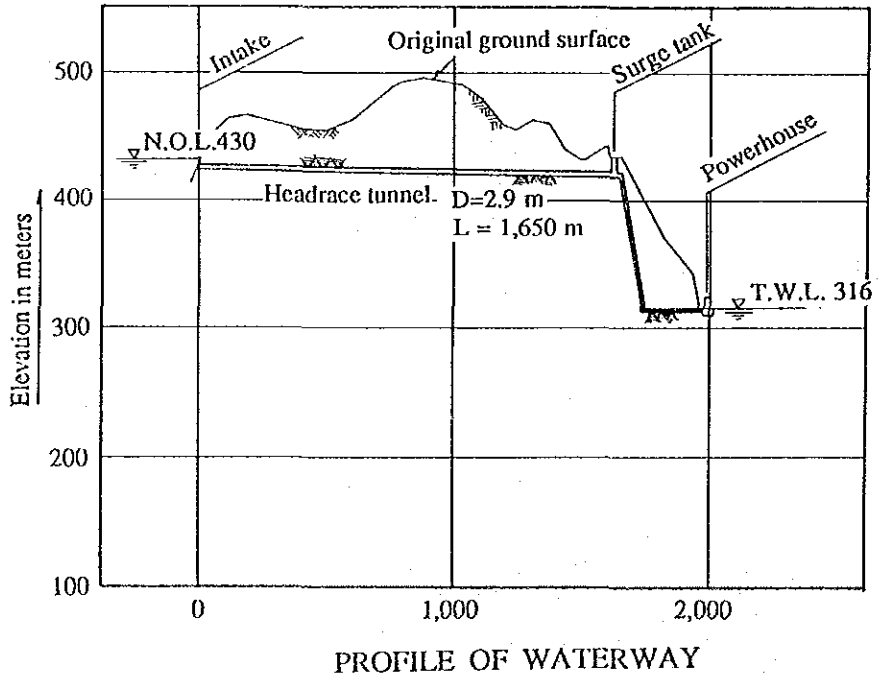
SECTION A-A
SCALE C



SECTION B-B
SCALE C

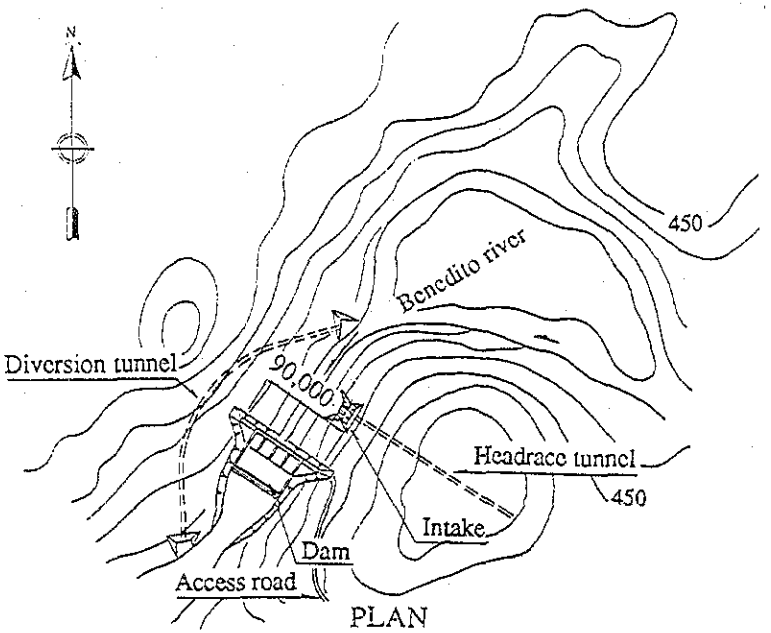
Fig. VI.9.5 GENERAL LAYOUT FOR BENEDITO NOVO SCHEME (3/3)



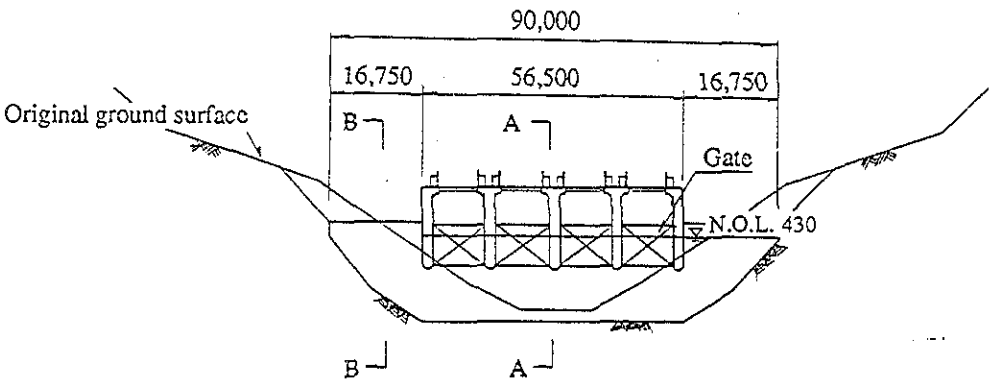


PROFILE OF WATERWAY

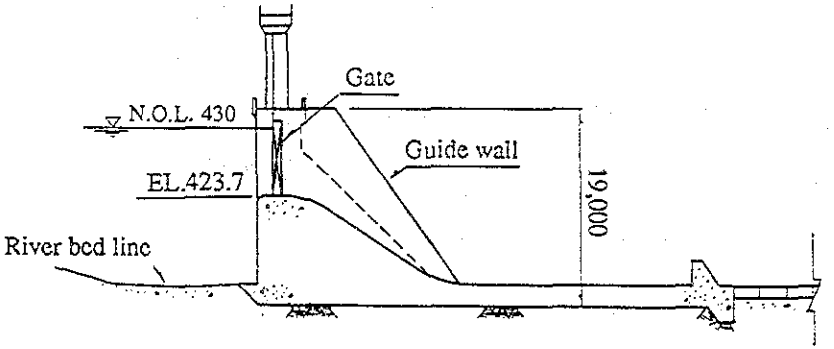
Fig. VI.9.6 GENERAL LAYOUT FOR ALTO BENEDITO NOVO SCHEME (1/3)



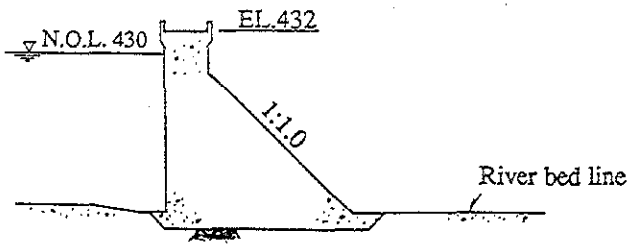
PLAN
SCALE A



UPSTREAM ELEVATION
SCALE B



SECTION A-A
SCALE C



SECTION B-B
SCALE C

SCALE A 0 100 200 m
SCALE B 0 50 100 m
SCALE C 0 10 20 m

Fig. VI.9.6 GENERAL LAYOUT FOR ALTO BENEDITO NOVO SCHEME (2/3)

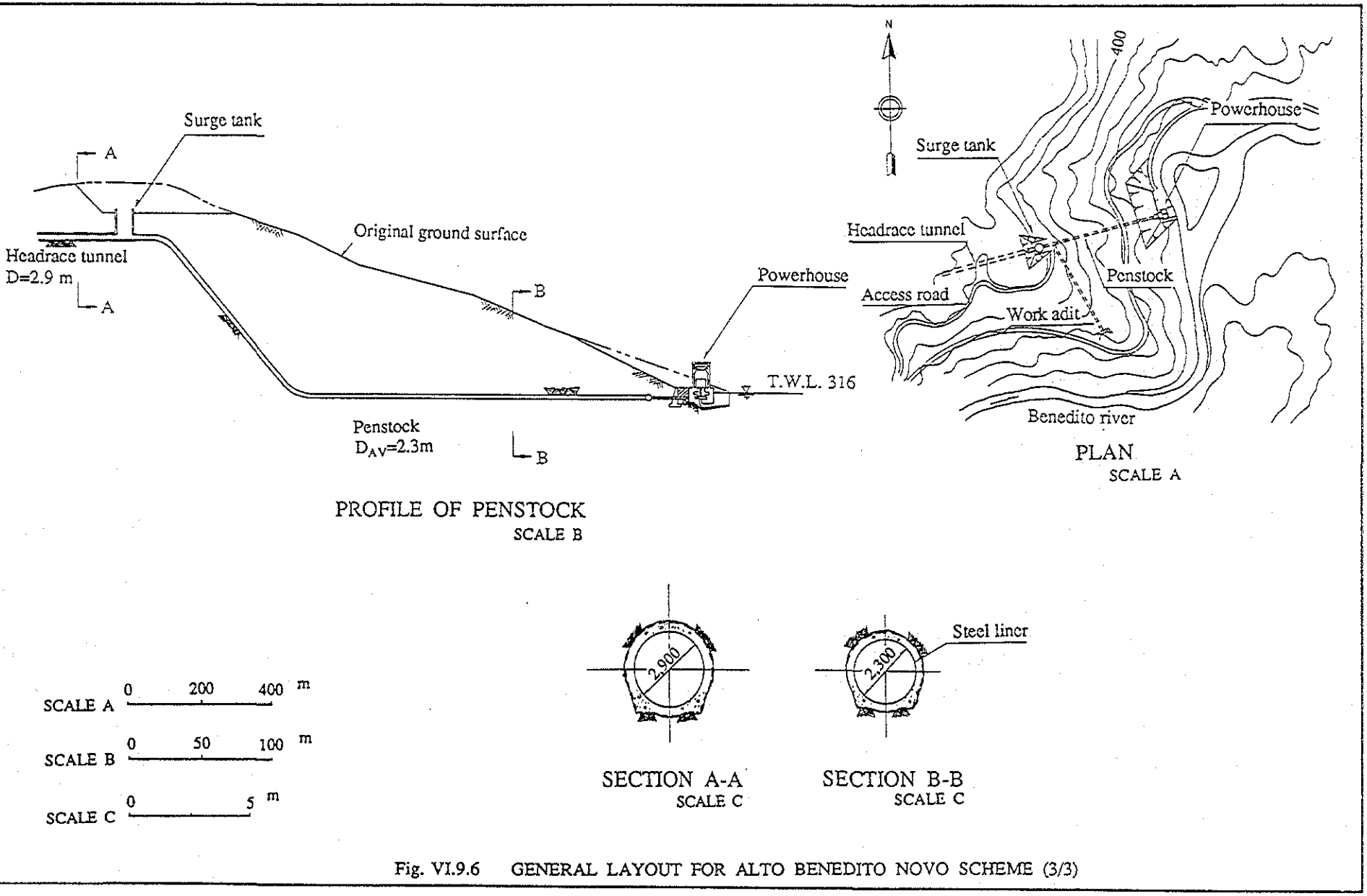


Fig. VI.9.6 GENERAL LAYOUT FOR ALTO BENEDITO NOVO SCHEME (3/3)

Name of Scheme	Power / Energy		Year	1992	1993	1994	1995	1996	1997	1998	1999	2000	Total
	(MW)	(GWh)											
Salto Pilao (1)	119	758	Work Items	F/S	L.P.	D/D	L.P. & T/C		Construction			▼	
			Annual disbursement (Mill. US $)	1.5		2.7			24.5	36.8	49.0	12.3	126.8

Name of Scheme	Power / Energy		Year	2002	2003	2004	2005	2006	2007	2008	2009	2010	Total
	(MW)	(GWh)											
Dalbergia	16	110	Work Items	F/S	L.P.	D/D	L.P. & T/C		Construction			▼	
			Annual disbursement (Mill. US $)	1.5		2.7			13.0	19.6	26.1	6.5	69.4

Name of Scheme	Power / Energy		Year	1993	1994	1995	1996	1997	1998	1999	2000		Total
	(MW)	(GWh)											
Benedito Novo	13	70	Work Items	F/S	L.P.	D/D	L.P. & T/C		Construction		▼		
			Annual disbursement (Mill. US $)	1.5		2.7			7.9	10.6	7.9		30.6

Notes
F/S : Feasibility Study
L.P. : Loan Procedure
D/D : Detailed Design
T/C : Tendering and Contract
▼ : Commissioning of Power Plant

Fig. VI.10.1 PROPOSED ORDERLY POWER DEVELOPMENT PROGRAM AND ANNUAL DISBURSEMENT SCHEDULE FOR THREE SCHEMES

ATTACHMENT

ATTACHMENT. RESULT OF ALTERNATIVE STUDY

TABLE OF CONTENTS

Scheme No. : 1
Project Name : Salto Pilao (1)
Type : Run-Of-River
Name of River : Itajai

****
* SUMMARY TABLE OF OUTPUTS *
****

Catchment Area	(km2) :	5597.0
Average Runoff for Long Term	(m3/s) :	109.9
Average Runoff for Critical Period	(m3/s) :	91.1
Normal Water Level	(m) :	330.0
Tail Water Level	(m) :	113.0
Pondage Capacity	(Mil. m3) :	25.4
Pondage Area	(km2) :	4.65

		Development Ratio					
Plant Discharge		0.5	0.6	0.7	0.8	0.9	1.0
Peak Discharge	(m3/s)	131.0	96.0	71.9	52.6	34.5	7.3
Firm Discharge	(m3/s)	65.4	57.7	50.3	42.1	31.0	7.3
Power Output							
Gross Head	(m)	217.0	217.0	217.0	217.0	217.0	217.0
Average Net Head	(m)	199.0	199.0	199.0	199.0	199.0	199.0
Firm Capacity	(MW)	107.2	94.5	82.3	68.9	50.8	12.0
Installed Capacity	(MW)	214.6	157.3	117.8	86.2	56.5	12.0
Firm Energy	(GWh)	939.0	827.6	721.3	603.5	445.1	104.8
Guaranteed Energy	(GWh)	845.1	744.8	649.1	543.1	400.6	94.3
Secondary Energy	(GWh)	142.6	104.5	69.5	40.0	18.6	0.0
Cost Estimate							
Dam	(Mil. US$)	7.2	7.2	7.2	7.5	7.7	8.4
Diversion Work	(Mil. US$)	0.6	0.6	0.7	0.7	0.7	0.9
Intake	(Mil. US$)	1.4	1.1	0.8	0.6	0.4	0.1
Headrace Tunnel	(Mil. US$)	54.4	41.8	33.1	26.0	18.9	8.1
Surge Tank	(Mil. US$)	4.1	3.1	2.4	1.8	1.2	0.4
Penstock Tunnel	(Mil. US$)	9.1	7.3	6.0	4.8	3.6	1.5
Powerhouse	(Mil. US$)	14.4	10.8	8.3	6.2	4.2	1.1
Generating Equipment	(Mil. US$)	41.8	33.3	24.8	19.2	14.2	4.8
T/L & S/S	(Mil. US$)	4.7	4.7	4.7	4.7	4.7	4.7
Access Road	(Mil. US$)	0.5	0.5	0.5	0.5	0.5	0.5
Land Slide Protet	(Mil. US$)	0.0	0.0	0.0	0.0	0.0	0.0
Miscellaneous Cost	(Mil. US$)	4.1	3.2	2.6	2.0	1.5	0.8
Direct Cost	(Mil. US$)	142.4	113.7	91.0	74.2	57.9	31.3
Compensation	(Mil. US$)	1.3	1.3	1.3	1.3	1.3	1.3
Administration	(Mil. US$)	7.1	5.7	4.6	3.7	2.9	1.6
Engineering Service	(Mil. US$)	4.1	4.1	4.1	4.1	4.1	4.1
Physical Contingency	(Mil. US$)	21.4	17.1	13.7	11.1	8.7	4.7
Project Cost	(Mil. US$)	176.3	141.9	114.6	94.4	74.8	43.0
Evaluation Indices							
Unit Cost of Guaranteed Energy	(US$/MWh)	19.4	17.8	16.7	16.8	18.4	46.0

Scheme No. : 2
Project Name : Salto Pilao (2)
Type : Run-Of-River
Name of River : Itajai

****
* SUMMARY TABLE OF OUTPUTS *
****

Catchment Area	(km2) :	5597.0
Average Runoff for Long Term	(m3/s) :	109.9
Average Runoff for Critical Period	(m3/s) :	91.1
Normal Water Level	(m) :	330.0
Tail Water Level	(m) :	160.0
Pondage Capacity	(Mil. m3) :	25.4
Pondage Area	(km2) :	4.65

		Development Ratio					
Plant Discharge		0.5	0.6	0.7	0.8	0.9	1.0
Peak Discharge	(m3/s)	131.0	96.0	71.9	52.6	34.5	7.3
Firm Discharge	(m3/s)	65.4	57.7	50.3	42.1	31.0	7.3
Power Output							
Gross Head	(m)	170.0	170.0	170.0	170.0	170.0	170.0
Average Net Head	(m)	155.0	155.0	155.0	155.0	155.0	155.0
Firm Capacity	(MW)	83.5	73.6	64.1	53.7	39.6	9.3
Installed Capacity	(MW)	167.2	122.5	91.7	67.1	44.0	9.3
Firm Energy	(GWh)	731.4	644.6	561.8	470.0	346.7	81.6
Guaranteed Energy	(GWh)	658.3	580.1	505.6	423.0	312.0	73.4
Secondary Energy	(GWh)	111.1	81.4	54.1	31.2	14.5	0.0
Cost Estimate							
Dam	(Mil. US$)	7.2	7.2	7.2	7.5	7.7	8.4
Diversion Work	(Mil. US$)	0.6	0.6	0.7	0.7	0.7	0.9
Intake	(Mil. US$)	1.4	1.1	0.8	0.6	0.4	0.1
Headrace Tunnel	(Mil. US$)	40.1	30.8	24.4	19.2	13.9	6.0
Surge Tank	(Mil. US$)	3.7	2.8	2.1	1.6	1.1	0.4
Penstock Tunnel	(Mil. US$)	10.0	8.0	6.6	5.3	4.0	1.6
Powerhouse	(Mil. US$)	12.4	9.3	7.2	5.4	3.7	0.8
Generating Equipment	(Mil. US$)	36.5	27.9	23.1	17.1	12.0	3.6
T/L & S/S	(Mil. US$)	3.5	3.5	3.5	3.5	3.5	3.5
Access Road	(Mil. US$)	0.8	0.8	0.8	0.8	0.8	0.8
Land Slide Protet	(Mil. US$)	0.0	0.0	0.0	0.0	0.0	0.0
Miscellaneous Cost	(Mil. US$)	3.3	2.6	2.1	1.7	1.3	0.7
Direct Cost	(Mil. US$)	119.5	94.6	78.4	63.4	49.2	26.6
Compensation	(Mil. US$)	1.3	1.3	1.3	1.3	1.3	1.3
Administration	(Mil. US$)	6.0	4.7	3.9	3.2	2.5	1.3
Engineering Service	(Mil. US$)	3.3	3.3	3.3	3.3	3.3	3.3
Physical Contingency	(Mil. US$)	17.9	14.2	11.8	9.5	7.4	4.0
Project Cost	(Mil. US$)	148.0	118.2	98.7	80.7	63.7	36.5
Evaluation Indices							
Unit Cost of Guaranteed Energy	(US$/MWh)	21.0	19.2	18.6	18.5	20.1	50.2

Scheme No. : 3
Project Name : Ibirama
Type : Run-Of-River
Name of River : Itajai

****
* SUMMARY TABLE OF OUTPUTS *
****

Catchment Area	(km2) :	9041.0
Average Runoff for Long Term	(m3/s) :	158.4
Average Runoff for Critical Period	(m3/s) :	130.1
Normal Water Level	(m) :	137.0
Tail Water Level	(m) :	82.0
Pondage Capacity	(Mil. m3) :	5.0
Pondage Area	(km2) :	0.75

		Development Ratio					
Plant Discharge		0.5	0.6	0.7	0.8	0.9	1.0
Peak Discharge	(m3/s)	192.0	142.0	106.8	78.6	52.7	11.2
Firm Discharge	(m3/s)	95.9	85.2	74.7	62.8	47.4	11.2
Power Output							
Gross Head	(m)	55.0	55.0	55.0	55.0	55.0	55.0
Average Net Head	(m)	38.0	38.0	38.0	38.0	38.0	38.0
Firm Capacity	(MW)	30.0	26.7	23.4	19.6	14.8	3.5
Installed Capacity	(MW)	60.1	44.4	33.4	24.6	16.5	3.5
Firm Energy	(GWh)	262.8	233.5	204.6	172.1	129.8	30.7
Guaranteed Energy	(GWh)	236.5	210.1	184.1	154.9	116.9	27.6
Secondary Energy	(GWh)	76.9	67.5	50.6	32.4	13.5	0.0
Cost Estimate							
Dam	(Mil. US$)	10.9	11.0	10.8	10.4	11.0	10.8
Diversion Work	(Mil. US$)	1.0	1.0	1.0	1.1	1.2	1.4
Intake	(Mil. US$)	2.0	1.5	1.2	0.9	0.6	0.2
Headrace Tunnel	(Mil. US$)	113.6	85.2	66.6	51.9	38.0	12.5
Surge Tank	(Mil. US$)	6.8	5.1	3.9	3.0	2.0	0.5
Penstock Tunnel	(Mil. US$)	6.5	5.3	4.4	3.6	2.7	1.0
Powerhouse	(Mil. US$)	7.9	6.0	4.6	3.5	2.5	0.6
Generating Equipment	(Mil. US$)	26.9	21.6	16.8	11.9	9.7	2.9
T/L & S/S	(Mil. US$)	3.5	3.5	3.5	3.5	3.5	3.5
Access Road	(Mil. US$)	2.0	2.0	2.0	2.0	2.0	2.0
Land Slide Protet	(Mil. US$)	0.0	0.0	0.0	0.0	0.0	0.0
Miscellaneous Cost	(Mil. US$)	7.0	5.4	4.3	3.4	2.6	1.2
Direct Cost	(Mil. US$)	188.1	147.6	119.2	95.1	75.8	36.4
Compensation	(Mil. US$)	2.5	2.5	2.5	2.5	2.5	2.5
Administration	(Mil. US$)	9.4	7.4	6.0	4.8	3.8	1.8
Engineering Service	(Mil. US$)	4.8	4.8	4.8	4.8	4.8	4.8
Physical Contingency	(Mil. US$)	28.2	22.1	17.9	14.3	11.4	5.5
Project Cost	(Mil. US$)	233.0	184.4	150.4	121.4	98.2	51.1
Evaluation Indices							
Unit Cost of Guaranteed Energy	(US$/MWh)	96.2	85.3	79.6	77.0	83.7	186.5

Scheme No. : 4
Project Name : Subida
Type : Run-Of-River
Name of River : Itajai

****
* SUMMARY TABLE OF OUTPUTS *
****

Catchment Area	(km2) :	9147.0
Average Runoff for Long Term	(m3/s) :	160.2
Average Runoff for Critical Period	(m3/s) :	131.6
Normal Water Level	(m) :	105.0
Tail Water Level	(m) :	82.0
Pondage Capacity	(Mil. m3) :	3.0
Pondage Area	(km2) :	0.60

		Development Ratio					
Plant Discharge		0.5	0.6	0.7	0.8	0.9	1.0
Peak Discharge	(m3/s)	194.0	144.0	108.0	79.5	53.0	11.4
Firm Discharge	(m3/s)	97.0	86.3	75.5	63.5	47.7	11.4
Power Output							
Gross Head	(m)	23.0	23.0	23.0	23.0	23.0	23.0
Average Net Head	(m)	14.0	14.0	14.0	14.0	14.0	14.0
Firm Capacity	(MW)	11.2	9.9	8.7	7.3	5.5	1.3
Installed Capacity	(MW)	22.4	16.6	12.4	9.2	6.1	1.3
Firm Energy	(GWh)	98.0	87.2	76.2	64.1	48.2	11.5
Guaranteed Energy	(GWh)	88.2	78.4	68.6	57.7	43.4	10.4
Secondary Energy	(GWh)	28.6	25.2	18.9	12.1	4.9	0.0
Cost Estimate							
Dam	(Mil. US$)	7.9	8.0	7.8	7.4	7.8	4.8
Diversion Work	(Mil. US$)	0.4	0.4	0.4	0.5	0.5	0.6
Intake	(Mil. US$)	2.1	1.6	1.2	0.9	0.6	0.2
Headrace Tunnel	(Mil. US$)	62.8	47.1	36.7	28.6	20.8	6.9
Surge Tank	(Mil. US$)	5.6	4.2	3.2	2.4	1.7	0.4
Penstock Tunnel	(Mil. US$)	3.9	3.1	2.5	2.0	1.5	0.6
Powerhouse	(Mil. US$)	4.6	3.5	2.7	2.1	1.3	0.4
Generating Equipment	(Mil. US$)	17.1	14.2	10.9	8.6	5.9	2.1
T/L & S/S	(Mil. US$)	2.2	2.2	2.2	2.2	2.2	2.2
Access Road	(Mil. US$)	1.7	1.7	1.7	1.7	1.7	1.7
Land Slide Protet	(Mil. US$)	0.0	0.0	0.0	0.0	0.0	0.0
Miscellaneous Cost	(Mil. US$)	4.0	3.1	2.4	1.9	1.5	0.6
Direct Cost	(Mil. US$)	112.1	89.0	71.8	58.3	45.5	20.4
Compensation	(Mil. US$)	1.3	1.3	1.3	1.3	1.3	1.3
Administration	(Mil. US$)	5.6	4.4	3.6	2.9	2.3	1.0
Engineering Service	(Mil. US$)	3.5	3.5	3.5	3.5	3.5	3.5
Physical Contingency	(Mil. US$)	16.8	13.3	10.8	8.7	6.8	3.1
Project Cost	(Mil. US$)	139.3	111.5	90.9	74.7	59.4	29.2
Evaluation Indices							
Unit Cost of Guaranteed Energy	(US$/MWh)	156.1	140.2	130.9	128.5	137.1	284.6

Scheme No. : 5
Project Name : Ascurra
Type : Run-Of-River
Name of River : Itajai

****
* SUMMARY TABLE OF OUTPUTS *
****

Catchment Area	(km2) :	9586.0
Average Runoff for Long Term	(m3/s) :	167.8
Average Runoff for Critical Period	(m3/s) :	137.9
Normal Water Level	(m) :	80.0
Tail Water Level	(m) :	68.0
Pondage Capacity	(Mil. m3) :	35.0
Pondage Area	(km2) :	8.00

		Development Ratio					
Plant Discharge		0.5	0.6	0.7	0.8	0.9	1.0
Peak Discharge	(m3/s)	204.0	151.0	113.0	83.0	55.8	11.9
Firm Discharge	(m3/s)	101.8	90.5	79.1	66.4	50.2	11.9
Power Output							
Gross Head	(m)	12.0	12.0	12.0	12.0	12.0	12.0
Average Net Head	(m)	6.0	6.0	6.0	6.0	6.0	6.0
Firm Capacity	(MW)	5.0	4.5	3.9	3.3	2.5	0.6
Installed Capacity	(MW)	10.1	7.5	5.6	4.1	2.8	0.6
Firm Energy	(GWh)	44.1	39.2	34.2	28.7	21.7	5.1
Guaranteed Energy	(GWh)	39.7	35.2	30.8	25.9	19.5	4.6
Secondary Energy	(GWh)	12.8	11.3	8.5	5.4	2.3	0.0
Cost Estimate							
Dam	(Mil. US$)	8.1	8.1	7.9	7.4	7.9	5.3
Diversion Work	(Mil. US$)	0.3	0.4	0.4	0.4	0.5	0.6
Intake	(Mil. US$)	2.2	1.6	1.3	1.0	0.7	0.2
Headrace Tunnel	(Mil. US$)	41.2	30.7	23.7	18.4	13.5	4.4
Surge Tank	(Mil. US$)	5.0	3.7	2.8	2.1	1.5	0.4
Penstock Tunnel	(Mil. US$)	6.6	5.3	4.2	3.3	2.5	0.9
Powerhouse	(Mil. US$)	3.0	2.4	1.8	1.4	1.0	0.3
Generating Equipment	(Mil. US$)	12.4	9.9	8.1	6.5	4.8	2.0
T/L & S/S	(Mil. US$)	2.1	2.1	2.1	2.1	2.1	2.1
Access Road	(Mil. US$)	0.2	0.2	0.2	0.2	0.2	0.2
Land Slide Protet	(Mil. US$)	0.0	0.0	0.0	0.0	0.0	0.0
Miscellaneous Cost	(Mil. US$)	2.8	2.1	1.7	1.3	1.0	0.5
Direct Cost	(Mil. US$)	83.8	66.4	54.2	44.2	35.6	16.7
Compensation	(Mil. US$)	6.1	6.1	6.1	6.1	6.1	6.1
Administration	(Mil. US$)	4.2	3.3	2.7	2.2	1.8	0.8
Engineering Service	(Mil. US$)	4.1	4.1	4.1	4.1	4.1	4.1
Physical Contingency	(Mil. US$)	12.6	10.0	8.1	6.6	5.3	2.5
Project Cost	(Mil. US$)	110.8	89.9	75.2	63.2	52.9	30.2
Evaluation Indices							
Unit Cost of Guaranteed Energy	(US$/MWh)	278.6	254.1	243.7	244.3	271.9	656.6

Scheme No. : 6
Project Name : Indaial
Type : Run-Of-River
Name of River : Itajai

****
* SUMMARY TABLE OF OUTPUTS *
****

Catchment Area	(km2) :	11493.0
Average Runoff for Long Term	(m3/s) :	220.1
Average Runoff for Critical Period	(m3/s) :	177.1
Normal Water Level	(m) :	54.0
Tail Water Level	(m) :	39.0
Pondage Capacity	(Mil. m3) :	1.0
Pondage Area	(km2) :	0.90

		Development Ratio					
Plant Discharge		0.5	0.6	0.7	0.8	0.9	1.0
Peak Discharge	(m3/s)	263.0	196.0	148.0	110.7	76.0	17.0
Firm Discharge	(m3/s)	131.3	117.7	103.7	88.5	68.4	17.0
Power Output							
Gross Head	(m)	15.0	15.0	15.0	15.0	15.0	15.0
Average Net Head	(m)	11.5	11.5	11.5	11.5	11.5	11.5
Firm Capacity	(MW)	12.4	11.1	9.8	8.4	6.5	1.6
Installed Capacity	(MW)	24.9	18.6	14.0	10.5	7.2	1.6
Firm Energy	(GWh)	108.9	97.6	86.0	73.4	56.7	14.1
Guaranteed Energy	(GWh)	98.0	87.9	77.4	66.0	51.0	12.7
Secondary Energy	(GWh)	21.4	19.3	16.1	11.5	5.5	0.0
Cost Estimate							
Dam	(Mil. US$)	5.8	5.8	5.8	5.8	5.8	5.8
Diversion Work	(Mil. US$)	0.5	0.5	0.5	0.5	0.5	0.5
Intake	(Mil. US$)	6.5	4.7	3.4	2.5	1.6	0.3
Sand Stilling Basin	(Mil. US$)	6.2	4.9	4.0	3.2	2.4	0.7
Headrace Channel	(Mil. US$)	9.6	8.1	6.9	5.8	4.8	2.3
Head Pond	(Mil. US$)	4.0	3.3	2.7	2.3	1.8	0.7
Penstock (open air)	(Mil. US$)	13.9	11.3	9.0	6.9	4.6	1.0
Powerhouse	(Mil. US$)	5.4	4.1	3.2	2.5	1.8	0.5
Generating Equipment	(Mil. US$)	20.0	15.6	12.3	9.8	7.5	2.4
T/L & S/S	(Mil. US$)	2.1	2.1	2.1	2.1	2.1	2.1
Access Road	(Mil. US$)	0.0	0.0	0.0	0.0	0.0	0.0
Land Slide Protet	(Mil. US$)	0.0	0.0	0.0	0.0	0.0	0.0
Miscellaneous Cost	(Mil. US$)	2.5	2.0	1.7	1.4	1.1	0.6
Direct Cost	(Mil. US$)	76.5	62.4	51.6	42.8	33.9	16.8
Compensation	(Mil. US$)	2.7	2.7	2.7	2.7	2.7	2.7
Administration	(Mil. US$)	3.8	3.1	2.6	2.1	1.7	0.8
Engineering Service	(Mil. US$)	3.0	3.0	3.0	3.0	3.0	3.0
Physical Contingency	(Mil. US$)	11.5	9.4	7.7	6.4	5.1	2.5
Project Cost	(Mil. US$)	97.5	80.6	67.7	57.1	46.4	25.9
Evaluation Indices							
Unit Cost of Guaranteed Energy	(US$/MWh)	98.2	90.4	86.1	85.5	90.8	206.2

Scheme No. : 7
Project Name : Dalbergia
Type : Run-Of-River
Name of River : Itajai Do Norte

****
* SUMMARY TABLE OF OUTPUTS *
****

Catchment Area	(km2) :	3212.0
Average Runoff for Long Term	(m3/s) :	52.7
Average Runoff for Critical Period	(m3/s) :	38.7
Normal Water Level	(m) :	215.0
Tail Water Level	(m) :	128.0
Pondage Capacity	(Mil. m3) :	1.6
Pondage Area	(km2) :	1.10

		Development Ratio					
Plant Discharge		0.5	0.6	0.7	0.8	0.9	1.0
Peak Discharge	(m3/s)	51.1	37.3	27.6	19.9	13.0	1.2
Firm Discharge	(m3/s)	25.5	22.4	19.3	15.9	11.7	1.2
Power Output							
Gross Head	(m)	87.0	87.0	87.0	87.0	87.0	87.0
Average Net Head	(m)	70.0	70.0	70.0	70.0	70.0	70.0
Firm Capacity	(MW)	14.7	12.9	11.1	9.2	6.7	0.7
Installed Capacity	(MW)	29.4	21.5	15.9	11.5	7.5	0.7
Firm Energy	(GWh)	128.7	112.9	97.5	80.4	59.0	6.1
Guaranteed Energy	(GWh)	115.9	101.6	87.7	72.4	53.1	5.5
Secondary Energy	(GWh)	21.4	18.2	14.2	8.8	4.2	0.0
Cost Estimate							
Dam	(Mil. US$)	6.5	6.8	7.0	7.0	7.7	7.8
Diversion Work	(Mil. US$)	0.7	0.8	0.8	0.8	0.9	0.9
Intake	(Mil. US$)	0.6	0.5	0.4	0.3	0.2	0.0
Headrace Tunnel	(Mil. US$)	33.1	26.1	20.8	16.3	12.2	10.5
Surge Tank	(Mil. US$)	1.9	1.4	1.1	0.8	0.6	0.3
Penstock Tunnel	(Mil. US$)	4.2	3.4	2.8	2.3	1.7	1.1
Powerhouse	(Mil. US$)	3.4	2.6	2.0	1.5	0.9	0.1
Generating Equipment	(Mil. US$)	10.9	8.4	6.7	5.3	3.7	1.4
T/L & S/S	(Mil. US$)	0.9	0.9	0.9	0.9	0.9	0.9
Access Road	(Mil. US$)	0.9	0.9	0.9	0.9	0.9	0.9
Land Slide Protet	(Mil. US$)	0.0	0.0	0.0	0.0	0.0	0.0
Miscellaneous Cost	(Mil. US$)	2.3	1.9	1.5	1.3	1.0	0.9
Direct Cost	(Mil. US$)	65.5	53.7	45.0	37.5	30.7	24.9
Compensation	(Mil. US$)	0.8	0.8	0.8	0.8	0.8	0.8
Administration	(Mil. US$)	3.3	2.7	2.2	1.9	1.5	1.2
Engineering Service	(Mil. US$)	3.8	3.8	3.8	3.8	3.8	3.8
Physical Contingency	(Mil. US$)	9.8	8.1	6.7	5.6	4.6	3.7
Project Cost	(Mil. US$)	83.1	68.9	58.5	49.5	41.4	34.5
Evaluation Indices							
Unit Cost of Guaranteed Energy	(US$/MWh)	70.5	66.7	65.7	67.8	77.9	638.1

Scheme No. : 8
Project Name : Barra da Pratinha
Type : Reservoir
Name of River : Itajal Do Norte

****
* SUMMARY TABLE OF OUTPUTS *
****

Case No.		:	1
Catchment Area	(km2)	:	1405.0
Average Runoff for Long Term	(m3/s)	:	24.5
Average Runoff for Critical Period	(m3/s)	:	18.0
Firm Discharge	(m3/s)	:	1.8
Peak Discharge	(m3/s)	:	3.6
Effective Storage	(Mil. m3)	:	2.4

Scheme Information		Full Supply Level (m)				
		394.0	384.4	374.9	365.3	355.8
Min. Operating Level	(m)	393.6	383.9	374.2	364.4	354.2
Rated Water Level	(m)	393.9	384.3	374.6	365.0	355.2
Tail Water Level	(m)	326.0	326.0	326.0	326.0	326.0
Reservoir Storage	(Mil. m3)	161.6	109.3	70.1	40.8	20.6
Reservoir Area	(km2)	6.3	4.7	3.4	2.5	1.7
Power Output						
Gross Head	(m)	67.9	58.3	48.6	39.0	29.2
Average Net Head	(m)	63.9	54.8	45.6	36.0	26.2
Firm Capacity	(MW)	0.9	0.8	0.7	0.5	0.4
Installed Capacity	(MW)	1.9	1.6	1.4	1.1	0.8
Firm Energy	(GWh)	8.3	7.1	5.9	4.7	3.4
Guaranteed Energy	(GWh)	7.5	6.4	5.3	4.2	3.1
Secondary Energy	(GWh)	4.1	3.6	3.0	2.3	1.7
Cost Estimate						
Dam	(Mil. US$)	92.7	67.7	47.5	31.7	19.7
Diversion Work	(Mil. US$)	7.9	7.9	7.9	7.9	7.9
Spillway	(Mil. US$)	6.5	6.0	5.6	5.1	4.6
Intake	(Mil. US$)	0.1	0.1	0.1	0.1	0.1
Headrace Tunnel	(Mil. US$)	0.2	0.2	0.2	0.2	0.2
Penstock Tunnel	(Mil. US$)	0.7	0.7	0.7	0.7	0.7
Powerhouse	(Mil. US$)	0.3	0.3	0.2	0.2	0.2
Generating Equipment	(Mil. US$)	1.7	1.6	1.5	1.4	1.3
T/L & S/S	(Mil. US$)	4.4	4.4	4.4	4.4	4.4
Access Road	(Mil. US$)	0.7	0.7	0.7	0.7	0.7
Miscellaneous Cost	(Mil. US$)	4.9	3.6	2.6	1.8	1.2
Direct Cost	(Mil. US$)	120.1	93.2	71.4	54.3	41.1
Compensation	(Mil. US$)	7.5	6.1	4.7	3.6	2.4
Administration	(Mil. US$)	6.0	4.7	3.6	2.7	2.1
Engineering Service	(Mil. US$)	4.2	3.9	3.5	3.1	2.7
Physical Contingency	(Mil. US$)	18.0	14.0	10.7	8.1	6.2
Project Cost	(Mil. US$)	155.8	121.9	93.9	71.8	54.5
Evaluation Indices						
Unit Cost of Guaranteed Energy	(US$/MWh)	2101.7	1916.5	1771.4	1716.1	1789.4

Scheme No. : 8
Project Name : Barra da Pratinha
Type : Reservoir
Name of River : Itajai Do Norte

****
* SUMMARY TABLE OF OUTPUTS *
****

Case No.		:	2
Catchment Area	(km2)	:	1405.0
Average Runoff for Long Term	(m3/s)	:	24.5
Average Runoff for Critical Period	(m3/s)	:	18.0
Firm Discharge	(m3/s)	:	3.6
Peak Discharge	(m3/s)	:	7.2
Effective Storage	(Mil. m3)	:	13.6

Scheme Information		Full Supply Level (m)				
		394.0	386.0	377.9	369.9	361.9
Min. Operating Level	(m)	391.9	383.1	374.0	364.7	354.2
Rated Water Level	(m)	393.3	385.0	376.6	368.2	359.3
Tail Water Level	(m)	326.0	326.0	326.0	326.0	326.0
Reservoir Storage	(Mil. m3)	161.6	116.6	80.8	52.7	31.8
Reservoir Area	(km2)	6.3	4.9	3.8	2.9	2.2
Power Output						
Gross Head	(m)	67.3	59.0	50.6	42.2	33.3
Average Net Head	(m)	63.3	55.5	47.6	39.2	30.3
Firm Capacity	(MW)	1.9	1.6	1.4	1.2	0.9
Installed Capacity	(MW)	3.8	3.3	2.8	2.3	1.8
Firm Energy	(GWh)	16.4	14.4	12.4	10.2	7.9
Guaranteed Energy	(GWh)	14.8	13.0	11.1	9.1	7.1
Secondary Energy	(GWh)	8.2	7.2	6.2	5.1	3.9
Cost Estimate						
Dam	(Mil. US$)	92.7	71.4	53.5	38.8	27.0
Diversion Work	(Mil. US$)	7.9	7.9	7.9	7.9	7.9
Spillway	(Mil. US$)	6.5	6.1	5.7	5.3	4.9
Intake	(Mil. US$)	0.1	0.1	0.1	0.2	0.2
Headrace Tunnel	(Mil. US$)	0.2	0.2	0.2	0.2	0.2
Penstock Tunnel	(Mil. US$)	0.7	0.7	0.7	0.6	0.7
Powerhouse	(Mil. US$)	0.5	0.5	0.4	0.4	0.4
Generating Equipment	(Mil. US$)	2.4	2.2	2.0	1.8	1.6
T/L & S/S	(Mil. US$)	4.4	4.4	4.4	4.4	4.4
Access Road	(Mil. US$)	0.7	0.7	0.7	0.7	0.7
Miscellaneous Cost	(Mil. US$)	4.9	3.8	2.9	2.2	1.6
Direct Cost	(Mil. US$)	121.2	98.1	78.7	62.6	49.6
Compensation	(Mil. US$)	7.5	6.3	5.1	4.1	3.2
Administration	(Mil. US$)	6.1	4.9	3.9	3.1	2.5
Engineering Service	(Mil. US$)	4.2	4.0	3.7	3.3	2.9
Physical Contingency	(Mil. US$)	18.2	14.7	11.8	9.4	7.4
Project Cost	(Mil. US$)	157.1	128.0	103.2	82.5	65.6
Evaluation Indices						
Unit Cost of Guaranteed Energy	(US$/MWh)	1066.2	990.1	930.4	904.8	930.0

Scheme No. : 8
Project Name : Barra da Pratinha
Type : Reservoir
Name of River : Itajai Do Norte

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* SUMMARY TABLE OF OUTPUTS *
****

Case No.		:	3
Catchment Area	(km2)	:	1405.0
Average Runoff for Long Term	(m3/s)	:	24.5
Average Runoff for Critical Period	(m3/s)	:	18.0
Firm Discharge	(m3/s)	:	5.4
Peak Discharge	(m3/s)	:	10.8
Effective Storage	(Mil. m3)	:	28.4

Scheme Information		Full Supply Level (m) 394.0	387.4	380.8	374.2	367.6
Min. Operating Level	(m)	389.4	381.5	373.0	364.7	354.2
Rated Water Level	(m)	392.5	385.4	378.2	371.0	363.2
Tail Water Level	(m)	326.0	326.0	326.0	326.0	326.0
Reservoir Storage	(Mil. m3)	161.6	123.5	91.8	67.7	46.8
Reservoir Area	(km2)	6.3	5.1	4.1	3.4	2.7
Power Output						
Gross Head	(m)	66.5	59.4	52.2	45.0	37.2
Average Net Head	(m)	62.5	55.9	49.2	42.0	34.2
Firm Capacity	(MW)	2.8	2.5	2.2	1.9	1.5
Installed Capacity	(MW)	5.6	5.0	4.4	3.7	3.0
Firm Energy	(GWh)	24.3	21.8	19.2	16.4	13.3
Guaranteed Energy	(GWh)	21.9	19.6	17.2	14.7	12.0
Secondary Energy	(GWh)	12.2	10.9	9.6	8.2	6.6
Cost Estimate						
Dam	(Mil. US$)	92.7	74.9	59.5	46.3	35.1
Diversion Work	(Mil. US$)	7.9	7.9	7.9	7.9	7.9
Spillway	(Mil. US$)	6.5	6.2	5.8	5.5	5.2
Intake	(Mil. US$)	0.2	0.2	0.2	0.2	0.3
Headrace Tunnel	(Mil. US$)	0.3	0.3	0.3	0.3	0.3
Penstock Tunnel	(Mil. US$)	0.7	0.7	0.7	0.6	0.7
Powerhouse	(Mil. US$)	0.7	0.7	0.6	0.6	0.5
Generating Equipment	(Mil. US$)	3.1	2.9	2.7	2.4	2.1
T/L & S/S	(Mil. US$)	4.4	4.4	4.4	4.4	4.4
Access Road	(Mil. US$)	0.7	0.7	0.7	0.7	0.7
Miscellaneous Cost	(Mil. US$)	4.9	4.0	3.2	2.6	2.0
Direct Cost	(Mil. US$)	122.1	102.8	86.0	71.5	59.3
Compensation	(Mil. US$)	7.5	6.5	5.6	4.6	3.8
Administration	(Mil. US$)	6.1	5.1	4.3	3.6	3.0
Engineering Service	(Mil. US$)	4.2	4.0	3.8	3.5	3.2
Physical Contingency	(Mil. US$)	18.3	15.4	12.9	10.7	8.9
Project Cost	(Mil. US$)	158.2	134.0	112.6	93.9	78.1
Evaluation Indices						
Unit Cost of Guaranteed Energy	(US$/MWh)	723.7	684.0	653.5	637.6	653.1

Scheme No. : 8
Project Name : Barra da Pratinha
Type : Reservoir
Name of River : Itajai Do Norte

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* SUMMARY TABLE OF OUTPUTS *
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Case No.		:	4
Catchment Area	(km2)	:	1405.0
Average Runoff for Long Term	(m3/s)	:	24.5
Average Runoff for Critical Period	(m3/s)	:	18.0
Firm Discharge	(m3/s)	:	7.2
Peak Discharge	(m3/s)	:	14.4
Effective Storage	(Mil. m3)	:	53.8

Scheme Information		Full Supply Level (m) 394.0	389.4	384.9	380.3	375.7
Min. Operating Level	(m)	384.1	377.6	371.3	363.3	354.8
Rated Water Level	(m)	390.7	385.5	380.3	374.6	368.8
Tail Water Level	(m)	326.0	326.0	326.0	326.0	326.0
Reservoir Storage	(Mil. m3)	161.6	133.3	111.3	89.4	73.0
Reservoir Area	(km2)	6.3	5.4	4.7	4.0	3.5
Power Output						
Gross Head	(m)	64.7	59.5	54.3	48.6	42.8
Average Net Head	(m)	60.7	56.0	50.8	45.6	39.8
Firm Capacity	(MW)	3.6	3.3	3.0	2.7	2.4
Installed Capacity	(MW)	7.2	6.6	6.0	5.4	4.7
Firm Energy	(GWh)	31.5	29.1	26.4	23.7	20.6
Guaranteed Energy	(GWh)	28.4	26.2	23.8	21.3	18.6
Secondary Energy	(GWh)	15.8	14.5	13.2	11.8	10.3
Cost Estimate						
Dam	(Mil. US$)	92.7	80.1	68.7	58.4	49.1
Diversion Work	(Mil. US$)	7.9	7.9	7.9	7.9	7.9
Spillway	(Mil. US$)	6.5	6.3	6.0	5.8	5.6
Intake	(Mil. US$)	0.3	0.3	0.3	0.4	0.4
Headrace Tunnel	(Mil. US$)	0.3	0.3	0.3	0.3	0.3
Penstock Tunnel	(Mil. US$)	0.7	0.7	0.7	0.7	0.7
Powerhouse	(Mil. US$)	0.9	0.8	0.8	0.8	0.7
Generating Equipment	(Mil. US$)	3.7	3.5	3.3	3.0	2.8
T/L & S/S	(Mil. US$)	4.4	4.4	4.4	4.4	4.4
Access Road	(Mil. US$)	0.7	0.7	0.7	0.7	0.7
Miscellaneous Cost	(Mil. US$)	5.0	4.3	3.7	3.2	2.7
Direct Cost	(Mil. US$)	123.1	109.4	96.9	85.6	75.4
Compensation	(Mil. US$)	7.5	6.8	6.1	5.5	4.8
Administration	(Mil. US$)	6.2	5.5	4.8	4.3	3.8
Engineering Service	(Mil. US$)	4.2	4.1	3.9	3.8	3.6
Physical Contingency	(Mil. US$)	18.5	16.4	14.5	12.8	11.3
Project Cost	(Mil. US$)	159.4	142.2	126.4	112.0	98.9
Evaluation Indices						
Unit Cost of Guaranteed Energy	(US$/MWh)	561.3	543.0	531.3	524.5	531.4

Scheme No. : 8
Project Name : Barra da Pratinha
Type : Reservoir
Name of River : Itajai Do Norte

****
* SUMMARY TABLE OF OUTPUTS *
****

Case No.		:	5
Catchment Area	(km2)	:	1405.0
Average Runoff for Long Term	(m3/s)	:	24.5
Average Runoff for Critical Period	(m3/s)	:	18.0
Firm Discharge	(m3/s)	:	9.0
Peak Discharge	(m3/s)	:	18.0
Effective Storage	(Mil. m3)	:	91.2

Scheme Information		Full Supply Level (m)				
		394.0	391.7	389.4	387.1	384.8
Min. Operating Level	(m)	375.0	370.8	365.8	361.5	355.3
Rated Water Level	(m)	387.7	384.7	381.5	378.6	375.0
Tail Water Level	(m)	326.0	326.0	326.0	326.0	326.0
Reservoir Storage	(Mil. m3)	161.6	146.9	133.2	122.2	111.2
Reservoir Area	(km2)	6.3	5.8	5.4	5.1	4.7
Power Output						
Gross Head	(m)	61.7	58.7	55.5	52.6	49.0
Average Net Head	(m)	58.2	55.2	52.0	49.6	46.0
Firm Capacity	(MW)	4.3	4.1	3.9	3.7	3.4
Installed Capacity	(MW)	8.6	8.2	7.7	7.3	6.8
Firm Energy	(GWh)	37.7	35.8	33.8	32.2	29.8
Guaranteed Energy	(GWh)	34.0	32.3	30.4	29.0	26.9
Secondary Energy	(GWh)	18.9	17.9	16.9	16.1	14.9
Cost Estimate						
Dam	(Mil. US$)	92.7	86.3	80.1	74.2	68.6
Diversion Work	(Mil. US$)	7.9	7.9	7.9	7.9	7.9
Spillway	(Mil. US$)	6.5	6.4	6.3	6.1	6.0
Intake	(Mil. US$)	0.4	0.4	0.5	0.5	0.5
Headrace Tunnel	(Mil. US$)	0.4	0.4	0.4	0.4	0.4
Penstock Tunnel	(Mil. US$)	0.8	0.8	0.8	0.8	0.8
Powerhouse	(Mil. US$)	1.0	1.0	1.0	1.0	0.9
Generating Equipment	(Mil. US$)	4.2	4.0	3.9	3.7	3.5
T/L & S/S	(Mil. US$)	4.4	4.4	4.4	4.4	4.4
Access Road	(Mil. US$)	0.7	0.7	0.7	0.7	0.7
Miscellaneous Cost	(Mil. US$)	5.0	4.6	4.3	4.0	3.7
Direct Cost	(Mil. US$)	124.0	116.9	110.1	103.7	97.5
Compensation	(Mil. US$)	7.5	7.1	6.8	6.5	6.1
Administration	(Mil. US$)	6.2	5.8	5.5	5.2	4.9
Engineering Service	(Mil. US$)	4.2	4.2	4.1	4.0	3.9
Physical Contingency	(Mil. US$)	18.6	17.5	16.5	15.6	14.6
Project Cost	(Mil. US$)	160.5	151.6	143.1	134.9	127.1
Evaluation Indices						
Unit Cost of Guaranteed Energy	(US$/MWh)	471.1	468.6	469.4	464.5	471.9

Scheme No. : 8
Project Name : Barra da Pratinha
Type : Reservoir
Name of River : Itajai Do Norte

****
* SUMMARY TABLE OF OUTPUTS *
****

Case No.		:	6
Catchment Area	(km2)	:	1405.0
Average Runoff for Long Term	(m3/s)	:	24.5
Average Runoff for Critical Period	(m3/s)	:	18.0
Firm Discharge	(m3/s)	:	10.8
Peak Discharge	(m3/s)	:	21.6
Effective Storage	(Mil. m3)	:	132.9

Scheme Information		Full Supply Level (m)				
		394.0	393.7	393.4	393.1	392.7
Min. Operating Level	(m)	360.7	359.8	358.4	357.1	355.7
Rated Water Level	(m)	382.9	382.4	381.7	381.1	380.4
Tail Water Level	(m)	326.0	326.0	326.0	326.0	326.0
Reservoir Storage	(Mil. m3)	161.6	159.6	157.6	155.5	153.5
Reservoir Area	(km2)	6.3	6.2	6.1	6.1	6.0
Power Output						
Gross Head	(m)	56.9	56.4	55.7	55.1	54.4
Average Net Head	(m)	53.4	52.9	52.2	51.6	50.9
Firm Capacity	(MW)	4.7	4.7	4.6	4.6	4.5
Installed Capacity	(MW)	9.5	9.4	9.3	9.2	9.1
Firm Energy	(GWh)	41.6	41.2	40.7	40.2	39.6
Guaranteed Energy	(GWh)	37.4	37.1	36.6	36.1	35.7
Secondary Energy	(GWh)	20.8	20.6	20.3	20.1	19.8
Cost Estimate						
Dam	(Mil. US$)	92.7	91.8	90.9	90.0	89.1
Diversion Work	(Mil. US$)	7.9	7.9	7.9	7.9	7.9
Spillway	(Mil. US$)	6.5	6.5	6.4	6.4	6.4
Intake	(Mil. US$)	0.6	0.6	0.6	0.6	0.6
Headrace Tunnel	(Mil. US$)	0.4	0.4	0.4	0.4	0.4
Penstock Tunnel	(Mil. US$)	0.8	0.8	0.8	0.8	0.8
Powerhouse	(Mil. US$)	1.2	1.1	1.1	1.1	1.1
Generating Equipment	(Mil. US$)	4.6	4.5	4.5	4.4	4.4
T/L & S/S	(Mil. US$)	4.4	4.4	4.4	4.4	4.4
Access Road	(Mil. US$)	0.7	0.7	0.7	0.7	0.7
Miscellaneous Cost	(Mil. US$)	5.0	4.9	4.9	4.9	4.8
Direct Cost	(Mil. US$)	124.7	123.7	122.7	121.7	120.7
Compensation	(Mil. US$)	7.5	7.4	7.4	7.3	7.3
Administration	(Mil. US$)	6.2	6.2	6.1	6.1	6.0
Engineering Service	(Mil. US$)	4.2	4.2	4.2	4.2	4.2
Physical Contingency	(Mil. US$)	18.7	18.6	18.4	18.3	18.1
Project Cost	(Mil. US$)	161.4	160.1	158.8	157.6	156.3
Evaluation Indices						
Unit Cost of Guaranteed Energy	(US$/MWh)	429.6	430.2	432.2	434.3	436.4

Scheme No. : 9
Project Name : Barra das Pombas
Type : Reservoir
Name of River : Itajai Do Norte

****
* SUMMARY TABLE OF OUTPUTS *
****

Case No.		:	1
Catchment Area	(km2)	:	979.0
Average Runoff for Long Term	(m3/s)	:	17.6
Average Runoff for Critical Period	(m3/s)	:	12.9
Firm Discharge	(m3/s)	:	1.3
Peak Discharge	(m3/s)	:	2.6
Effective Storage	(Mil. m3)	:	1.7

Scheme Information		Full Supply Level (m)				
		494.0	475.0	456.0	437.0	418.0
Min. Operating Level	(m)	494.0	474.9	455.8	436.6	416.9
Rated Water Level	(m)	494.0	475.0	456.0	436.9	417.6
Tail Water Level	(m)	405.0	405.0	405.0	405.0	405.0
Reservoir Storage	(Mil. m3)	990.0	505.1	233.1	86.6	17.0
Reservoir Area	(km2)	28.6	18.0	11.4	6.6	2.6
Power Output						
Gross Head	(m)	89.0	70.0	51.0	31.9	12.6
Average Net Head	(m)	85.0	67.0	48.0	29.9	11.1
Firm Capacity	(MW)	0.9	0.7	0.5	0.3	0.1
Installed Capacity	(MW)	1.8	1.4	1.0	0.6	0.2
Firm Energy	(GWh)	7.9	6.2	4.5	2.8	1.0
Guaranteed Energy	(GWh)	7.1	5.6	4.0	2.5	0.9
Secondary Energy	(GWh)	4.0	3.1	2.2	1.4	0.5
Cost Estimate						
Dam	(Mil. US$)	127.3	79.7	44.6	20.7	6.5
Diversion Work	(Mil. US$)	7.5	7.5	7.5	7.5	7.5
Spillway	(Mil. US$)	6.4	5.6	4.8	4.0	3.1
Intake	(Mil. US$)	0.1	0.1	0.1	0.1	0.1
Headrace Tunnel	(Mil. US$)	0.2	0.2	0.2	0.2	0.2
Penstock Tunnel	(Mil. US$)	0.6	0.5	0.5	0.4	0.4
Powerhouse	(Mil. US$)	0.3	0.2	0.2	0.2	0.1
Generating Equipment	(Mil. US$)	1.7	1.6	1.4	1.3	1.2
T/L & S/S	(Mil. US$)	3.0	3.0	3.0	3.0	3.0
Access Road	(Mil. US$)	4.4	4.4	4.4	4.4	4.4
Miscellaneous Cost	(Mil. US$)	6.8	4.4	2.6	1.4	0.6
Direct Cost	(Mil. US$)	158.2	107.1	69.3	43.2	27.2
Compensation	(Mil. US$)	18.0	13.2	9.2	6.1	4.6
Administration	(Mil. US$)	7.9	5.4	3.5	2.2	1.4
Engineering Service	(Mil. US$)	4.6	4.1	3.5	2.8	2.2
Physical Contingency	(Mil. US$)	23.7	16.1	10.4	6.5	4.1
Project Cost	(Mil. US$)	212.4	145.9	95.8	60.7	39.4
Evaluation Indices						
Unit Cost of Guaranteed Energy	(US$/MWh)	3006.6	2619.8	2401.8	2442.5	4256.5

Scheme No. : 9
Project Name : Barra das Pombas
Type : Reservoir
Name of River : Itajai Do Norte

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* SUMMARY TABLE OF OUTPUTS *
****

Case No.		:	2
Catchment Area	(km2)	:	979.0
Average Runoff for Long Term	(m3/s)	:	17.6
Average Runoff for Critical Period	(m3/s)	:	12.9
Firm Discharge	(m3/s)	:	2.6
Peak Discharge	(m3/s)	:	5.2
Effective Storage	(Mil. m3)	:	9.8

Scheme Information		Full Supply Level (m) 494.0	475.9	457.7	439.6	421.5
Min. Operating Level	(m)	493.7	475.4	456.8	437.4	416.9
Rated Water Level	(m)	493.9	475.7	457.4	438.9	419.9
Tail Water Level	(m)	405.0	405.0	405.0	405.0	405.0
Reservoir Storage	(Mil. m3)	990.0	521.5	251.2	98.2	25.1
Reservoir Area	(km2)	28.6	18.3	11.9	7.2	3.3
Power Output						
Gross Head	(m)	88.9	70.7	52.4	33.9	14.9
Average Net Head	(m)	84.9	67.2	49.4	31.9	12.9
Firm Capacity	(MW)	1.8	1.4	1.0	0.7	0.3
Installed Capacity	(MW)	3.6	2.9	2.1	1.4	0.5
Firm Energy	(GWh)	15.8	12.5	9.2	5.9	2.4
Guaranteed Energy	(GWh)	14.2	11.3	8.3	5.3	2.2
Secondary Energy	(GWh)	7.9	6.3	4.6	3.0	1.2
Cost Estimate						
Dam	(Mil. US$)	127.3	81.6	47.3	23.4	8.4
Diversion Work	(Mil. US$)	7.5	7.5	7.5	7.5	7.5
Spillway	(Mil. US$)	6.4	5.6	4.8	4.1	3.3
Intake	(Mil. US$)	0.1	0.1	0.1	0.1	0.1
Headrace Tunnel	(Mil. US$)	0.2	0.2	0.2	0.2	0.2
Penstock Tunnel	(Mil. US$)	0.6	0.5	0.5	0.4	0.4
Powerhouse	(Mil. US$)	0.4	0.4	0.3	0.3	0.2
Generating Equipment	(Mil. US$)	2.3	2.0	1.7	1.5	1.3
T/L & S/S	(Mil. US$)	3.0	3.0	3.0	3.0	3.0
Access Road	(Mil. US$)	4.4	4.4	4.4	4.4	4.4
Miscellaneous Cost	(Mil. US$)	6.9	4.5	2.8	1.5	0.7
Direct Cost	(Mil. US$)	159.0	109.8	72.7	46.5	29.6
Compensation	(Mil. US$)	18.0	13.4	9.5	6.4	4.9
Administration	(Mil. US$)	8.0	5.5	3.6	2.3	1.5
Engineering Service	(Mil. US$)	4.6	4.1	3.5	2.8	2.3
Physical Contingency	(Mil. US$)	23.9	16.5	10.9	7.0	4.4
Project Cost	(Mil. US$)	213.4	149.3	100.3	64.9	42.7
Evaluation Indices						
Unit Cost of Guaranteed Energy	(US$/MWh)	1509.2	1333.6	1217.3	1222.1	1981.0

Scheme No. : 9
Project Name : Barra das Pombas
Type : Reservoir
Name of River : Itajai Do Norte

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* SUMMARY TABLE OF OUTPUTS *
****

Case No.		:	3
Catchment Area	(km2)	:	979.0
Average Runoff for Long Term	(m3/s)	:	17.6
Average Runoff for Critical Period	(m3/s)	:	12.3
Firm Discharge	(m3/s)	:	3.9
Peak Discharge	(m3/s)	:	7.7
Effective Storage	(Mil. m3)	:	20.4

Scheme Information		Full Supply Level (m)				
		494.0	476.6	459.2	441.9	424.5
Min. Operating Level	(m)	493.4	475.6	457.3	438.4	416.9
Rated Water Level	(m)	493.8	476.3	458.6	440.7	422.0
Tail Water Level	(m)	405.0	405.0	405.0	405.0	405.0
Reservoir Storage	(Mil. m3)	990.0	535.9	267.1	113.1	35.7
Reservoir Area	(km2)	28.6	18.6	12.3	7.7	3.9
Power Output						
Gross Head	(m)	88.8	71.3	53.6	35.7	17.0
Average Net Head	(m)	84.8	67.8	50.6	33.7	15.0
Firm Capacity	(MW)	2.7	2.2	1.6	1.1	0.5
Installed Capacity	(MW)	5.4	4.3	3.2	2.1	1.0
Firm Energy	(GWh)	23.7	18.9	14.1	9.4	4.2
Guaranteed Energy	(GWh)	21.3	17.0	12.7	8.5	3.8
Secondary Energy	(GWh)	11.8	9.5	7.1	4.7	2.1
Cost Estimate						
Dam	(Mil. US$)	127.3	83.2	49.8	25.9	10.3
Diversion Work	(Mil. US$)	7.5	7.5	7.5	7.5	7.5
Spillway	(Mil. US$)	6.4	5.6	4.9	4.2	3.4
Intake	(Mil. US$)	0.1	0.1	0.1	0.2	0.2
Headrace Tunnel	(Mil. US$)	0.2	0.2	0.2	0.2	0.2
Penstock Tunnel	(Mil. US$)	0.6	0.5	0.5	0.4	0.4
Powerhouse	(Mil. US$)	0.6	0.6	0.5	0.4	0.3
Generating Equipment	(Mil. US$)	2.9	2.5	2.1	1.7	1.4
T/L & S/S	(Mil. US$)	3.0	3.0	3.0	3.0	3.0
Access Road	(Mil. US$)	4.4	4.4	4.4	4.4	4.4
Miscellaneous Cost	(Mil. US$)	6.9	4.6	2.9	1.7	0.8
Direct Cost	(Mil. US$)	159.9	112.3	75.9	49.6	32.0
Compensation	(Mil. US$)	18.0	13.6	9.8	6.5	5.1
Administration	(Mil. US$)	8.0	5.6	3.8	2.5	1.6
Engineering Service	(Mil. US$)	4.6	4.1	3.6	2.9	2.4
Physical Contingency	(Mil. US$)	24.0	16.9	11.4	7.4	4.8
Project Cost	(Mil. US$)	214.5	152.5	104.6	68.9	45.9
Evaluation Indices						
Unit Cost of Guaranteed Energy	(US$/MWh)	1010.4	898.7	824.5	815.8	1227.4

Scheme No. : 9
Project Name : Barra das Pombas
Type : Reservoir
Name of River : Itajai Do Norte

****
* SUMMARY TABLE OF OUTPUTS *
****

Case No.		:	4
Catchment Area	(km2)	:	979.0
Average Runoff for Long Term	(m3/s)	:	17.6
Average Runoff for Critical Period	(m3/s)	:	12.9
Firm Discharge	(m3/s)	:	5.2
Peak Discharge	(m3/s)	:	10.3
Effective Storage	(Mil. m3)	:	38.7

Scheme Information		Full Supply Level (m) 494.0	477.9	461.9	445.8	429.7
Min. Operating Level	(m)	492.9	475.9	458.7	440.3	416.9
Rated Water Level	(m)	493.6	477.3	460.8	444.0	425.4
Tail Water Level	(m)	405.0	405.0	405.0	405.0	405.0
Reservoir Storage	(Mil. m3)	990.0	560.7	300.1	140.6	54.0
Reservoir Area	(km2)	28.6	19.2	13.2	8.7	4.9
Power Output						
Gross Head	(m)	88.6	72.3	55.8	39.0	20.4
Average Net Head	(m)	84.6	68.8	52.8	36.5	18.4
Firm Capacity	(MW)	3.6	2.9	2.2	1.5	0.8
Installed Capacity	(MW)	7.2	5.8	4.5	3.1	1.6
Firm Energy	(GWh)	31.5	25.6	19.7	13.6	6.9
Guaranteed Energy	(GWh)	28.3	23.0	17.7	12.2	6.2
Secondary Energy	(GWh)	15.7	12.8	9.8	6.8	3.4
Cost Estimate						
Dam	(Mil. US$)	127.3	86.2	54.2	30.5	14.2
Diversion Work	(Mil. US$)	7.5	7.5	7.5	7.5	7.5
Spillway	(Mil. US$)	6.4	5.7	5.0	4.3	3.6
Intake	(Mil. US$)	0.2	0.2	0.2	0.2	0.3
Headrace Tunnel	(Mil. US$)	0.2	0.2	0.2	0.2	0.2
Penstock Tunnel	(Mil. US$)	0.6	0.5	0.5	0.4	0.4
Powerhouse	(Mil. US$)	0.8	0.7	0.6	0.5	0.4
Generating Equipment	(Mil. US$)	3.6	3.1	2.6	2.1	1.6
T/L & S/S	(Mil. US$)	3.0	3.0	3.0	3.0	3.0
Access Road	(Mil. US$)	4.4	4.4	4.4	4.4	4.4
Miscellaneous Cost	(Mil. US$)	6.9	4.8	3.1	1.9	1.1
Direct Cost	(Mil. US$)	160.8	116.2	81.3	55.1	36.7
Compensation	(Mil. US$)	18.0	13.9	10.4	7.1	5.5
Administration	(Mil. US$)	8.0	5.8	4.1	2.8	1.8
Engineering Service	(Mil. US$)	4.6	4.2	3.7	3.1	2.5
Physical Contingency	(Mil. US$)	24.1	17.4	12.2	8.3	5.5
Project Cost	(Mil. US$)	215.5	157.5	111.7	76.3	52.1
Evaluation Indices						
Unit Cost of Guaranteed Energy	(US$/MWh)	761.6	684.8	631.6	624.9	845.2

Scheme No. : 9
Project Name : Barra das Pombas
Type : Reservoir
Name of River : Itajai Do Norte

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* SUMMARY TABLE OF OUTPUTS *
****

Case No.		:	5
Catchment Area	(km2)	:	979.0
Average Runoff for Long Term	(m3/s)	:	17.6
Average Runoff for Critical Period	(m3/s)	:	12.9
Firm Discharge	(m3/s)	:	6.4
Peak Discharge	(m3/s)	:	12.9
Effective Storage	(Mil. m3)	:	65.5

Scheme Information		Full Supply Level (m)				
		494.0	479.5	464.9	450.4	435.9
Min. Operating Level	(m)	492.1	476.0	460.1	441.3	417.3
Rated Water Level	(m)	493.4	478.3	463.3	447.4	429.7
Tail Water Level	(m)	405.0	405.0	405.0	405.0	405.0
Reservoir Storage	(Mil. m3)	990.0	590.0	341.7	174.4	81.5
Reservoir Area	(km2)	28.6	19.8	14.2	9.8	6.4
Power Output						
Gross Head	(m)	88.4	73.3	58.3	42.4	24.7
Average Net Head	(m)	84.4	69.8	55.3	39.9	22.7
Firm Capacity	(MW)	4.5	3.7	2.9	2.1	1.2
Installed Capacity	(MW)	9.0	7.4	5.9	4.2	2.4
Firm Energy	(GWh)	39.2	32.5	25.7	18.5	10.6
Guaranteed Energy	(GWh)	35.3	29.2	23.2	16.7	9.5
Secondary Energy	(GWh)	19.6	16.2	12.9	9.3	5.3
Cost Estimate						
Dam	(Mil. US$)	127.3	89.7	59.6	36.5	19.6
Diversion Work	(Mil. US$)	7.5	7.5	7.5	7.5	7.5
Spillway	(Mil. US$)	6.4	5.8	5.1	4.5	3.9
Intake	(Mil. US$)	0.2	0.2	0.2	0.3	0.3
Headrace Tunnel	(Mil. US$)	0.3	0.3	0.3	0.3	0.3
Penstock Tunnel	(Mil. US$)	0.6	0.5	0.5	0.5	0.5
Powerhouse	(Mil. US$)	0.9	0.9	0.8	0.7	0.5
Generating Equipment	(Mil. US$)	4.3	3.7	3.1	2.5	1.8
T/L & S/S	(Mil. US$)	3.0	3.0	3.0	3.0	3.0
Access Road	(Mil. US$)	4.4	4.4	4.4	4.4	4.4
Miscellaneous Cost	(Mil. US$)	6.9	5.0	3.4	2.2	1.4
Direct Cost	(Mil. US$)	161.7	120.8	88.0	62.3	43.2
Compensation	(Mil. US$)	18.0	14.2	11.0	8.0	6.0
Administration	(Mil. US$)	8.1	6.0	4.4	3.1	2.2
Engineering Service	(Mil. US$)	4.6	4.2	3.8	3.2	2.7
Physical Contingency	(Mil. US$)	24.3	18.1	13.2	9.3	6.5
Project Cost	(Mil. US$)	216.7	163.4	120.4	86.0	60.6
Evaluation Indices						
Unit Cost of Guaranteed Energy	(US$/MWh)	613.4	558.7	519.0	514.7	638.0

Scheme No. : 9
Project Name : Barra das Pombas
Type : Reservoir
Name of River : Itajai Do Norte

****
* SUMMARY TABLE OF OUTPUTS *
****

Case No.		:	6
Catchment Area	(km2)	:	979.0
Average Runoff for Long Term	(m3/s)	:	17.6
Average Runoff for Critical Period	(m3/s)	:	12.9
Firm Discharge	(m3/s)	:	7.7
Peak Discharge	(m3/s)	:	15.5
Effective Storage	(Mil. m3)	:	95.5

Scheme Information		Full Supply Level (m) 494.0	480.9	467.9	454.8	441.7
Min. Operating Level	(m)	491.3	476.2	460.8	443.5	417.7
Rated Water Level	(m)	493.1	479.4	465.5	451.0	433.7
Tail Water Level	(m)	405.0	405.0	405.0	405.0	405.0
Reservoir Storage	(Mil. m3)	990.0	623.3	381.1	220.3	112.1
Reservoir Area	(km2)	28.6	20.5	15.3	11.0	7.7
Power Output						
Gross Head	(m)	88.1	74.4	60.5	46.0	28.7
Average Net Head	(m)	84.1	70.9	57.5	43.5	26.7
Firm Capacity	(MW)	5.4	4.5	3.7	2.8	1.7
Installed Capacity	(MW)	10.7	9.0	7.3	5.5	3.4
Firm Energy	(GWh)	46.9	39.5	32.1	24.3	14.9
Guaranteed Energy	(GWh)	42.2	35.6	28.9	21.9	13.4
Secondary Energy	(GWh)	23.5	19.8	16.0	12.2	7.5
Cost Estimate						
Dam	(Mil. US$)	127.3	93.1	65.1	42.8	25.7
Diversion Work	(Mil. US$)	7.5	7.5	7.5	7.5	7.5
Spillway	(Mil. US$)	6.4	5.8	5.3	4.7	4.2
Intake	(Mil. US$)	0.2	0.3	0.3	0.3	0.4
Headrace Tunnel	(Mil. US$)	0.3	0.3	0.3	0.3	0.3
Penstock Tunnel	(Mil. US$)	0.6	0.5	0.5	0.5	0.5
Powerhouse	(Mil. US$)	1.3	1.0	0.9	0.8	0.6
Generating Equipment	(Mil. US$)	5.0	4.3	3.6	3.0	2.2
T/L & S/S	(Mil. US$)	3.0	3.0	3.0	3.0	3.0
Access Road	(Mil. US$)	4.4	4.4	4.4	4.4	4.4
Miscellaneous Cost	(Mil. US$)	6.9	5.2	3.7	2.6	1.7
Direct Cost	(Mil. US$)	163.0	125.4	94.6	69.9	50.5
Compensation	(Mil. US$)	18.0	14.6	11.7	8.9	6.5
Administration	(Mil. US$)	8.1	6.3	4.7	3.5	2.5
Engineering Service	(Mil. US$)	4.6	4.2	3.9	3.4	2.9
Physical Contingency	(Mil. US$)	24.4	18.8	14.2	10.5	7.6
Project Cost	(Mil. US$)	218.1	169.3	129.1	96.1	70.0
Evaluation Indices						
Unit Cost of Guaranteed Energy	(US$/MWh)	515.5	474.5	445.5	438.0	520.7

Scheme No. : 9
Project Name : Barra das Pombas
Type : Reservoir
Name of River : Itajai Do Norte

****
* SUMMARY TABLE OF OUTPUTS *
****

Case No.		:	7
Catchment Area	(km2)	:	979.0
Average Runoff for Long Term	(m3/s)	:	17.6
Average Runoff for Critical Period	(m3/s)	:	12.9
Firm Discharge	(m3/s)	:	9.0
Peak Discharge	(m3/s)	:	18.1
Effective Storage	(Mil. m3)	:	129.0

Scheme Information		Full Supply Level (m) 494.0	482.1	470.3	458.4	446.6
Min. Operating Level	(m)	490.3	476.0	460.9	444.2	418.0
Rated Water Level	(m)	492.8	480.1	467.1	453.7	437.1
Tail Water Level	(m)	405.0	405.0	405.0	405.0	405.0
Reservoir Storage	(Mil. m3)	990.0	653.6	415.5	258.6	146.1
Reservoir Area	(km2)	28.6	21.1	16.1	12.1	8.9
Power Output						
Gross Head	(m)	87.8	75.1	62.1	48.7	32.1
Average Net Head	(m)	83.8	71.6	59.1	46.2	30.1
Firm Capacity	(MW)	6.2	5.3	4.4	3.4	2.2
Installed Capacity	(MW)	12.5	10.6	8.8	6.9	4.5
Firm Energy	(GWh)	54.5	46.6	38.5	30.1	19.6
Guaranteed Energy	(GWh)	49.1	42.0	34.7	27.1	17.6
Secondary Energy	(GWh)	25.9	22.1	18.3	14.3	9.3
Cost Estimate						
Dam	(Mil. US$)	127.3	96.0	69.9	48.5	31.5
Diversion Work	(Mil. US$)	7.5	7.5	7.5	7.5	7.5
Spillway	(Mil. US$)	6.4	5.9	5.4	4.9	4.4
Intake	(Mil. US$)	0.3	0.3	0.4	0.4	0.5
Headrace Tunnel	(Mil. US$)	0.4	0.4	0.4	0.4	0.4
Penstock Tunnel	(Mil. US$)	0.6	0.6	0.5	0.5	0.5
Powerhouse	(Mil. US$)	1.5	1.4	1.0	0.9	0.8
Generating Equipment	(Mil. US$)	5.8	5.0	4.2	3.5	2.6
T/L & S/S	(Mil. US$)	3.0	3.0	3.0	3.0	3.0
Access Road	(Mil. US$)	4.4	4.4	4.4	4.4	4.4
Miscellaneous Cost	(Mil. US$)	6.9	5.3	4.0	2.9	2.0
Direct Cost	(Mil. US$)	164.0	129.7	100.6	76.7	57.4
Compensation	(Mil. US$)	18.0	14.9	12.2	9.7	7.2
Administration	(Mil. US$)	8.2	6.5	5.0	3.8	2.9
Engineering Service	(Mil. US$)	4.6	4.3	4.0	3.5	3.1
Physical Contingency	(Mil. US$)	24.6	19.5	15.1	11.5	8.6
Project Cost	(Mil. US$)	219.4	174.8	136.9	105.3	79.2
Evaluation Indices						
Unit Cost of Guaranteed Energy	(US$/MWh)	445.6	415.0	393.3	387.2	448.2

Scheme No. : 9
Project Name : Barra das Pombas
Type : Reservoir
Name of River : Itajai Do Norte

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* SUMMARY TABLE OF OUTPUTS *
****

Case No.		:	8
Catchment Area	(km2)	:	979.0
Average Runoff for Long Term	(m3/s)	:	17.6
Average Runoff for Critical Period	(m3/s)	:	12.9
Firm Discharge	(m3/s)	:	10.3
Peak Discharge	(m3/s)	:	20.6
Effective Storage	(Mil. m3)	:	186.0

Scheme Information		Full Supply Level (m)				
		494.0	483.8	473.6	463.4	453.2
Min. Operating Level	(m)	488.2	475.2	461.3	445.0	418.4
Rated Water Level	(m)	492.1	480.9	469.5	457.3	441.6
Tail Water Level	(m)	405.0	405.0	405.0	405.0	405.0
Reservoir Storage	(Mil. m3)	990.0	695.0	478.4	320.8	203.5
Reservoir Area	(km2)	28.6	21.9	17.4	13.7	10.6
Power Output						
Gross Head	(m)	87.1	75.9	64.5	52.3	36.6
Average Net Head	(m)	83.1	72.4	61.5	49.3	34.6
Firm Capacity	(MW)	7.1	6.2	5.2	4.2	2.9
Installed Capacity	(MW)	14.1	12.3	10.4	8.4	5.9
Firm Energy	(GWh)	61.8	53.9	45.8	36.7	25.7
Guaranteed Energy	(GWh)	55.6	48.5	41.2	33.0	23.2
Secondary Energy	(GWh)	21.8	19.0	16.1	12.9	9.1
Cost Estimate						
Dam	(Mil. US$)	127.3	100.1	76.7	56.9	40.4
Diversion Work	(Mil. US$)	7.5	7.5	7.5	7.5	7.5
Spillway	(Mil. US$)	6.4	6.0	5.5	5.1	4.6
Intake	(Mil. US$)	0.3	0.4	0.4	0.5	0.6
Headrace Tunnel	(Mil. US$)	0.4	0.4	0.4	0.4	0.4
Penstock Tunnel	(Mil. US$)	0.6	0.6	0.6	0.5	0.5
Powerhouse	(Mil. US$)	1.7	1.5	1.4	1.1	0.9
Generating Equipment	(Mil. US$)	6.5	5.7	4.9	4.1	3.1
T/L & S/S	(Mil. US$)	3.0	3.0	3.0	3.0	3.0
Access Road	(Mil. US$)	4.4	4.4	4.4	4.4	4.4
Miscellaneous Cost	(Mil. US$)	6.9	5.5	4.3	3.3	2.5
Direct Cost	(Mil. US$)	165.0	135.1	109.1	86.7	67.9
Compensation	(Mil. US$)	18.0	15.2	12.9	10.7	8.6
Administration	(Mil. US$)	8.2	6.8	5.5	4.3	3.4
Engineering Service	(Mil. US$)	4.6	4.3	4.1	3.8	3.3
Physical Contingency	(Mil. US$)	24.7	20.3	16.4	13.0	10.2
Project Cost	(Mil. US$)	220.6	181.6	147.9	118.5	93.4
Evaluation Indices						
Unit Cost of Guaranteed Energy	(US$/MWh)	396.2	373.8	358.5	358.4	402.9

Scheme No. : 9
Project Name : Barra das Pombas
Type : Reservoir
Name of River : Itajai Do Norte

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* SUMMARY TABLE OF OUTPUTS *
****

Case No.		:	9
Catchment Area	(km2)	:	979.0
Average Runoff for Long Term	(m3/s)	:	17.6
Average Runoff for Critical Period	(m3/s)	:	12.9
Firm Discharge	(m3/s)	:	11.6
Peak Discharge	(m3/s)	:	23.2
Effective Storage	(Mil. m3)	:	247.1

Scheme Information		Full Supply Level (m)				
		494.0	485.3	476.5	467.8	459.1
Min. Operating Level	(m)	485.7	473.9	460.9	444.7	418.7
Rated Water Level	(m)	491.2	481.5	471.3	460.1	445.6
Tail Water Level	(m)	405.0	405.0	405.0	405.0	405.0
Reservoir Storage	(Mil. m3)	990.0	731.6	534.0	380.2	265.1
Reservoir Area	(km2)	28.6	22.6	18.6	15.2	12.2
Power Output						
Gross Head	(m)	86.2	76.5	66.3	55.1	40.6
Average Net Head	(m)	82.2	73.0	63.3	52.1	38.6
Firm Capacity	(MW)	7.9	7.0	6.1	5.0	3.7
Installed Capacity	(MW)	15.7	14.0	12.1	10.0	7.4
Firm Energy	(GWh)	68.9	61.1	53.0	43.6	32.3
Guaranteed Energy	(GWh)	62.0	55.0	47.7	39.3	29.1
Secondary Energy	(GWh)	17.8	15.8	13.7	11.3	8.3
Cost Estimate						
Dam	(Mil. US$)	127.3	103.7	83.0	65.0	49.5
Diversion Work	(Mil. US$)	7.5	7.5	7.5	7.5	7.5
Spillway	(Mil. US$)	6.4	6.0	5.6	5.3	4.9
Intake	(Mil. US$)	0.4	0.4	0.5	0.5	0.7
Headrace Tunnel	(Mil. US$)	0.4	0.4	0.4	0.4	0.4
Penstock Tunnel	(Mil. US$)	0.6	0.6	0.6	0.6	0.5
Powerhouse	(Mil. US$)	1.8	1.7	1.6	1.4	1.0
Generating Equipment	(Mil. US$)	6.8	6.4	5.6	4.7	3.6
T/L & S/S	(Mil. US$)	3.0	3.0	3.0	3.0	3.0
Access Road	(Mil. US$)	4.4	4.4	4.4	4.4	4.4
Miscellaneous Cost	(Mil. US$)	6.9	5.7	4.7	3.8	2.9
Direct Cost	(Mil. US$)	165.6	140.0	116.9	96.6	78.5
Compensation	(Mil. US$)	18.0	15.6	13.6	11.7	9.8
Administration	(Mil. US$)	8.3	7.0	5.8	4.8	3.9
Engineering Service	(Mil. US$)	4.6	4.3	4.1	3.9	3.6
Physical Contingency	(Mil. US$)	24.8	21.0	17.5	14.5	11.8
Project Cost	(Mil. US$)	221.3	187.9	158.0	131.4	107.6
Evaluation Indices						
Unit Cost of Guaranteed Energy	(US$/MWh)	357.5	342.0	331.4	334.9	370.4

Scheme No. : 9
Project Name : Barra das Pombas
Type : Reservoir
Name of River : Itajai Do Norte

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* SUMMARY TABLE OF OUTPUTS *
****

Case No.		:	10
Catchment Area	(km2)	:	979.0
Average Runoff for Long Term	(m3/s)	:	17.6
Average Runoff for Critical Period	(m3/s)	:	12.9
Firm Discharge	(m3/s)	:	12.9
Peak Discharge	(m3/s)	:	25.8
Effective Storage	(Mil. m3)	:	416.0

Scheme Information		Full Supply Level (m) 494.0	488.3	482.6	477.0	471.3
Min. Operating Level	(m)	478.6	468.7	457.6	443.8	418.9
Rated Water Level	(m)	488.9	481.8	474.3	465.9	453.8
Tail Water Level	(m)	405.0	405.0	405.0	405.0	405.0
Reservoir Storage	(Mil. m3)	990.0	808.0	666.0	542.3	434.4
Reservoir Area	(km2)	28.6	24.2	21.3	18.8	16.5
Power Output						
Gross Head	(m)	83.9	76.8	69.3	60.9	48.8
Average Net Head	(m)	79.9	73.3	66.3	57.9	46.3
Firm Capacity	(MW)	8.5	7.8	7.0	6.1	4.9
Installed Capacity	(MW)	17.0	15.6	14.1	12.3	9.8
Firm Energy	(GWh)	74.3	68.2	61.7	53.9	43.1
Guaranteed Energy	(GWh)	66.9	61.3	55.5	48.5	38.8
Secondary Energy	(GWh)	13.5	12.4	11.2	9.8	7.9
Cost Estimate						
Dam	(Mil. US$)	127.3	111.7	97.2	84.0	71.9
Diversion Work	(Mil. US$)	7.5	7.5	7.5	7.5	7.5
Spillway	(Mil. US$)	6.4	6.2	5.9	5.7	5.4
Intake	(Mil. US$)	0.5	0.6	0.6	0.7	0.8
Headrace Tunnel	(Mil. US$)	0.5	0.5	0.5	0.5	0.5
Penstock Tunnel	(Mil. US$)	0.6	0.6	0.6	0.6	0.5
Powerhouse	(Mil. US$)	2.0	1.9	1.8	1.7	1.5
Generating Equipment	(Mil. US$)	7.1	6.8	6.5	5.7	4.7
T/L & S/S	(Mil. US$)	3.0	3.0	3.0	3.0	3.0
Access Road	(Mil. US$)	4.4	4.4	4.4	4.4	4.4
Miscellaneous Cost	(Mil. US$)	7.0	6.2	5.4	4.7	4.1
Direct Cost	(Mil. US$)	166.2	149.1	133.4	118.3	104.2
Compensation	(Mil. US$)	18.0	16.5	15.0	13.7	12.4
Administration	(Mil. US$)	8.3	7.5	6.7	5.9	5.2
Engineering Service	(Mil. US$)	4.6	4.4	4.3	4.1	4.0
Physical Contingency	(Mil. US$)	24.9	22.4	20.0	17.8	15.8
Project Cost	(Mil. US$)	222.0	199.8	179.3	159.8	141.4
Evaluation Indices						
Unit Cost of Guaranteed Energy	(US$/MWh)	332.9	326.7	323.8	330.7	365.9

Scheme No. : 10
Project Name : Timbo
Type : Reservoir
Name of River : Benedito

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* SUMMARY TABLE OF OUTPUTS *
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Case No.		:	1
Catchment Area	(km2)	:	765.0
Average Runoff for Long Term	(m3/s)	:	19.3
Average Runoff for Critical Period	(m3/s)	:	15.1
Firm Discharge	(m3/s)	:	4.5
Peak Discharge	(m3/s)	:	9.1
Effective Storage	(Mil. m3)	:	3.5

Scheme Information		Full Supply Level (m) 114.0	110.7	107.4	104.1	100.8
Min. Operating Level	(m)	110.5	106.5	103.0	99.6	95.2
Rated Water Level	(m)	112.8	109.3	105.9	102.6	98.9
Tail Water Level	(m)	67.0	67.0	67.0	67.0	67.0
Reservoir Storage	(Mil. m3)	24.0	20.7	17.9	15.3	12.6
Reservoir Area	(km2)	1.0	0.9	0.8	0.8	0.7
Power Output						
Gross Head	(m)	45.8	42.3	38.9	35.6	31.9
Average Net Head	(m)	43.8	40.3	36.9	33.6	30.4
Firm Capacity	(MW)	1.6	1.5	1.4	1.3	1.1
Installed Capacity	(MW)	3.3	3.0	2.8	2.5	2.3
Firm Energy	(GWh)	14.3	13.2	12.1	11.0	9.9
Guaranteed Energy	(GWh)	12.9	11.8	10.9	9.9	8.9
Secondary Energy	(GWh)	7.2	6.6	6.0	5.5	5.0
Cost Estimate						
Dam	(Mil. US$)	33.3	28.6	24.4	20.5	17.1
Diversion Work	(Mil. US$)	4.8	4.8	4.8	4.8	4.8
Spillway	(Mil. US$)	4.1	4.0	3.9	3.7	3.6
Intake	(Mil. US$)	0.2	0.2	0.2	0.2	0.2
Headrace Tunnel	(Mil. US$)	0.1	0.1	0.1	0.1	0.1
Penstock Tunnel	(Mil. US$)	0.3	0.3	0.3	0.3	0.3
Powerhouse	(Mil. US$)	0.5	0.5	0.5	0.5	0.4
Generating Equipment	(Mil. US$)	2.3	2.2	2.1	2.0	1.9
T/L & S/S	(Mil. US$)	0.5	0.5	0.5	0.5	0.5
Access Road	(Mil. US$)	0.0	0.0	0.0	0.0	0.0
Miscellaneous Cost	(Mil. US$)	1.8	1.6	1.4	1.2	1.0
Direct Cost	(Mil. US$)	47.9	42.8	38.1	33.8	29.9
Compensation	(Mil. US$)	2.8	2.7	2.5	2.4	2.3
Administration	(Mil. US$)	2.4	2.1	1.9	1.7	1.5
Engineering Service	(Mil. US$)	3.1	3.0	2.9	2.7	2.6
Physical Contingency	(Mil. US$)	7.2	6.4	5.7	5.1	4.5
Project Cost	(Mil. US$)	63.4	57.0	51.1	45.7	40.8
Evaluation Indices						
Unit Cost of Guaranteed Energy	(US$/MWh)	491.2	479.7	469.2	461.3	455.1

Scheme No. : 10
Project Name : Timbo
Type : Reservoir
Name of River : Benedito

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* SUMMARY TABLE OF OUTPUTS *
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Case No.		:	2
Catchment Area	(km2)	:	765.0
Average Runoff for Long Term	(m3/s)	:	19.3
Average Runoff for Critical Period	(m3/s)	:	15.1
Firm Discharge	(m3/s)	:	6.0
Peak Discharge	(m3/s)	:	12.1
Effective Storage	(Mil. m3)	:	13.8

Scheme Information		Full Supply Level (m)				
		114.0	113.8	113.6	113.3	113.1
Min. Operating Level	(m)	97.0	96.6	96.3	95.9	95.5
Rated Water Level	(m)	108.3	108.1	107.8	107.5	107.2
Tail Water Level	(m)	67.0	67.0	67.0	67.0	67.0
Reservoir Storage	(Mil. m3)	24.0	23.8	23.6	23.3	23.1
Reservoir Area	(km2)	1.0	1.0	1.0	1.0	1.0
Power Output						
Gross Head	(m)	41.3	41.1	40.8	40.5	40.2
Average Net Head	(m)	39.3	39.1	38.8	38.5	38.2
Firm Capacity	(MW)	2.0	1.9	1.9	1.9	1.9
Installed Capacity	(MW)	3.9	3.9	3.9	3.8	3.8
Firm Energy	(GWh)	17.1	17.0	16.9	16.8	16.7
Guaranteed Energy	(GWh)	15.4	15.3	15.2	15.1	15.0
Secondary Energy	(GWh)	8.6	8.5	8.4	8.4	8.3
Cost Estimate						
Dam	(Mil. US$)	33.3	33.0	32.6	32.3	32.0
Diversion Work	(Mil. US$)	4.8	4.8	4.8	4.8	4.8
Spillway	(Mil. US$)	4.1	4.1	4.1	4.1	4.1
Intake	(Mil. US$)	0.3	0.3	0.3	0.3	0.3
Headrace Tunnel	(Mil. US$)	0.1	0.1	0.1	0.1	0.1
Penstock Tunnel	(Mil. US$)	0.3	0.3	0.3	0.3	0.3
Powerhouse	(Mil. US$)	0.6	0.6	0.6	0.6	0.6
Generating Equipment	(Mil. US$)	2.6	2.6	2.6	2.5	2.5
T/L & S/S	(Mil. US$)	0.5	0.5	0.5	0.5	0.5
Access Road	(Mil. US$)	0.0	0.0	0.0	0.0	0.0
Miscellaneous Cost	(Mil. US$)	1.8	1.8	1.8	1.8	1.8
Direct Cost	(Mil. US$)	48.5	48.1	47.8	47.4	47.0
Compensation	(Mil. US$)	2.8	2.8	2.8	2.8	2.8
Administration	(Mil. US$)	2.4	2.4	2.4	2.4	2.4
Engineering Service	(Mil. US$)	3.1	3.1	3.1	3.1	3.1
Physical Contingency	(Mil. US$)	7.3	7.2	7.2	7.1	7.1
Project Cost	(Mil. US$)	64.2	63.7	63.2	62.8	62.3
Evaluation Indices						
Unit Cost of Guaranteed Energy	(US$/MWh)	414.3	414.2	414.0	413.9	413.8

Scheme No. : 11
Project Name : Benedito Novo
Type : Run-Of-River
Name of River : Benedito

****
* SUMMARY TABLE OF OUTPUTS *
****

Catchment Area	(km2) :	586.0
Average Runoff for Long Term	(m3/s) :	14.5
Average Runoff for Critical Period	(m3/s) :	11.3
Normal Water Level	(m) :	277.0
Tail Water Level	(m) :	160.0
Pondage Capacity	(Mil. m3) :	0.3
Pondage Area	(km2) :	0.18

		Development Ratio					
Plant Discharge		0.5	0.6	0.7	0.8	0.9	1.0
Peak Discharge	(m3/s)	18.1	13.9	10.8	8.3	5.9	1.9
Firm Discharge	(m3/s)	9.0	8.4	7.6	6.6	5.3	1.9
Power Output							
Gross Head	(m)	117.0	117.0	117.0	117.0	117.0	117.0
Average Net Head	(m)	109.0	109.0	109.0	109.0	109.0	109.0
Firm Capacity	(MW)	8.1	7.5	6.8	6.0	4.8	1.7
Installed Capacity	(MW)	16.2	12.5	9.7	7.4	5.3	1.7
Firm Energy	(GWh)	71.0	65.7	59.6	52.2	41.7	14.9
Guaranteed Energy	(GWh)	63.9	59.1	53.7	46.9	37.5	13.4
Secondary Energy	(GWh)	13.4	11.7	9.7	6.8	3.3	0.0
Cost Estimate							
Dam	(Mil. US$)	4.5	4.5	4.7	4.7	4.7	4.7
Diversion Work	(Mil. US$)	0.7	0.7	0.7	0.7	0.7	0.7
Intake	(Mil. US$)	0.3	0.2	0.2	0.1	0.1	0.1
Headrace Tunnel	(Mil. US$)	3.9	3.4	3.0	3.0	3.0	3.0
Surge Tank	(Mil. US$)	0.5	0.4	0.3	0.3	0.3	0.2
Penstock Tunnel	(Mil. US$)	1.4	1.2	1.0	0.9	0.8	0.8
Powerhouse	(Mil. US$)	1.7	1.4	1.1	0.7	0.6	0.2
Generating Equipment	(Mil. US$)	5.7	4.8	3.9	3.1	2.5	1.4
T/L & S/S	(Mil. US$)	1.1	1.1	1.1	1.1	1.1	1.1
Access Road	(Mil. US$)	0.4	0.4	0.4	0.4	0.4	0.4
Land Slide Protet	(Mil. US$)	0.0	0.0	0.0	0.0	0.0	0.0
Miscellaneous Cost	(Mil. US$)	0.5	0.5	0.5	0.4	0.4	0.4
Direct Cost	(Mil. US$)	20.6	18.5	16.9	15.4	14.5	13.0
Compensation	(Mil. US$)	0.4	0.4	0.4	0.4	0.4	0.4
Administration	(Mil. US$)	1.0	0.9	0.8	0.8	0.7	0.6
Engineering Service	(Mil. US$)	3.5	3.5	3.5	3.5	3.5	3.5
Physical Contingency	(Mil. US$)	3.1	2.8	2.5	2.3	2.2	1.9
Project Cost	(Mil. US$)	28.6	26.1	24.1	22.4	21.3	19.4
Evaluation Indices							
Unit Cost of Guaranteed Energy	(US$/MWh)	43.1	42.5	43.5	46.7	56.3	146.6

Scheme No. : 12
Project Name : Alto Benedito Novo
Type : Run-Of-River
Name of River : Benedito

****
* SUMMARY TABLE OF OUTPUTS *
****

Catchment Area	(km2) :	473.0
Average Runoff for Long Term	(m3/s) :	11.7
Average Runoff for Critical Period	(m3/s) :	9.2
Normal Water Level	(m) :	430.0
Tail Water Level	(m) :	316.0
Pondage Capacity	(Mil. m3) :	0.9
Pondage Area	(km2) :	0.17

		Development Ratio					
Plant Discharge		0.5	0.6	0.7	0.8	0.9	1.0
Peak Discharge	(m3/s)	14.7	11.3	8.8	6.8	4.8	1.5
Firm Discharge	(m3/s)	7.3	6.8	6.2	5.4	4.3	1.5
Power Output							
Gross Head	(m)	114.0	114.0	114.0	114.0	114.0	114.0
Average Net Head	(m)	107.0	107.0	107.0	107.0	107.0	107.0
Firm Capacity	(MW)	6.5	6.0	5.4	4.8	3.8	1.3
Installed Capacity	(MW)	12.9	10.0	7.8	5.9	4.2	1.3
Firm Energy	(GWh)	56.7	52.5	47.5	41.6	33.3	11.6
Guaranteed Energy	(GWh)	51.0	47.2	42.8	37.5	30.0	10.4
Secondary Energy	(GWh)	10.5	9.2	7.6	5.3	2.6	0.0
Cost Estimate							
Dam	(Mil. US$)	2.5	2.6	2.6	2.6	2.6	2.6
Diversion Work	(Mil. US$)	0.3	0.3	0.3	0.3	0.3	0.3
Intake	(Mil. US$)	0.2	0.2	0.1	0.1	0.1	0.0
Headrace Tunnel	(Mil. US$)	2.6	2.2	2.1	2.1	2.1	2.1
Surge Tank	(Mil. US$)	0.4	0.3	0.3	0.2	0.2	0.2
Penstock Tunnel	(Mil. US$)	1.3	1.1	0.9	0.8	0.8	0.8
Powerhouse	(Mil. US$)	1.4	1.1	0.8	0.6	0.5	0.2
Generating Equipment	(Mil. US$)	4.9	4.0	3.1	2.6	2.1	1.3
T/L & S/S	(Mil. US$)	1.4	1.4	1.4	1.4	1.4	1.4
Access Road	(Mil. US$)	0.3	0.3	0.3	0.3	0.3	0.3
Land Slide Protet	(Mil. US$)	10.0	10.0	10.0	10.0	10.0	10.0
Miscellaneous Cost	(Mil. US$)	1.7	1.6	1.6	1.5	1.5	1.5
Direct Cost	(Mil. US$)	26.8	25.1	23.4	22.5	21.8	20.6
Compensation	(Mil. US$)	0.3	0.3	0.3	0.3	0.3	0.3
Administration	(Mil. US$)	1.3	1.3	1.2	1.1	1.1	1.0
Engineering Service	(Mil. US$)	3.5	3.5	3.5	3.5	3.5	3.5
Physical Contingency	(Mil. US$)	4.0	3.8	3.5	3.4	3.3	3.1
Project Cost	(Mil. US$)	36.0	33.9	31.8	30.8	30.0	28.5
Evaluation Indices							
Unit Cost of Guaranteed Energy	(US$/MWh)	69.2	70.4	73.3	81.5	99.9	276.1

Scheme No. : 13
Project Name : Doutor Pedrinho
Type : Reservoir
Name of River : Benedito

****
* SUMMARY TABLE OF OUTPUTS *
****

Case No.		:	1
Catchment Area	(km2)	:	161.0
Average Runoff for Long Term	(m3/s)	:	4.2
Average Runoff for Critical Period	(m3/s)	:	3.2
Firm Discharge	(m3/s)	:	1.0
Peak Discharge	(m3/s)	:	1.9
Effective Storage	(Mil. m3)	:	0.8

Scheme Information		Full Supply Level (m)				
		594.0	580.7	567.3	554.0	540.7
Min. Operating Level	(m)	593.7	580.3	566.9	553.3	539.3
Rated Water Level	(m)	593.9	580.6	567.2	553.7	540.2
Tail Water Level	(m)	530.0	530.0	530.0	530.0	530.0
Reservoir Storage	(Mil. m3)	94.6	59.7	35.5	16.4	3.6
Reservoir Area	(km2)	2.9	2.1	1.7	1.2	0.6
Power Output						
Gross Head	(m)	63.9	50.6	37.2	23.7	10.2
Average Net Head	(m)	60.9	47.6	34.7	21.7	8.2
Firm Capacity	(MW)	0.5	0.4	0.3	0.2	0.1
Installed Capacity	(MW)	1.0	0.8	0.5	0.3	0.1
Firm Energy	(GWh)	4.2	3.3	2.4	1.5	0.6
Guaranteed Energy	(GWh)	3.8	3.0	2.2	1.4	0.5
Secondary Energy	(GWh)	2.1	1.6	1.2	0.8	0.3
Cost Estimate						
Dam	(Mil. US$)	85.9	54.9	31.9	16.0	5.9
Diversion Work	(Mil. US$)	1.6	1.6	1.6	1.6	1.6
Spillway	(Mil. US$)	2.6	2.3	1.9	1.6	1.3
Intake	(Mil. US$)	0.0	0.0	0.0	0.0	0.1
Headrace Tunnel	(Mil. US$)	0.2	0.2	0.2	0.2	0.2
Penstock Tunnel	(Mil. US$)	0.5	0.5	0.5	0.5	0.4
Powerhouse	(Mil. US$)	0.2	0.2	0.1	0.1	0.1
Generating Equipment	(Mil. US$)	1.2	1.1	1.1	1.0	1.0
T/L & S/S	(Mil. US$)	0.5	0.5	0.5	0.5	0.5
Access Road	(Mil. US$)	0.5	0.5	0.5	0.5	0.5
Miscellaneous Cost	(Mil. US$)	4.5	2.9	1.7	0.9	0.4
Direct Cost	(Mil. US$)	97.7	64.7	40.1	22.9	11.9
Compensation	(Mil. US$)	5.9	5.2	4.7	4.4	3.8
Administration	(Mil. US$)	4.9	3.2	2.0	1.1	0.6
Engineering Service	(Mil. US$)	4.2	3.7	3.1	2.6	2.2
Physical Contingency	(Mil. US$)	14.7	9.7	6.0	3.4	1.8
Project Cost	(Mil. US$)	127.3	86.5	55.9	34.4	20.2
Evaluation Indices						
Unit Cost of Guaranteed Energy	(US$/MWh)	3377.9	2939.1	2604.5	2556.3	3982.4

Scheme No. : 13
Project Name : Doutor Pedrinho
Type : Reservoir
Name of River : Benedito

****
* SUMMARY TABLE OF OUTPUTS *
****

Case No.		:	2
Catchment Area	(km2)	:	161.0
Average Runoff for Long Term	(m3/s)	:	4.2
Average Runoff for Critical Period	(m3/s)	:	3.2
Firm Discharge	(m3/s)	:	1.3
Peak Discharge	(m3/s)	:	2.6
Effective Storage	(Mil. m3)	:	3.0

Scheme Information		Full Supply Level (m) 594.0	581.3	568.5	555.8	543.1
Min. Operating Level	(m)	593.0	580.1	566.8	553.1	539.3
Rated Water Level	(m)	593.7	580.9	568.0	554.9	541.8
Tail Water Level	(m)	530.0	530.0	530.0	530.0	530.0
Reservoir Storage	(Mil. m3)	94.6	61.2	37.5	18.4	5.8
Reservoir Area	(km2)	2.9	2.2	1.7	1.2	0.7
Power Output						
Gross Head	(m)	63.7	50.9	38.0	24.9	11.8
Average Net Head	(m)	60.7	47.9	35.5	22.9	9.8
Firm Capacity	(MW)	0.6	0.5	0.4	0.2	0.1
Installed Capacity	(MW)	1.3	1.0	0.7	0.5	0.2
Firm Energy	(GWh)	5.6	4.4	3.3	2.1	0.9
Guaranteed Energy	(GWh)	5.0	4.0	2.9	1.9	0.8
Secondary Energy	(GWh)	2.8	2.2	1.6	1.1	0.5
Cost Estimate						
Dam	(Mil. US$)	85.9	56.1	33.7	17.8	7.3
Diversion Work	(Mil. US$)	1.6	1.6	1.6	1.6	1.6
Spillway	(Mil. US$)	2.6	2.3	2.0	1.6	1.3
Intake	(Mil. US$)	0.1	0.1	0.1	0.1	0.1
Headrace Tunnel	(Mil. US$)	0.2	0.2	0.2	0.2	0.2
Penstock Tunnel	(Mil. US$)	0.5	0.5	0.5	0.5	0.4
Powerhouse	(Mil. US$)	0.2	0.2	0.2	0.1	0.1
Generating Equipment	(Mil. US$)	1.4	1.3	1.1	1.1	1.0
T/L & S/S	(Mil. US$)	0.5	0.5	0.5	0.5	0.5
Access Road	(Mil. US$)	0.5	0.5	0.5	0.5	0.5
Miscellaneous Cost	(Mil. US$)	4.5	2.9	1.8	1.0	0.5
Direct Cost	(Mil. US$)	97.9	66.1	42.1	24.9	13.5
Compensation	(Mil. US$)	5.9	5.2	4.7	4.4	3.9
Administration	(Mil. US$)	4.9	3.3	2.1	1.2	0.7
Engineering Service	(Mil. US$)	4.2	3.7	3.1	2.7	2.2
Physical Contingency	(Mil. US$)	14.7	9.9	6.3	3.7	2.0
Project Cost	(Mil. US$)	127.5	88.3	58.4	37.0	22.3
Evaluation Indices						
Unit Cost of Guaranteed Energy	(US$/MWh)	2547.4	2235.1	1995.5	1954.1	2750.7

Scheme No. : 13
Project Name : Doutor Pedrinho
Type : Reservoir
Name of River : Benedito

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* SUMMARY TABLE OF OUTPUTS *
****

Case No.		:	3
Catchment Area	(km2)	:	161.0
Average Runoff for Long Term	(m3/s)	:	4.2
Average Runoff for Critical Period	(m3/s)	:	3.2
Firm Discharge	(m3/s)	:	1.6
Peak Discharge	(m3/s)	:	3.2
Effective Storage	(Mil. m3)	:	7.2

Scheme Information		Full Supply Level (m) 594.0	582.4	570.9	559.3	547.8
Min. Operating Level	(m)	591.5	579.4	566.7	552.8	539.3
Rated Water Level	(m)	593.2	581.4	569.5	557.1	544.9
Tail Water Level	(m)	530.0	530.0	530.0	530.0	530.0
Reservoir Storage	(Mil. m3)	94.6	64.1	41.6	22.3	10.0
Reservoir Area	(km2)	2.9	2.2	1.8	1.4	0.9
Power Output						
Gross Head	(m)	63.2	51.4	39.5	27.1	14.9
Average Net Head	(m)	60.2	48.4	37.0	25.1	12.9
Firm Capacity	(MW)	0.8	0.6	0.5	0.3	0.2
Installed Capacity	(MW)	1.6	1.3	1.0	0.7	0.3
Firm Energy	(GWh)	6.9	5.6	4.3	2.9	1.5
Guaranteed Energy	(GWh)	6.2	5.0	3.8	2.6	1.3
Secondary Energy	(GWh)	3.5	2.8	2.1	1.5	0.7
Cost Estimate						
Dam	(Mil. US$)	85.9	58.5	37.3	21.6	10.5
Diversion Work	(Mil. US$)	1.6	1.6	1.6	1.6	1.6
Spillway	(Mil. US$)	2.6	2.3	2.0	1.7	1.4
Intake	(Mil. US$)	0.1	0.1	0.1	0.1	0.1
Headrace Tunnel	(Mil. US$)	0.2	0.2	0.2	0.2	0.2
Penstock Tunnel	(Mil. US$)	0.5	0.5	0.5	0.5	0.4
Powerhouse	(Mil. US$)	0.3	0.2	0.2	0.2	0.1
Generating Equipment	(Mil. US$)	1.5	1.4	1.2	1.1	1.0
T/L & S/S	(Mil. US$)	0.5	0.5	0.5	0.5	0.5
Access Road	(Mil. US$)	0.5	0.5	0.5	0.5	0.5
Miscellaneous Cost	(Mil. US$)	4.5	3.1	2.0	1.2	0.6
Direct Cost	(Mil. US$)	98.1	68.9	46.1	29.1	17.1
Compensation	(Mil. US$)	5.9	5.3	4.8	4.5	4.1
Administration	(Mil. US$)	4.9	3.4	2.3	1.5	0.9
Engineering Service	(Mil. US$)	4.2	3.8	3.3	2.8	2.4
Physical Contingency	(Mil. US$)	14.7	10.3	6.9	4.4	2.6
Project Cost	(Mil. US$)	127.7	91.7	63.4	42.2	27.0
Evaluation Indices						
Unit Cost of Guaranteed Energy	(US$/MWh)	2057.0	1834.7	1659.7	1625.9	2019.3

Scheme No. : 13
Project Name : Doutor Pedrinho
Type : Reservoir
Name of River : Benedito

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* SUMMARY TABLE OF OUTPUTS *
****

Case No.		:	4
Catchment Area	(km2)	:	161.0
Average Runoff for Long Term	(m3/s)	:	4.2
Average Runoff for Critical Period	(m3/s)	:	3.2
Firm Discharge	(m3/s)	:	1.9
Peak Discharge	(m3/s)	:	3.8
Effective Storage	(Mil. m3)	:	11.4

Scheme Information		Full Supply Level (m)				
		594.0	583.5	573.0	562.5	552.0
Min. Operating Level	(m)	590.1	578.5	566.5	553.5	539.3
Rated Water Level	(m)	592.7	581.8	570.8	559.5	547.8
Tail Water Level	(m)	530.0	530.0	530.0	530.0	530.0
Reservoir Storage	(Mil. m3)	94.6	66.7	45.4	27.2	14.2
Reservoir Area	(km2)	2.9	2.3	1.9	1.5	1.1
Power Output						
Gross Head	(m)	62.7	51.8	40.8	29.5	17.8
Average Net Head	(m)	59.7	48.8	38.3	27.5	15.8
Firm Capacity	(MW)	0.9	0.8	0.6	0.4	0.2
Installed Capacity	(MW)	1.9	1.5	1.2	0.9	0.5
Firm Energy	(GWh)	8.3	6.8	5.3	3.8	2.2
Guaranteed Energy	(GWh)	7.4	6.1	4.8	3.4	2.0
Secondary Energy	(GWh)	4.1	3.4	2.7	1.9	1.1
Cost Estimate						
Dam	(Mil. US$)	85.9	60.7	40.7	25.4	14.1
Diversion Work	(Mil. US$)	1.6	1.6	1.6	1.6	1.6
Spillway	(Mil. US$)	2.6	2.3	2.1	1.8	1.5
Intake	(Mil. US$)	0.1	0.1	0.1	0.1	0.1
Headrace Tunnel	(Mil. US$)	0.2	0.2	0.2	0.2	0.2
Penstock Tunnel	(Mil. US$)	0.5	0.5	0.5	0.5	0.4
Powerhouse	(Mil. US$)	0.3	0.3	0.2	0.2	0.2
Generating Equipment	(Mil. US$)	1.7	1.5	1.4	1.2	1.1
T/L & S/S	(Mil. US$)	0.5	0.5	0.5	0.5	0.5
Access Road	(Mil. US$)	0.5	0.5	0.5	0.5	0.5
Miscellaneous Cost	(Mil. US$)	4.5	3.2	2.2	1.4	0.8
Direct Cost	(Mil. US$)	98.3	71.4	50.0	33.4	21.0
Compensation	(Mil. US$)	5.9	5.3	4.8	4.6	4.3
Administration	(Mil. US$)	4.9	3.6	2.5	1.7	1.1
Engineering Service	(Mil. US$)	4.2	3.8	3.4	2.9	2.5
Physical Contingency	(Mil. US$)	14.7	10.7	7.5	5.0	3.2
Project Cost	(Mil. US$)	128.0	94.9	68.1	47.5	32.0
Evaluation Indices						
Unit Cost of Guaranteed Energy	(US$/MWh)	1730.3	1567.2	1434.5	1393.3	1638.7

Scheme No. : 13
Project Name : Doutor Pedrinho
Type : Reservoir
Name of River : Benedito

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* SUMMARY TABLE OF OUTPUTS *
****

Case No.		:	5
Catchment Area	(km2)	:	161.0
Average Runoff for Long Term	(m3/s)	:	4.2
Average Runoff for Critical Period	(m3/s)	:	3.2
Firm Discharge	(m3/s)	:	2.2
Peak Discharge	(m3/s)	:	4.5
Effective Storage	(Mil. m3)	:	16.4

Scheme Information		Full Supply Level (m) 594.0	584.6	575.3	565.9	556.5
Min. Operating Level	(m)	588.1	577.3	565.9	554.2	539.3
Rated Water Level	(m)	592.0	582.2	572.2	562.0	550.8
Tail Water Level	(m)	530.0	530.0	530.0	530.0	530.0
Reservoir Storage	(Mil. m3)	94.6	69.6	49.5	33.0	19.2
Reservoir Area	(km2)	2.9	2.3	2.0	1.6	1.3
Power Output						
Gross Head	(m)	62.0	52.2	42.2	32.0	20.8
Average Net Head	(m)	59.0	49.2	39.7	30.0	18.8
Firm Capacity	(MW)	1.1	0.9	0.7	0.6	0.3
Installed Capacity	(MW)	2.2	1.8	1.5	1.1	0.7
Firm Energy	(GWh)	9.5	7.9	6.4	4.8	3.0
Guaranteed Energy	(GWh)	8.6	7.2	5.8	4.4	2.7
Secondary Energy	(GWh)	4.2	3.5	2.8	2.1	1.3
Cost Estimate						
Dam	(Mil. US$)	85.9	63.2	44.7	29.9	18.5
Diversion Work	(Mil. US$)	1.6	1.6	1.6	1.6	1.6
Spillway	(Mil. US$)	2.6	2.4	2.1	1.9	1.7
Intake	(Mil. US$)	0.1	0.1	0.1	0.1	0.2
Headrace Tunnel	(Mil. US$)	0.2	0.2	0.2	0.2	0.2
Penstock Tunnel	(Mil. US$)	0.5	0.5	0.5	0.5	0.4
Powerhouse	(Mil. US$)	0.3	0.3	0.3	0.2	0.2
Generating Equipment	(Mil. US$)	1.8	1.6	1.5	1.3	1.1
T/L & S/S	(Mil. US$)	0.5	0.5	0.5	0.5	0.5
Access Road	(Mil. US$)	0.5	0.5	0.5	0.5	0.5
Miscellaneous Cost	(Mil. US$)	4.5	3.3	2.4	1.6	1.0
Direct Cost	(Mil. US$)	98.5	74.2	54.3	38.4	25.9
Compensation	(Mil. US$)	5.9	5.4	4.9	4.6	4.4
Administration	(Mil. US$)	4.9	3.7	2.7	1.9	1.3
Engineering Service	(Mil. US$)	4.2	3.9	3.5	3.0	2.7
Physical Contingency	(Mil. US$)	14.8	11.1	8.1	5.8	3.9
Project Cost	(Mil. US$)	128.2	98.3	73.5	53.7	38.2
Evaluation Indices						
Unit Cost of Guaranteed Energy	(US$/MWh)	1502.3	1382.1	1282.1	1237.7	1407.1

Scheme No. : 13
Project Name : Doutor Pedrinho
Type : Reservoir
Name of River : Benedito

****
* SUMMARY TABLE OF OUTPUTS *
****

Case No.		:	6
Catchment Area	(km2)	:	161.0
Average Runoff for Long Term	(m3/s)	:	4.2
Average Runoff for Critical Period	(m3/s)	:	3.2
Firm Discharge	(m3/s)	:	2.6
Peak Discharge	(m3/s)	:	5.1
Effective Storage	(Mil. m3)	:	29.8

Scheme Information		Full Supply Level (m) 594.0	586.9	579.8	572.7	565.6
Min. Operating Level	(m)	582.7	573.0	562.9	552.8	539.3
Rated Water Level	(m)	590.2	582.3	574.2	566.1	556.9
Tail Water Level	(m)	530.0	530.0	530.0	530.0	530.0
Reservoir Storage	(Mil. m3)	94.6	75.3	57.7	44.9	32.6
Reservoir Area	(km2)	2.9	2.4	2.1	1.9	1.6
Power Output						
Gross Head	(m)	60.2	52.3	44.2	36.1	26.9
Average Net Head	(m)	57.2	49.3	41.7	33.6	24.9
Firm Capacity	(MW)	1.2	1.0	0.9	0.7	0.5
Installed Capacity	(MW)	2.4	2.1	1.8	1.4	1.0
Firm Energy	(GWh)	10.6	9.1	7.7	6.2	4.6
Guaranteed Energy	(GWh)	9.5	8.2	6.9	5.6	4.1
Secondary Energy	(GWh)	3.4	2.9	2.5	2.0	1.5
Cost Estimate						
Dam	(Mil. US$)	85.9	68.3	53.2	40.3	29.5
Diversion Work	(Mil. US$)	1.6	1.6	1.6	1.6	1.6
Spillway	(Mil. US$)	2.6	2.4	2.2	2.1	1.9
Intake	(Mil. US$)	0.2	0.2	0.2	0.2	0.2
Headrace Tunnel	(Mil. US$)	0.2	0.2	0.2	0.2	0.2
Penstock Tunnel	(Mil. US$)	0.5	0.5	0.5	0.5	0.4
Powerhouse	(Mil. US$)	0.4	0.3	0.3	0.3	0.3
Generating Equipment	(Mil. US$)	1.9	1.7	1.6	1.4	1.3
T/L & S/S	(Mil. US$)	0.5	0.5	0.5	0.5	0.5
Access Road	(Mil. US$)	0.5	0.5	0.5	0.5	0.5
Miscellaneous Cost	(Mil. US$)	4.5	3.6	2.8	2.2	1.6
Direct Cost	(Mil. US$)	98.6	79.8	63.6	49.7	38.0
Compensation	(Mil. US$)	5.9	5.5	5.1	4.8	4.6
Administration	(Mil. US$)	4.9	4.0	3.2	2.5	1.9
Engineering Service	(Mil. US$)	4.2	3.9	3.7	3.3	3.0
Physical Contingency	(Mil. US$)	14.8	12.0	9.5	7.5	5.7
Project Cost	(Mil. US$)	128.4	105.3	85.1	67.8	53.3
Evaluation Indices						
Unit Cost of Guaranteed Energy	(US$/MWh)	1358.5	1293.4	1237.0	1222.0	1297.7

Scheme No. : 13
Project Name : Doutor Pedrinho
Type : Reservoir
Name of River : Benedito

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* SUMMARY TABLE OF OUTPUTS *
****

Case No.		:	7
Catchment Area	(km2)	:	161.0
Average Runoff for Long Term	(m3/s)	:	4.2
Average Runoff for Critical Period	(m3/s)	:	3.2
Firm Discharge	(m3/s)	:	2.9
Peak Discharge	(m3/s)	:	5.8
Effective Storage	(Mil. m3)	:	53.0

Scheme Information		Full Supply Level (m) 594.0	590.2	586.4	582.6	578.8
Min. Operating Level	(m)	570.9	564.4	558.1	549.4	539.3
Rated Water Level	(m)	586.3	581.6	577.0	571.5	565.6
Tail Water Level	(m)	530.0	530.0	530.0	530.0	530.0
Reservoir Storage	(Mil. m3)	94.6	83.6	74.0	64.4	55.8
Reservoir Area	(km2)	2.9	2.6	2.4	2.2	2.1
Power Output						
Gross Head	(m)	56.3	51.6	47.0	41.5	35.6
Average Net Head	(m)	53.3	48.6	44.0	39.0	33.6
Firm Capacity	(MW)	1.3	1.2	1.0	0.9	0.8
Installed Capacity	(MW)	2.5	2.3	2.1	1.8	1.6
Firm Energy	(GWh)	11.1	10.1	9.1	8.1	7.0
Guaranteed Energy	(GWh)	10.0	9.1	8.2	7.3	6.3
Secondary Energy	(GWh)	2.5	2.3	2.1	1.9	1.6
Cost Estimate						
Dam	(Mil. US$)	85.9	76.1	67.1	58.8	51.1
Diversion Work	(Mil. US$)	1.6	1.6	1.6	1.6	1.6
Spillway	(Mil. US$)	2.6	2.5	2.4	2.3	2.2
Intake	(Mil. US$)	0.2	0.2	0.2	0.3	0.3
Headrace Tunnel	(Mil. US$)	0.2	0.2	0.2	0.2	0.2
Penstock Tunnel	(Mil. US$)	0.5	0.5	0.5	0.4	0.4
Powerhouse	(Mil. US$)	0.4	0.4	0.4	0.3	0.3
Generating Equipment	(Mil. US$)	1.9	1.8	1.7	1.6	1.5
T/L & S/S	(Mil. US$)	0.5	0.5	0.5	0.5	0.5
Access Road	(Mil. US$)	0.5	0.5	0.5	0.5	0.5
Miscellaneous Cost	(Mil. US$)	4.5	4.0	3.5	3.1	2.7
Direct Cost	(Mil. US$)	98.7	88.3	78.6	69.7	61.4
Compensation	(Mil. US$)	5.9	5.7	5.5	5.3	5.1
Administration	(Mil. US$)	4.9	4.4	3.9	3.5	3.1
Engineering Service	(Mil. US$)	4.2	4.1	3.9	3.8	3.6
Physical Contingency	(Mil. US$)	14.8	13.2	11.8	10.5	9.2
Project Cost	(Mil. US$)	128.5	115.7	103.8	92.7	82.4
Evaluation Indices						
Unit Cost of Guaranteed Energy	(US$/MWh)	1299.0	1282.5	1271.2	1280.0	1320.9

Scheme No. : 13
Project Name : Doutor Pedrinho
Type : Reservoir
Name of River : Benedito

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* SUMMARY TABLE OF OUTPUTS *
****

Case No.		:	8
Catchment Area	(km2)	:	161.0
Average Runoff for Long Term	(m3/s)	:	4.2
Average Runoff for Critical Period	(m3/s)	:	3.2
Firm Discharge	(m3/s)	:	3.2
Peak Discharge	(m3/s)	:	6.4
Effective Storage	(Mil. m3)	:	78.2

Scheme Information		Full Supply Level (m) 594.0	592.8	591.6	590.4	589.2
Min. Operating Level	(m)	554.0	550.8	547.1	543.3	539.3
Rated Water Level	(m)	580.7	578.8	576.8	574.7	572.6
Tail Water Level	(m)	530.0	530.0	530.0	530.0	530.0
Reservoir Storage	(Mil. m3)	94.6	91.1	87.6	84.1	81.0
Reservoir Area	(km2)	2.9	2.8	2.7	2.6	2.6
Power Output						
Gross Head	(m)	50.7	48.8	46.8	44.7	42.6
Average Net Head	(m)	47.7	45.8	44.3	42.2	40.1
Firm Capacity	(MW)	1.3	1.2	1.2	1.1	1.1
Installed Capacity	(MW)	2.5	2.4	2.3	2.2	2.1
Firm Energy	(GWh)	11.0	10.6	10.2	9.7	9.2
Guaranteed Energy	(GWh)	9.9	9.5	9.2	8.8	8.3
Secondary Energy	(GWh)	1.7	1.7	1.6	1.5	1.4
Cost Estimate						
Dam	(Mil. US$)	85.9	82.7	79.6	76.6	73.7
Diversion Work	(Mil. US$)	1.6	1.6	1.6	1.6	1.6
Spillway	(Mil. US$)	2.6	2.6	2.5	2.5	2.5
Intake	(Mil. US$)	0.3	0.3	0.3	0.3	0.3
Headrace Tunnel	(Mil. US$)	0.2	0.2	0.2	0.2	0.2
Penstock Tunnel	(Mil. US$)	0.4	0.4	0.4	0.4	0.4
Powerhouse	(Mil. US$)	0.4	0.4	0.4	0.4	0.4
Generating Equipment	(Mil. US$)	1.9	1.9	1.9	1.8	1.8
T/L & S/S	(Mil. US$)	0.5	0.5	0.5	0.5	0.5
Access Road	(Mil. US$)	0.5	0.5	0.5	0.5	0.5
Miscellaneous Cost	(Mil. US$)	4.5	4.3	4.2	4.0	3.9
Direct Cost	(Mil. US$)	98.8	95.4	92.1	88.9	85.7
Compensation	(Mil. US$)	5.9	5.8	5.7	5.7	5.6
Administration	(Mil. US$)	4.9	4.8	4.6	4.4	4.3
Engineering Service	(Mil. US$)	4.2	4.1	4.1	4.1	4.0
Physical Contingency	(Mil. US$)	14.8	14.3	13.8	13.3	12.9
Project Cost	(Mil. US$)	128.6	124.4	120.4	116.4	112.5
Evaluation Indices						
Unit Cost of Guaranteed Energy	(US$/MWh)	1308.6	1317.9	1318.8	1338.4	1362.3

Scheme No. : 14
Project Name : Trombudo Central (1)
Type : Reservoir
Name of River : Trombudo

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* SUMMARY TABLE OF OUTPUTS *
****

Case No.		:	1
Catchment Area	(km2)	:	293.0
Average Runoff for Long Term	(m3/s)	:	6.9
Average Runoff for Critical Period	(m3/s)	:	5.7
Firm Discharge	(m3/s)	:	1.1
Peak Discharge	(m3/s)	:	2.3
Effective Storage	(Mil. m3)	:	1.6

Scheme Information		Full Supply Level (m) 384.0	378.6	373.2	367.9	362.5
Min. Operating Level	(m)	383.9	378.4	373.0	367.5	362.1
Rated Water Level	(m)	384.0	378.6	373.2	367.7	362.4
Tail Water Level	(m)	353.0	353.0	353.0	353.0	353.0
Reservoir Storage	(Mil. m3)	179.2	116.7	72.6	37.0	14.4
Reservoir Area	(km2)	13.7	10.5	7.5	4.7	2.2
Power Output						
Gross Head	(m)	31.0	25.6	20.2	14.7	9.4
Average Net Head	(m)	29.0	23.6	18.7	13.7	8.4
Firm Capacity	(MW)	0.3	0.2	0.2	0.1	0.1
Installed Capacity	(MW)	0.5	0.4	0.4	0.3	0.2
Firm Energy	(GWh)	2.4	1.9	1.5	1.1	0.7
Guaranteed Energy	(GWh)	2.1	1.7	1.4	1.0	0.6
Secondary Energy	(GWh)	1.2	1.0	0.8	0.6	0.3
Cost Estimate						
Dam	(Mil. US$)	21.7	16.2	11.6	7.8	4.8
Diversion Work	(Mil. US$)	1.9	1.9	1.9	1.9	1.9
Spillway	(Mil. US$)	2.3	2.1	1.9	1.8	1.6
Intake	(Mil. US$)	0.0	0.0	0.0	0.1	0.1
Headrace Tunnel	(Mil. US$)	0.3	0.3	0.3	0.3	0.3
Penstock Tunnel	(Mil. US$)	0.3	0.3	0.3	0.3	0.3
Powerhouse	(Mil. US$)	0.1	0.1	0.1	0.1	0.1
Generating Equipment	(Mil. US$)	1.2	1.1	1.0	1.0	1.0
T/L & S/S	(Mil. US$)	0.5	0.5	0.5	0.5	0.5
Access Road	(Mil. US$)	0.0	0.0	0.0	0.0	0.0
Miscellaneous Cost	(Mil. US$)	1.2	0.9	0.7	0.5	0.3
Direct Cost	(Mil. US$)	29.4	23.5	18.4	14.2	10.8
Compensation	(Mil. US$)	7.6	6.6	5.7	4.8	4.0
Administration	(Mil. US$)	1.5	1.2	0.9	0.7	0.5
Engineering Service	(Mil. US$)	2.8	2.6	2.4	2.3	2.1
Physical Contingency	(Mil. US$)	4.4	3.5	2.8	2.1	1.6
Project Cost	(Mil. US$)	45.7	37.4	30.2	24.1	19.0
Evaluation Indices						
Unit Cost of Guaranteed Energy	(US$/MWh)	2145.3	2159.6	2200.9	2389.7	3103.2

Scheme No. : 14
Project Name : Trombudo Central (1)
Type : Reservoir
Name of River : Trombudo

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* SUMMARY TABLE OF OUTPUTS *
****

Case No.		:	2
Catchment Area	(km2)	:	293.0
Average Runoff for Long Term	(m3/s)	:	6.9
Average Runoff for Critical Period	(m3/s)	:	5.7
Firm Discharge	(m3/s)	:	1.7
Peak Discharge	(m3/s)	:	3.4
Effective Storage	(Mil. m3)	:	6.4

Scheme Information		Full Supply Level (m) 384.0	378.9	373.8	368.7	363.6
Min. Operating Level	(m)	383.5	378.1	373.0	367.2	362.1
Rated Water Level	(m)	383.8	378.6	373.6	368.2	363.1
Tail Water Level	(m)	353.0	353.0	353.0	353.0	353.0
Reservoir Storage	(Mil. m3)	179.2	119.0	77.3	40.6	19.2
Reservoir Area	(km2)	13.7	10.7	7.8	5.1	2.7
Power Output						
Gross Head	(m)	30.8	25.6	20.6	15.2	10.1
Average Net Head	(m)	28.8	23.6	19.1	14.2	9.1
Firm Capacity	(MW)	0.4	0.3	0.3	0.2	0.1
Installed Capacity	(MW)	0.8	0.7	0.5	0.4	0.3
Firm Energy	(GWh)	3.6	2.9	2.3	1.8	1.1
Guaranteed Energy	(GWh)	3.2	2.6	2.1	1.6	1.0
Secondary Energy	(GWh)	1.8	1.5	1.2	0.9	0.6
Cost Estimate						
Dam	(Mil. US$)	21.7	16.5	12.1	8.4	5.4
Diversion Work	(Mil. US$)	1.9	1.9	1.9	1.9	1.9
Spillway	(Mil. US$)	2.3	2.1	2.0	1.8	1.7
Intake	(Mil. US$)	0.1	0.1	0.1	0.1	0.1
Headrace Tunnel	(Mil. US$)	0.3	0.3	0.3	0.3	0.3
Penstock Tunnel	(Mil. US$)	0.3	0.3	0.3	0.3	0.3
Powerhouse	(Mil. US$)	0.2	0.2	0.2	0.1	0.1
Generating Equipment	(Mil. US$)	1.3	1.2	1.1	1.1	1.0
T/L & S/S	(Mil. US$)	0.5	0.5	0.5	0.5	0.5
Access Road	(Mil. US$)	0.0	0.0	0.0	0.0	0.0
Miscellaneous Cost	(Mil. US$)	1.2	0.9	0.7	0.5	0.3
Direct Cost	(Mil. US$)	29.7	24.0	19.1	14.9	11.5
Compensation	(Mil. US$)	7.6	6.7	5.8	5.0	4.1
Administration	(Mil. US$)	1.5	1.2	1.0	0.7	0.6
Engineering Service	(Mil. US$)	2.8	2.6	2.4	2.3	2.2
Physical Contingency	(Mil. US$)	4.5	3.6	2.9	2.2	1.7
Project Cost	(Mil. US$)	45.9	38.0	31.1	25.2	20.1
Evaluation Indices						
Unit Cost of Guaranteed Energy	(US$/MWh)	1443.2	1457.3	1479.5	1604.8	2003.2

Scheme No. : 14
Project Name : Trombudo Central (1)
Type : Reservoir
Name of River : Trombudo

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* SUMMARY TABLE OF OUTPUTS *
****

Case No.		:	3
Catchment Area	(km2)	:	293.0
Average Runoff for Long Term	(m3/s)	:	6.9
Average Runoff for Critical Period	(m3/s)	:	5.7
Firm Discharge	(m3/s)	:	2.3
Peak Discharge	(m3/s)	:	4.6
Effective Storage	(Mil. m3)	:	13.8

Scheme Information		Full Supply Level (m) 384.0	379.3	374.7	370.0	365.4
Min. Operating Level	(m)	382.9	377.7	373.0	366.8	362.1
Rated Water Level	(m)	383.6	378.8	374.1	369.0	364.3
Tail Water Level	(m)	353.0	353.0	353.0	353.0	353.0
Reservoir Storage	(Mil. m3)	179.2	122.6	84.5	46.3	26.6
Reservoir Area	(km2)	13.7	10.9	8.3	5.7	3.5
Power Output						
Gross Head	(m)	30.6	25.8	21.1	16.0	11.3
Average Net Head	(m)	28.6	23.8	19.6	15.0	10.3
Firm Capacity	(MW)	0.5	0.4	0.4	0.3	0.2
Installed Capacity	(MW)	1.1	0.9	0.7	0.6	0.4
Firm Energy	(GWh)	4.7	3.9	3.2	2.5	1.7
Guaranteed Energy	(GWh)	4.2	3.5	2.9	2.2	1.5
Secondary Energy	(GWh)	2.4	2.0	1.6	1.2	0.8
Cost Estimate						
Dam	(Mil. US$)	21.7	16.9	12.8	9.3	6.4
Diversion Work	(Mil. US$)	1.9	1.9	1.9	1.9	1.9
Spillway	(Mil. US$)	2.3	2.1	2.0	1.8	1.7
Intake	(Mil. US$)	0.1	0.1	0.1	0.1	0.1
Headrace Tunnel	(Mil. US$)	0.3	0.3	0.3	0.3	0.3
Penstock Tunnel	(Mil. US$)	0.3	0.3	0.3	0.3	0.3
Powerhouse	(Mil. US$)	0.2	0.2	0.2	0.2	0.2
Generating Equipment	(Mil. US$)	1.5	1.4	1.3	1.2	1.1
T/L & S/S	(Mil. US$)	0.5	0.5	0.5	0.5	0.5
Access Road	(Mil. US$)	0.0	0.0	0.0	0.0	0.0
Miscellaneous Cost	(Mil. US$)	1.2	0.9	0.7	0.5	0.4
Direct Cost	(Mil. US$)	29.9	24.6	20.0	16.1	12.7
Compensation	(Mil. US$)	7.6	6.8	6.0	5.2	4.4
Administration	(Mil. US$)	1.5	1.2	1.0	0.8	0.6
Engineering Service	(Mil. US$)	2.8	2.6	2.5	2.3	2.2
Physical Contingency	(Mil. US$)	4.5	3.7	3.0	2.4	1.9
Project Cost	(Mil. US$)	46.2	38.9	32.5	26.8	21.9
Evaluation Indices						
Unit Cost of Guaranteed Energy	(US$/MWh)	1094.7	1110.3	1121.5	1215.7	1444.9

Scheme No. : 14
Project Name : Trombudo Central (I)
Type : Reservoir
Name of River : Trombudo

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* SUMMARY TABLE OF OUTPUTS *
****

Case No.		:	4
Catchment Area	(km2)	:	293.0
Average Runoff for Long Term	(m3/s)	:	6.9
Average Runoff for Critical Period	(m3/s)	:	5.7
Firm Discharge	(m3/s)	:	2.8
Peak Discharge	(m3/s)	:	5.7
Effective Storage	(Mil. m3)	:	22.6

Scheme Information		Full Supply Level (m)				
		384.0	379.9	375.7	371.6	367.5
Min. Operating Level	(m)	382.2	377.1	373.0	367.8	362.1
Rated Water Level	(m)	383.4	379.0	374.8	370.3	365.7
Tail Water Level	(m)	353.0	353.0	353.0	353.0	353.0
Reservoir Storage	(Mil. m3)	179.2	126.9	93.1	59.2	35.4
Reservoir Area	(km2)	13.7	11.2	8.9	6.6	4.5
Power Output						
Gross Head	(m)	30.4	26.0	21.8	17.3	12.7
Average Net Head	(m)	28.4	24.0	20.3	16.3	11.7
Firm Capacity	(MW)	0.7	0.6	0.5	0.4	0.3
Installed Capacity	(MW)	1.3	1.1	1.0	0.8	0.5
Firm Energy	(GWh)	5.8	4.9	4.2	3.4	2.4
Guaranteed Energy	(GWh)	5.3	4.4	3.8	3.0	2.2
Secondary Energy	(GWh)	2.9	2.5	2.1	1.7	1.2
Cost Estimate						
Dam	(Mil. US$)	21.7	17.4	13.7	10.4	7.6
Diversion Work	(Mil. US$)	1.9	1.9	1.9	1.9	1.9
Spillway	(Mil. US$)	2.3	2.1	2.0	1.9	1.8
Intake	(Mil. US$)	0.1	0.1	0.1	0.1	0.1
Headrace Tunnel	(Mil. US$)	0.3	0.3	0.3	0.3	0.3
Penstock Tunnel	(Mil. US$)	0.3	0.3	0.3	0.3	0.3
Powerhouse	(Mil. US$)	0.3	0.3	0.2	0.2	0.2
Generating Equipment	(Mil. US$)	1.6	1.5	1.4	1.3	1.2
T/L & S/S	(Mil. US$)	0.5	0.5	0.5	0.5	0.5
Access Road	(Mil. US$)	0.0	0.0	0.0	0.0	0.0
Miscellaneous Cost	(Mil. US$)	1.2	1.0	0.8	0.6	0.5
Direct Cost	(Mil. US$)	30.1	25.4	21.2	17.5	14.3
Compensation	(Mil. US$)	7.6	6.8	6.1	5.4	4.8
Administration	(Mil. US$)	1.5	1.3	1.1	0.9	0.7
Engineering Service	(Mil. US$)	2.8	2.6	2.5	2.4	2.2
Physical Contingency	(Mil. US$)	4.5	3.8	3.2	2.6	2.1
Project Cost	(Mil. US$)	46.5	39.9	34.0	28.8	24.1
Evaluation Indices						
Unit Cost of Guaranteed Energy	(US$/MWh)	886.8	903.9	908.1	956.1	1120.6

Scheme No. : 14
Project Name : Trombudo Central (1)
Type : Reservoir
Name of River : Trombudo

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* SUMMARY TABLE OF OUTPUTS *
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Case No.		:	5
Catchment Area	(km2)	:	293.0
Average Runoff for Long Term	(m3/s)	:	6.9
Average Runoff for Critical Period	(m3/s)	:	5.7
Firm Discharge	(m3/s)	:	3.4
Peak Discharge	(m3/s)	:	6.8
Effective Storage	(Mil. m3)	:	31.4

Scheme Information		Full Supply Level (m) 384.0	380.4	376.8	373.2	369.6
Min. Operating Level	(m)	381.5	376.8	373.0	368.7	362.1
Rated Water Level	(m)	383.2	379.2	375.5	371.7	367.1
Tail Water Level	(m)	353.0	353.0	353.0	353.0	353.0
Reservoir Storage	(Mil. m3)	179.2	133.1	101.7	72.1	44.2
Reservoir Area	(km2)	13.7	11.5	9.5	7.5	5.5
Power Output						
Gross Head	(m)	30.2	26.2	22.5	18.7	14.1
Average Net Head	(m)	28.2	24.2	20.5	17.2	13.1
Firm Capacity	(MW)	0.8	0.7	0.6	0.5	0.4
Installed Capacity	(MW)	1.6	1.4	1.2	1.0	0.7
Firm Energy	(GWh)	7.0	6.0	5.1	4.2	3.2
Guaranteed Energy	(GWh)	6.3	5.4	4.6	3.8	2.9
Secondary Energy	(GWh)	3.5	3.0	2.5	2.1	1.6
Cost Estimate						
Dam	(Mil. US$)	21.7	17.9	14.6	11.6	9.0
Diversion Work	(Mil. US$)	1.9	1.9	1.9	1.9	1.9
Spillway	(Mil. US$)	2.3	2.2	2.0	1.9	1.8
Intake	(Mil. US$)	0.1	0.1	0.1	0.1	0.2
Headrace Tunnel	(Mil. US$)	0.3	0.3	0.3	0.3	0.3
Penstock Tunnel	(Mil. US$)	0.3	0.3	0.3	0.3	0.3
Powerhouse	(Mil. US$)	0.3	0.3	0.3	0.3	0.2
Generating Equipment	(Mil. US$)	1.7	1.6	1.5	1.4	1.3
T/L & S/S	(Mil. US$)	0.5	0.5	0.5	0.5	0.5
Access Road	(Mil. US$)	0.0	0.0	0.0	0.0	0.0
Miscellaneous Cost	(Mil. US$)	1.2	1.0	0.8	0.7	0.5
Direct Cost	(Mil. US$)	30.3	26.1	22.3	19.0	16.0
Compensation	(Mil. US$)	7.6	6.9	6.3	5.7	5.1
Administration	(Mil. US$)	1.5	1.3	1.1	0.9	0.8
Engineering Service	(Mil. US$)	2.8	2.7	2.5	2.4	2.3
Physical Contingency	(Mil. US$)	4.5	3.9	3.4	2.8	2.4
Project Cost	(Mil. US$)	46.7	41.0	35.7	30.9	26.6
Evaluation Indices						
Unit Cost of Guaranteed Energy	(US$/MWh)	747.7	764.0	784.6	810.2	917.1

Scheme No. : 14
Project Name : Trombudo Central (1)
Type : Reservoir
Name of River : Trombudo

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* SUMMARY TABLE OF OUTPUTS *
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Case No.		:	6
Catchment Area	(km2)	:	293.0
Average Runoff for Long Term	(m3/s)	:	6.9
Average Runoff for Critical Period	(m3/s)	:	5.7
Firm Discharge	(m3/s)	:	4.0
Peak Discharge	(m3/s)	:	8.0
Effective Storage	(Mil. m3)	:	42.1

Scheme Information		Full Supply Level (m) 384.0	380.8	377.5	374.3	371.1
Min. Operating Level	(m)	380.7	376.1	372.4	368.4	362.1
Rated Water Level	(m)	382.9	379.2	375.8	372.3	368.1
Tail Water Level	(m)	353.0	353.0	353.0	353.0	353.0
Reservoir Storage	(Mil. m3)	179.2	137.9	107.9	81.4	54.9
Reservoir Area	(km2)	13.7	11.8	9.9	8.1	6.3
Power Output						
Gross Head	(m)	29.9	26.2	22.8	19.3	15.1
Average Net Head	(m)	27.9	24.2	21.3	17.8	14.1
Firm Capacity	(MW)	0.9	0.8	0.7	0.6	0.5
Installed Capacity	(MW)	1.8	1.6	1.4	1.2	0.9
Firm Energy	(GWh)	8.0	7.0	6.1	5.1	4.1
Guaranteed Energy	(GWh)	7.2	6.3	5.5	4.6	3.6
Secondary Energy	(GWh)	2.9	2.5	2.2	1.9	1.5
Cost Estimate						
Dam	(Mil. US$)	21.7	18.3	15.2	12.5	10.0
Diversion Work	(Mil. US$)	1.9	1.9	1.9	1.9	1.9
Spillway	(Mil. US$)	2.3	2.2	2.1	2.0	1.9
Intake	(Mil. US$)	0.2	0.2	0.2	0.2	0.2
Headrace Tunnel	(Mil. US$)	0.3	0.3	0.3	0.3	0.3
Penstock Tunnel	(Mil. US$)	0.3	0.3	0.3	0.3	0.3
Powerhouse	(Mil. US$)	0.4	0.4	0.3	0.3	0.3
Generating Equipment	(Mil. US$)	1.8	1.7	1.7	1.5	1.4
T/L & S/S	(Mil. US$)	0.5	0.5	0.5	0.5	0.5
Access Road	(Mil. US$)	0.0	0.0	0.0	0.0	0.0
Miscellaneous Cost	(Mil. US$)	1.2	1.0	0.9	0.7	0.6
Direct Cost	(Mil. US$)	30.5	26.7	23.3	20.1	17.3
Compensation	(Mil. US$)	7.6	7.0	6.4	5.9	5.4
Administration	(Mil. US$)	1.5	1.3	1.2	1.0	0.9
Engineering Service	(Mil. US$)	2.8	2.7	2.5	2.4	2.3
Physical Contingency	(Mil. US$)	4.6	4.0	3.5	3.0	2.6
Project Cost	(Mil. US$)	46.9	41.7	36.9	32.5	28.5
Evaluation Indices						
Unit Cost of Guaranteed Energy	(US$/MWh)	650.9	667.6	670.8	705.7	783.0

Scheme No. : 14
Project Name : Trombudo Central (1)
Type : Reservoir
Name of River : Trombudo

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* SUMMARY TABLE OF OUTPUTS *
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Case No.		:	7
Catchment Area	(km2)	:	293.0
Average Runoff for Long Term	(m3/s)	:	6.9
Average Runoff for Critical Period	(m3/s)	:	5.7
Firm Discharge	(m3/s)	:	4.6
Peak Discharge	(m3/s)	:	9.1
Effective Storage	(Mil. m3)	:	67.1

Scheme Information		Full Supply Level (m) 384.0	381.5	379.1	376.6	374.1
Min. Operating Level	(m)	378.1	374.2	370.9	366.9	362.1
Rated Water Level	(m)	382.0	379.1	376.3	373.4	370.1
Tail Water Level	(m)	353.0	353.0	353.0	353.0	353.0
Reservoir Storage	(Mil. m3)	179.2	147.6	120.4	100.1	79.9
Reservoir Area	(km2)	13.7	12.2	10.8	9.4	8.0
Power Output						
Gross Head	(m)	29.0	26.1	23.3	20.4	17.1
Average Net Head	(m)	27.0	24.1	21.8	18.9	16.1
Firm Capacity	(MW)	1.0	0.9	0.8	0.7	0.6
Installed Capacity	(MW)	2.0	1.8	1.6	1.4	1.2
Firm Energy	(GWh)	8.9	7.9	7.2	6.2	5.3
Guaranteed Energy	(GWh)	8.0	7.1	6.5	5.6	4.8
Secondary Energy	(GWh)	2.3	2.0	1.8	1.6	1.4
Cost Estimate						
Dam	(Mil. US$)	21.7	19.1	16.6	14.4	12.3
Diversion Work	(Mil. US$)	1.9	1.9	1.9	1.9	1.9
Spillway	(Mil. US$)	2.3	2.2	2.1	2.0	2.0
Intake	(Mil. US$)	0.2	0.2	0.2	0.2	0.2
Headrace Tunnel	(Mil. US$)	0.3	0.3	0.3	0.3	0.3
Penstock Tunnel	(Mil. US$)	0.3	0.3	0.3	0.3	0.3
Powerhouse	(Mil. US$)	0.4	0.4	0.4	0.3	0.3
Generating Equipment	(Mil. US$)	1.9	1.8	1.8	1.7	1.5
T/L & S/S	(Mil. US$)	0.5	0.5	0.5	0.5	0.5
Access Road	(Mil. US$)	0.0	0.0	0.0	0.0	0.0
Miscellaneous Cost	(Mil. US$)	1.2	1.1	0.9	0.8	0.7
Direct Cost	(Mil. US$)	30.6	27.7	25.0	22.5	20.1
Compensation	(Mil. US$)	7.6	7.1	6.7	6.3	5.9
Administration	(Mil. US$)	1.5	1.4	1.3	1.1	1.0
Engineering Service	(Mil. US$)	2.8	2.7	2.6	2.5	2.4
Physical Contingency	(Mil. US$)	4.6	4.2	3.8	3.4	3.0
Project Cost	(Mil. US$)	47.1	43.1	39.3	35.8	32.4
Evaluation Indices						
Unit Cost of Guaranteed Energy	(US$/MWh)	591.4	607.0	611.2	643.4	682.6

Scheme No. : 14
Project Name : Trombudo Central (1)
Type : Reservoir
Name of River : Trombudo

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* SUMMARY TABLE OF OUTPUTS *
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Case No.		:	8
Catchment Area	(km2)	:	293.0
Average Runoff for Long Term	(m3/s)	:	6.9
Average Runoff for Critical Period	(m3/s)	:	5.7
Firm Discharge	(m3/s)	:	5.1
Peak Discharge	(m3/s)	:	10.3
Effective Storage	(Mil. m3)	:	95.1

Scheme Information		Full Supply Level (m) 384.0	382.4	380.8	379.2	377.6
Min. Operating Level	(m)	374.6	372.1	369.2	365.2	362.1
Rated Water Level	(m)	380.9	379.0	376.9	374.5	372.4
Tail Water Level	(m)	353.0	353.0	353.0	353.0	353.0
Reservoir Storage	(Mil. m3)	179.2	158.6	137.9	121.1	107.9
Reservoir Area	(km2)	13.7	12.8	11.8	10.8	9.9
Power Output						
Gross Head	(m)	27.9	26.0	23.9	21.5	19.4
Average Net Head	(m)	25.9	24.5	22.4	20.0	17.9
Firm Capacity	(MW)	1.1	1.0	0.9	0.8	0.8
Installed Capacity	(MW)	2.2	2.1	1.9	1.7	1.5
Firm Energy	(GWh)	9.6	9.1	8.3	7.4	6.6
Guaranteed Energy	(GWh)	8.6	8.1	7.5	6.7	6.0
Secondary Energy	(GWh)	1.7	1.6	1.4	1.3	1.1
Cost Estimate						
Dam	(Mil. US$)	21.7	19.9	18.3	16.7	15.2
Diversion Work	(Mil. US$)	1.9	1.9	1.9	1.9	1.9
Spillway	(Mil. US$)	2.3	2.2	2.2	2.1	2.1
Intake	(Mil. US$)	0.2	0.2	0.2	0.3	0.3
Headrace Tunnel	(Mil. US$)	0.3	0.3	0.3	0.3	0.3
Penstock Tunnel	(Mil. US$)	0.3	0.3	0.3	0.3	0.3
Powerhouse	(Mil. US$)	0.4	0.4	0.4	0.4	0.4
Generating Equipment	(Mil. US$)	2.0	1.9	1.9	1.8	1.7
T/L & S/S	(Mil. US$)	0.5	0.5	0.5	0.5	0.5
Access Road	(Mil. US$)	0.0	0.0	0.0	0.0	0.0
Miscellaneous Cost	(Mil. US$)	1.2	1.1	1.0	0.9	0.9
Direct Cost	(Mil. US$)	30.8	28.9	27.0	25.2	23.5
Compensation	(Mil. US$)	7.6	7.3	7.0	6.7	6.5
Administration	(Mil. US$)	1.5	1.4	1.4	1.3	1.2
Engineering Service	(Mil. US$)	2.8	2.7	2.7	2.6	2.5
Physical Contingency	(Mil. US$)	4.6	4.3	4.1	3.8	3.5
Project Cost	(Mil. US$)	47.3	44.7	42.1	39.6	37.2
Evaluation Indices						
Unit Cost of Guaranteed Energy	(US$/MWh)	551.7	551.2	566.7	597.4	628.2

Scheme No. : 14
Project Name : Trombudo Central (1)
Type : Reservoir
Name of River : Trombudo

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* SUMMARY TABLE OF OUTPUTS *
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Case No.		:	9
Catchment Area	(km2)	:	293.0
Average Runoff for Long Term	(m3/s)	:	6.9
Average Runoff for Critical Period	(m3/s)	:	5.7
Firm Discharge	(m3/s)	:	5.7
Peak Discharge	(m3/s)	:	11.4
Effective Storage	(Mil. m3)	:	155.2

Scheme Information		Full Supply Level (m) 384.0	383.8	383.6	383.4	383.2
Min. Operating Level	(m)	364.8	364.1	363.5	362.9	362.3
Rated Water Level	(m)	377.6	377.2	376.9	376.6	376.2
Tail Water Level	(m)	353.0	353.0	353.0	353.0	353.0
Reservoir Storage	(Mil. m3)	179.2	176.6	174.0	171.4	168.8
Reservoir Area	(km2)	13.7	13.6	13.5	13.4	13.2
Power Output						
Gross Head	(m)	24.6	24.2	23.9	23.6	23.2
Average Net Head	(m)	23.1	22.7	22.4	22.1	21.7
Firm Capacity	(MW)	1.1	1.1	1.1	1.0	1.0
Installed Capacity	(MW)	2.2	2.1	2.1	2.1	2.0
Firm Energy	(GWh)	9.5	9.3	9.2	9.1	8.9
Guaranteed Energy	(GWh)	8.5	8.4	8.3	8.2	8.0
Secondary Energy	(GWh)	1.0	1.0	1.0	1.0	0.9
Cost Estimate						
Dam	(Mil. US$)	21.7	21.4	21.2	21.0	20.8
Diversion Work	(Mil. US$)	1.9	1.9	1.9	1.9	1.9
Spillway	(Mil. US$)	2.3	2.3	2.3	2.2	2.2
Intake	(Mil. US$)	0.3	0.3	0.3	0.3	0.3
Headrace Tunnel	(Mil. US$)	0.3	0.3	0.3	0.3	0.3
Penstock Tunnel	(Mil. US$)	0.3	0.3	0.3	0.3	0.3
Powerhouse	(Mil. US$)	0.5	0.5	0.5	0.4	0.4
Generating Equipment	(Mil. US$)	2.0	2.0	2.0	1.9	1.9
T/L & S/S	(Mil. US$)	0.5	0.5	0.5	0.5	0.5
Access Road	(Mil. US$)	0.0	0.0	0.0	0.0	0.0
Miscellaneous Cost	(Mil. US$)	1.2	1.2	1.2	1.2	1.2
Direct Cost	(Mil. US$)	30.9	30.6	30.4	30.1	29.9
Compensation	(Mil. US$)	7.6	7.5	7.5	7.5	7.4
Administration	(Mil. US$)	1.5	1.5	1.5	1.5	1.5
Engineering Service	(Mil. US$)	2.8	2.8	2.8	2.8	2.8
Physical Contingency	(Mil. US$)	4.6	4.6	4.6	4.5	4.5
Project Cost	(Mil. US$)	47.4	47.1	46.7	46.4	46.0
Evaluation Indices						
Unit Cost of Guaranteed Energy	(US$/MWh)	559.0	563.3	567.7	572.2	576.9