

て民間融資団が挙げられる。以下の表に融資先別のローンに関連する条件を列記する。

資 金 源	条 件			
	金利 (%)	猶予期間 (年)	返済期間 (年)	満期期間 (年)
内貨融資				
マレーシア連邦政府	7.5	5	20	25
非金融団体	8.0	5	15	20
外貨融資				
A D B	8.0	5	15	20
O E C F	4.0	7	18	25
民間融資 (円クレジット)	5.8	2	6	8
民間融資 (その他)	5.5	2.5	5	7.5

上記の表の各融資機関のローンに関連する条件は1987年時点のものである。財務分析に当り、これら各種の条件が将来も同じと仮定する。ムダミット-2小水力の内貨分はわずか124マレーシア百万ドルなので、内貨分に関しては融資先を考えず実施主体で十分融資できる範囲内にある。外貨分に関しては複数の融資先を考慮するほどの投資金額でない。従って、外・内貨の両方に対して融資先を選定する上での問題はないと考えられる。

8.2.3 財務分析

(1) 財務内部収益率

本計画の費用発生は前渡金等の財務条件を考慮に入れて配分している。販売電力量は、発電所内電力量と送電ロス(13%)を、電力供給量から差し引いて算定した。ムダミット-2計画による電力販売収入は、1996年より始まるとして、その時点での料金(M\$0.31/kWh)がプロジェクト・ライフ(2036年まで)中、同一であるとする。評価期間は1987年から2036年までの50年間とする。表8.6に示す収入と費用のキャッシュ・

フローよりFIRRは8.4%と算定された。

もし、内貨と外貨がそれぞれマレーシア連邦政府とOECDにより融資されるならば上記のFIRRは内貨に適用される金利(7.5%)より低く、一方OECDの貸出し金利よりは高い結果となる。さて、内貨が実施主体によって融資される場合は、本プロジェクトの財務上の妥当性は保障できることが判断できる。

感度分析を以下に示す条件で試算した。

		FIRR
ケース1	料金がM\$0.33/kWhの場合	8.9%
ケース2	費用増加 10%	7.6%

ケース2の場合FIRRが7.6%と低くなるが、外・内貨にたいする金利よりも、多少高いので、財務上の妥当性は維持できる。

(2) 返済能力と財務管理能力

返済能力は収入と元利支払い金とのバランスで判断できる。表8.7に示す財務表は、内貨がマレーシア連邦政府に、外貨がソフトローンによって融資される場合を想定している。このケースでは、収入と元利支払いのバランスが運転開始年度でプラスに転じ、外貨及び内貨金利に対して実施主体全体の正味利益で十分カバーできるものと判断する。累積バランスも満期期間内にプラスに転じ、実施主体の財務状況に与える当プロジェクトの影響は殆どないと言える。

一方、表8.8に示す財務表は内貨分を実施主体が自己融資、外貨がソフトローンによって融資されることを想定した予測財務表である。収入と元利支払いのバランスは運転開始年度でプラスに転じるが、実施主体の内貨融資及び外貨金利支払いの累積額が1995年に27マレーシア百万ドルとなるので、現状下における実施主体全体のキャッシュ発生量又は当該年(1995年)でのキャッシュ発生予測で判断する限り実施主体の融資能力に焦点が当てられる。

表 8.9 に示す財務表は内貨分を実施主体が自己融資し、外貨分がハードローン(8%)によって融資される場合を想定して作成した。収入と元利支払いのバランスが一部猶予期間を除いて負の状態が続いており、表 8.7 に示した外貨がソフトローンによって融資されるケースと比較しても、累積バランスの負債状況が著しく増大することが予想される。

上記財務 3 表はいずれも本計画に対する返済状況を分析したが、以下に示す財務表は将来のリンバン電力供給システムが全てディーゼルプラントで形成される場合と本計画とディーゼルプラントの組み合わせで形成される場合の 2 ケースでの収入と費用のバランスを示している。表 8.7 に示した融資条件に準じた。財務表を作成するに際して燃料費が上昇する場合と現状維持の場合に分けて予測した。

表 8.10 ; 全ディーゼルプラント	燃料費が上昇するケース
表 8.11 ; 全ディーゼルプラント	燃料費が一定のケース
表 8.12 ; 本計画を投入する場合	燃料費が上昇するケース
表 8.13 ; 本計画を投入する場合	燃料費が一定のケース

上記財務表で kWh 当りの電力料金を 2 セント上げた場合の年ベースでの収入と費用の正味収益を算定したが、全れのケースも負の状態、現行料金の場合と比較しても負債状況が減少する度合が少ない。財務表から判断できる重要事項は、燃料費の上昇又は一定という仮定条件にも係らず、正味収益及びその累積バランスの結果が本計画を投入する場合の方が有利であるという点にある。この有利性は、全ディーゼルプラント又は本計画が投入される場合における燃料消費量の差異に原因があると判断する。

(3) 財務分析の結果

(1)と(2)の分析結果より、内貨はマレーシア政府で、外貨はソフトローンを供与する融資機関で融資されることが望ましい。実施主体からみて、年ベースで推定した収入と元利支払いの差及びその累積額は実施主体に何ら財務上の問題をもたらすことはない。

また FIRR (8.4%) は外貨分金利 (4%) と内貨分金利 (7.5%) よりも高いので財務上の妥当性は十分確証できる。

更に本小水力の実施が有利またはディーゼルプラントよりも望ましいという結論はリ
ンバン電力供給システム全体における財務状況から判断できる。

第九章 今後の調査検討

9.1 概 括

前章で述べた通り、ムダミットー2水力発電計画は経済的にも財務的にも高い実施可能性をもつものとして評価された。そしてムダミットー2計画は施工計画検討結果にもとずき1996年の初めに運開させることが推奨される。

プロジェクトの運開を1996年年頭とするためには資金調達後1989年9月までには詳細設計を開始しなければならない。ポスト・フィージビリティスタディ調査は詳細設計を円滑に実施するために詳細設計に先立って実施されることが望まれる。

9.2 ポストフィージビリティスタディ調査

長期流量観測を目的として量水板が開発地点より8km下流に立てられた。水位観測は設置以来毎日定期的に行われている。さらに、水位-流量曲線を作成するために流量観測がD I D及びS E S C Oの共同チームのもと定期的に実施されている。

水文観測を増強し、信頼出来る流量データを蓄積するために、自記水位計を量水板近くに設置することが望まれる。自記水位計による水位記録は日2回の量水板観測によって裏付けられる。さらに、流量観測は水位-流量曲線の信頼おける範囲を広げるために高水時期にも実施されることが望まれる。

手動式雨量計が量水板近くに設置された。熱帯地方の降雨が局所的に起こることを考慮して、もう二つ自記雨量計が開発地点より上流のムダミット川流域に設置されることが望ましい。

本調査においては、コンクリート骨材の供給源として、河床堆積物および原石山開発案の2案を検討し、その利用可能量、運搬距離および物理特性を考慮して原石山開発案を提案している。しかし、本計画に対する、骨材の必要量は比較的少ないことから、市場販売ルートよりの買付けによる供給案に対する詳細調査・検討が必要と考えられる。

9.3 詳細設計

9.3.1 目的

このフィージビリティスタディ完了に引き続いてムダミットー2計画の開発に向けて詳細設計が開始される。詳細設計に対する技術サービスの目的は次の通りである。

- (イ) 最新のデータ及び情報を集めて計画の最適開発規模決定の見直しを行なう。
 - (ロ) 設計に必要なデータを得るために追加調査を実施する。
 - (ハ) 建設に向けて設計図面、設計報告書、技術仕様書、予備審査及び入札書の作成、建設費算定、さらに建設の施工工程表の作成を行なう。
- (ニ) 詳細設計実施中に S E S C O 職員に対して技術移転を行なう。

9.3.2 作業範囲

詳細設計に対する技術サービスは S E S C O 職員と緊密な関係をもって実施される。

(1) 既存データの見直し

既存データの見直しとは最新の情報を集め、これに基づいてフィージビリティスタディ報告書を見直し、必要な場合は開発案及び開発規模の修正を実施することである。

(2) インセプションレポート作成

インセプションレポートは次の点を述べることになる。

- (イ) 技術サービスに対する検討及び調査方法を述べた上で作業計画を示す。

(ロ) フィージビリティスタディの見直し。

(3) 現地調査の入札書類作成

現地調査は現地業者によって実施され、次の様な作業が実施される。

(イ) 試験ボーリング及び試験グラウティング

(ロ) 弾性波探査

(ハ) 現場岩石剪断試験

(ニ) 骨材に対する剪断試験

(ホ) 材料採集場での材料収集及び試験削掘を含むコンクリート試験

(ヘ) 地形図作成

(ト) ボーリング及び貫入試験

(4) 詳細設計のための現地作業及び試験

上項(3)の(イ)から(ト)までの現地作業及び試験作業はコンサルタントの技術指導及び監督のもと現地業者によって実施される。

(5) 基本設計及び建設費見積り

基本設計及び建設費見積りは次の作業を含む。

(イ) 手法、解析方法等を考慮して詳細設計のための設計基準を作成

(ロ) 項目(4)の調査結果に基づき最適開発規模及び構造物の最終見直し及び修正

(ハ) ダム、取水口、導水路、調圧水槽、pensstock、発電所、発電機器、水門やpensstockの鋼構造物、送電線等の全構造物の設計の見直し

(ニ) 基本設計レベルでの建設作業工程の検討

(ホ) 基本設計レベルでの建設費見積り

(ヘ) 計画の経済的実施可能性の確認

(6) 詳細設計

詳細設計、建設作業工程及び建設費見積りは次の作業を含む。

(イ) 宿舍、修理工場、倉庫等の設計や水道、電気の設備を含めた準備作業案の作成

(ロ) 橋を含めた建設用道路の設計

(ハ) 下流への洪水予報システムを含めた仮排水路、ダム、取水口、導水路、調圧水槽、pensストック、放水路を含めた発電所、開閉所等の構造物の詳細な設計

(ニ) 発電機器及び周辺機器の詳細な設計

(ホ) 水門、pensストック及びバルブの鋼構造物の詳細な設計

(ヘ) 木柱を含めた送電線と電機機器を含めた変電所の詳細な設計

(ト) 詳細な作業工程図の作成

(チ) 詳細な建設費見積り

(リ) 必要な場合、環境調査等の実施

(7) 入札書の作成

入札書は次の項目に対して作成される。

- (イ) 予備審査書類
- (ロ) 土木工事入札書類
- (ハ) 発電機器の入札書類
- (ニ) 鋼構造物に対する入札書類
- (ホ) 送電線及び変電所の入札書類
- (ヘ) 準備作業及び建設用道路に対する入札書類

(8) 報告書

次の報告書が作成される。

- (イ) インセプションレポート
- (ロ) 上項(3)の現地調査のための入札書類
- (ハ) 現地調査のデータブック
- (ニ) 設計基準書
- (ホ) 図面を含む設計書
- (ヘ) 建設費見積り
- (ト) 上項(7)の作業に対する入札書
- (チ) 進捗報告書

(9) 技術移転

コンサルタントは作業期間中 S E S C O 職員及び現地業者への技術移転に努める。

(10) 予備審査での援助

コンサルタントは業者選択の予備審査において S E S C O を援助する。

参 考 文 献

The following are a list of literatures mainly referred through the study:

1. Malaysian Meteorological Service, Micro-seismic of Malaysia and Adjacent Areas, 1983
2. Wolfenden, E.B., The Geology and Mineral Resources of Lower Rajang and Adjoining Area, Sarawak Memoir II, Geological Survey Department, British Territories in Borneo, 1960
3. Drainage and Irrigation Department, Sarawak Hydrological Year Book, 1962 - 1982
4. Drainage and Irrigation Department, Estimation of the Design Rainstorm (Hydrological Procedure No.1), 1973
5. Drainage and Irrigation Department, Estimation of Design Rainstorm in Sabah and Sarawak (Hydrological Procedure No. 26), 1982
6. ENEX Mini-Hydro Consultants, Final Report on Hydrological Study in Sarawak, March 1982
7. M + R International, Prefeasibility Study Limbang River Basin, January 1980
8. SAMA Consortium, Feasibility Report on Bakun Hydro-electric Project, November 1983
9. Snowy Mountains Engineering Corporation, Feasibility Report on Batang Ai Hydroelectric Project, December 1978
10. Toshio Takenouchi (JICA), Hydrological Characteristics of Sarawak, October 1982
11. WMO, Manual for Estimation of Probable Maximum Precipitation (Operational Hydrology Report No. 1), WMO - No.332, 1973
12. Mr Sugawara, On the Analysis of Runoff Structure about several Japanese Rivers, Japanese Journal of Geophysics Vol. 2 No. 4, March 1961
13. Department of Environment, A Handbook of Environmental Impact
14. Annual Report of the Forest Department, Sarawak (1980 to 1985)
15. Kapit District Annual Report (1978 to 1980 and 1985)

16. Land Code (Sarawak Chapter 81)
17. Annual Statistical Bulletin, Sarawak
18. SAMA Consortium, Pelagus/Bakun Hydro-electric Project, Ecological Impacts, July 1982
19. SESCO, 21st Annual Report, 1983
20. SESCO, 22nd Annual Report, 1984
21. SESCO, Data and Information on Small-scale Hydroelectric Power Project in Sarawak, Malaysia, September 1986
22. SAMA Consortium, Master Plan for Power System Development, April 1981
23. SAMA Consortium, Recommendations for Sarawak Hydropower Development, February 1983
24. Snowy Mountains Engineering Corporation, Ulu Ai Hydroelectric Project, Feasibility Report, July 1985
25. SAMA Consortium, Bakun Hydroelectric Project Detailed Design, August 1986

付 表

表 1.1 サラワク州における設備容量、発電力量および電力消費量

Year	Installed Capacity (KW)	Generated Energy (MWh)	Number of Consumer	Consumption (GWh)			Total
				Domestic	Industrial	Street	
1975	80,885	199,924	46,631	41,662	125,450	2,924	170,034
1976	86,602	228,555	50,138	47,337	142,415	3,432	193,183
1977	102,184	258,155	53,477	53,137	164,217	3,271	220,625
1978	138,362	301,193	61,433	56,458	198,411	3,412	258,280
1979	147,387	343,178	65,722	69,034	227,240	3,688	299,962
1980	152,755	383,319	73,212	93,270	232,502	4,194	329,965
1981	156,002	429,201	83,358	107,655	259,026	4,396	371,077
1982	189,246	483,059	94,200	120,788	286,658	4,807	412,253
1983	203,499	551,852	106,102	147,464	328,066	5,408	408,938
1984	228,508	601,987	116,107	148,295	356,279	5,806	510,379

Source : Annual Statistical Bulletin Sarawak, 1984

表3.1 材料試驗結果(1/2)

Item of Tests	Places		Value in General
	Medamit River (TME-1-TME-2)	Limbang River (TME-3-TME-7)	
a. Fineness Modulus of Gravel (F.M.)	8.18	8.61	6.5-9.0
Fineness Modulus of Sand (F.M.)	3.68	2.96	2.3-3.5
b. Specific Gravity of Gravel	2.553	2.588	2.5-2.7
Specific Gravity of Sand	2.438	2.361	2.5-2.7
c. Absorption of Gravel (%)	1.54	1.20	less than 3.0
Absorption of Sand (%)	2.438	2.361	less than 3.0
d. Organic Impurities of Sand	passed	not passed	
e. Scratch Hardness of Gravel	5.6	4.6	less than 5.0
f. Soundness of Gravel (%)	1.8	4.2	less than 12.0
Soundness of Sand (%)	-	19.1	less than 10.0
g. Abrasion of Gravel (%)	13.6	15.7	less than 40.0
h. Unit Weight of Gravel (t/m ³)	1.54	1.20	1.5-1.9
Unit Weight of Sand (t/m ³)	2.438	2.361	1.4-1.8

表3.1 材料試驗結果 (2/2)

Item of Tests	Quarry Samples	Acceptable Values
a. Specific Gravity	2.635	2.5-2.7
b. Absorption (%)	0.77	less than 3.0
c. Scratch Hardness	0.3	less than 5.0
d. Soundness (%)	1.09	less than 12.0
e. Abrasion (%)	17.8	less than 40.0
f. Aggregate Impact Value (%)	18	less than 45.0
g. Aggregate Crushing Value (%)	19	less than 45.0

表 3.2 調査孔およびサンプリング位置図 (1 / 2)

Sampling No.	Distance from Dam or Power House Site (km)	Volume of River Deposit (m ³)	Maximum Size of Particles (m)	Type of Rock	Sampling Weight (kg)
Quarry sample QME-1	0.2 upstream from damsite (left bank)	more than required	50x20	Sandstone and Shale	120
TME-1	From damsite up 0.85 (Middle of River)	1,000 (250)	30-50	Shale and Sandstone	120
TME-2	From damsite up 0.60 (Right Bank)	600 (150)	30-50	Shale and Sandstone	90

表 3. 2 調査孔およびサンプリング位置図 (2 / 2)

Sampling No.	Distance from Dam or Power House Site (Km)	Volume of River Deposit (m ³)	Maximum size of particles (m)	Type of rock	Sampling weight (Kg)
TME-3	From Power House up 2.50 (Left Bank)	9,000 (3,000)	30 - 50	Shale, Sandstone and limestone	90
TME-4	From Power House up 1.70 (Right Bank)	18,000 (6,000)	30 - 50	Shale, Sandstone and limestone	180
TME-5	From Power House up 0.70 (Left Bank)	21,000 (7,000)	30 - 50	Shale, Sandstone and limestone	90
TME-6	From Power House Down 1.80 (Right Bank)	7,800 (2,600)	20 - 30	Shale, Sandstone and limestone	90
TME-7	From Power House Down 2.20 (Left Bank)	10,000 (5,000)	20 - 30	Shale, Sandstone and Lime-stone	180
Total Volume		67,400 (24,000)			

Note: Figures in parenthesis show the estimated volume of gravel with the size under 10 cm

表3.3 環境影響調查結果 (1/2)

Item	Prediction	Evaluation
Settlement	No submergence is expected in the project area due to no inhabitants in the upstream from the damsite.	0
Land issues and compensation	About 40,000 m ² will have to be secured for the construction of such major facilities as dam, powerhouse and access road in the forest. Land issues are not foreseen, since the land is reserved to the Government and nobody may claim native customary rights.	0
Economic activities and social welfare	A large construction labour demand is expected. Electricity will be supplied to the villages from Medamit village to Limbang.	+H
Public health	It is not predicted that a vector of malaria will increase due to the creation of reservoir.	0
Sedimentation	Sediment deposited in the reservoir will be flushed out by the sand flush gate. Thus, the sedimentation problem is less affected.	-L

表3.3 環境影響調查結果 (2 / 2)

Item	Prediction	Evaluation
Vegetation	Since only a limited area of forest is opened, the effect to the vegetation is minimal. However, afforestation will be necessary at the opened areas after construction.	-L
Wildlife	Wildlife will not be affected, since the project area is only limited.	-L
Fish and fisheries	The migration of river fish is affected with the construction of dam. Thus, a fish ladder will be provided.	-L

表 4.1 サラワク州における設備容量

Station	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
1. Kuching	42,758	42,758	42,758	77,414	77,414	77,414	77,414	77,414	91,548*	103,324*	210,908*	212,264*
2. Sibü	15,794	15,794	31,560	31,560	31,560	31,560	31,560	31,560	31,560	31,560	47,560	47,564
3. Miri	10,680	10,680	10,680	10,680	14,550	14,550	14,550	32,150	31,050	41,950	41,950	41,200
4. Bintulu	1,154	1,611	1,611	1,811	3,811	11,551	11,551	22,991	20,664	20,376	19,776	30,890
5. Sarikei	1,775	2,575	2,575	2,575	2,575	2,575	2,575	3,295	4,415	4,415	4,415	6,415
6. Sri Aman	2,095	1,949	2,024	2,078	1,478	1,874	2,474	2,474	2,534	2,534	4,184	4,184
7. Limbang	1,734	1,734	1,735	1,735	1,735	1,935	2,535	2,535	2,310	2,535	3,585	3,585
8. Kapit	437	385	529	529	729	729	654	1,054	1,254	1,164	2,363	2,363
9. Marudi	607	607	607	607	804	804	754	954	879	943	1,280	1,313
10. Lawas	223	367	381	381	536	492	548	655	786	1,775	1,775	1,775
Whole Sarawak	80,435	81,956	98,174	133,575	139,255	148,055	151,102	183,646	196,599	221,518	348,699	364,624

Remarks: (1) * Inclusive of Batang Ai.

(2) These readings do not include generating units which have been retired.

(3) Source: As per SESCO Annual Reports (Commercial Office) and the answers to the Questionnaire

表 4.2 サラワク州における発電電力量

(Unit : MWh)

Station	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
1. Kuching	94,998	111,746	127,026	149,736	174,426	189,720	207,674	230,048	261,034	295,458*	344,975*	377,408
2. Sibü	39,666	43,720	48,188	55,002	60,894	67,017	73,100	80,217	88,018	91,941	101,412	104,842
3. Miri	20,793	24,550	29,255	38,474	44,231	52,338	60,688	70,224	78,053	81,186	92,343	98,901
4. Bintulu	2,678	3,141	4,161	5,618	7,930	13,299	18,631	24,996	33,615	37,908	53,481	52,240
5. Sarikei	3,580	3,962	4,745	5,655	6,418	6,996	7,910	9,016	9,718	10,234	13,375	15,607
6. Sri Aman	3,332	3,713	4,861	5,289	6,092	6,724	7,706	8,372	9,294	9,546	10,223	11,090
7. Limbang	3,253	3,679	3,965	4,526	5,033	5,567	5,993	7,506	8,781	9,462	10,609	11,596
8. Kapit	1,071	1,167	1,475	1,679	2,053	2,454	2,936	3,465	3,838	4,209	5,038	5,528
9. Marudi	1,343	1,465	1,663	1,960	2,198	2,603	2,830	3,091	3,192	3,312	3,614	4,478
10. Lawas	648	814	1,004	1,297	1,288	1,491	1,719	2,024	2,619	2,855	3,544	3,933
Whole Sarawak	176,322	203,425	232,697	277,024	317,540	355,261	398,923	451,242	513,397	563,317	656,593	706,560

Remarks: (1) * 1984, 1985, 1986 for Kuching inclusive of Batang Ai Hydropower Station
 (2) Source: SESCO Annual Reports and the answers to the Questionnaire

表 4.3 サラワク州における電力消費量

(Unit : MWh)

Station	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
1. Kuching	77,676	91,590	105,226	125,261	150,888	159,334	175,329	191,954	220,586	239,067	268,351	279,878
2. Sibü	32,347	36,793	40,945	46,216	51,897	57,215	63,401	68,528	78,238	78,597	84,326	86,830
3. Miri	16,938	20,022	25,163	32,749	37,293	44,700	51,737	56,168	65,802	66,403	67,707	78,973
4. Bintulu	2,339	2,733	3,639	4,947	7,237	12,002	16,161	21,441	29,572	32,849	47,845	45,584
5. Sarikei	2,654	3,143	4,120	4,893	5,592	6,436	6,931	8,291	8,863	9,672	10,890	11,908
6. Sri Aman	2,647	3,019	4,053	4,455	5,106	5,554	6,585	7,222	7,966	8,170	8,776	9,460
7. Limbang	3,007	3,137	3,419	3,818	4,265	4,753	5,247	6,331	7,499	8,083	9,239	10,212
8. Kapit	906	987	1,259	1,453	1,779	2,152	2,584	3,038	3,398	3,689	4,611	5,045
9. Marudi	1,070	1,190	1,396	1,620	1,826	2,155	2,350	2,584	2,737	2,834	3,117	3,724
10. Lawas	548	632	776	1,018	1,076	1,254	1,422	1,688	2,175	2,338	2,835	3,058
Whole Sarawak	146,431	168,054	195,496	233,151	274,833	304,952	343,964	382,604	445,518	473,806	535,342	568,562

Source: SESCO Annual Reports and the answers to the Questionnaire

表 4.4 サラワク州における最大需要電力

(Unit : kW)

Station	Year	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
1. Kuching		19,110	24,270	26,990	33,170	38,900	39,500	43,200	54,140	55,600	60,500	68,500	72,800
2. Sibü		8,240	9,300	10,250	11,600	12,490	14,000	15,800	17,050	18,050	19,320	20,450	20,950
3. Miri		4,140	4,840	5,560	7,860	8,210	9,380	11,100	12,350	13,810	15,300	16,500	17,700
4. Bintulu		735	940	1,240	1,468	1,955	3,080	4,197	5,409	6,532	7,200	11,500	11,650
5. Sarikei		884	826	1,000	1,270	1,325	1,505	1,617	1,910	2,060	2,480	3,030	3,260
6. Sri Aman		833	1,025	1,070	1,275	1,210	1,365	1,964	1,751	1,993	1,960	1,971	2,197
7. Limbang		963	759	877	936	1,110	1,098	1,276	1,541	1,659	1,912	2,006	2,502
8. Kapit		258	242	419	362	476	529	612	738	796	948	1,184	1,358
9. Marudi		317	319	428	413	439	499	529	800	589	661	782	925
10. Lawas		173	200	244	295	340	275	435	430	582	585	820	800
Whole Sarawak		37,325	44,693	50,048	61,053	69,070	73,635	84,147	100,580	107,194	116,939	133,507	141,408

Source: SESCO Annual Reports and the answers to the Questionnaire.

表 4.5 サラワク州における電力消費者数

Station	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
1. Kuching	20,386	21,644	23,008	26,751	27,828	30,198	32,519	36,737	40,136	44,261	48,874	49,316
2. Sibü	9,534	10,097	11,153	12,371	13,262	14,496	15,509	16,574	17,923	18,790	19,835	20,610
3. Miri	4,645	5,104	5,543	6,197	6,771	7,580	8,310	8,939	10,234	11,386	12,673	13,690
4. Bintulu	1,141	1,268	1,398	1,656	1,849	2,097	2,454	3,018	4,027	4,756	5,827	6,822
5. Sarikei	1,443	1,555	1,662	1,791	2,065	2,218	2,505	2,760	2,860	3,161	3,522	3,674
6. Sri Aman	1,421	1,568	1,631	1,742	1,878	2,184	2,386	2,637	2,801	2,966	3,203	3,307
7. Limbang	881	973	1,029	1,063	1,168	1,232	1,493	1,753	1,960	2,109	2,289	2,558
8. Kapit	432	461	492	568	649	713	742	742	817	958	1,074	1,172
9. Marudi	714	755	813	856	881	958	1,006	1,032	1,079	1,141	1,193	1,251
10. Lawas	278	311	344	395	407	443	460	595	733	764	787	1,060
Whole Sarawak	45,808	49,315	52,654	60,610	64,899	72,862	82,358	93,200	105,102	115,106	128,949	136,041

Source: SESCO Annual Reports and the answers to the Questionnaire.

表 4.6 電力消費の内訳 (リンパン地区) :

(Unit: MWh)

Year	1980	1981	1982	1983	1984	1985	1986
Domestic	1,001	1,232	1,508	2,019	2,181	2,507	2,922
Commercial	3,650	3,908	4,108	4,381	4,727	5,463	6,014
Industrial	67	75	681	1,052	1,123	1,215	1,206
Lighting	35	32	34	47	52	54	70
Total	4,753	5,247	6,331	7,499	8,083	9,239	10,212

表 4.7 家庭および商業用消費電力量の内訳 (リンパン地区)

Year	1984				1985				1986			
	No. of Consumers		Sold (kWh/month)		No. of Consumers		Sold (kWh/month)		No. of Consumers		Sold (kWh/month)	
	D	C	D	C	D	C	D	C	D	C	D	C
January	1,475	486	168,985	386,016	1,599	497	186,820	531,810	1,779	523	229,030	515,586
February	1,515	493	183,334	372,022	1,611	501	191,514	432,772	1,778	524	215,221	433,632
March	1,511	493	164,075	327,091	1,616	502	213,003	399,056	1,782	527	212,063	405,819
April	1,548	488	185,034	412,042	1,629	504	193,534	457,050	1,784	534	240,763	516,314
May	1,530	491	187,289	389,987	1,624	498	208,615	475,906	1,779	538	230,317	494,570
June	1,547	498	180,982	377,635	1,615	501	214,585	450,701	1,720	614	270,398	542,307
July	1,600	501	189,136	451,900	1,730	501	231,130	427,175	1,800	546	263,588	534,889
August	1,629	500	183,533	393,821	1,738	499	221,958	482,338	1,797	556	234,542	554,743
September	1,609	503	194,988	468,455	1,295	850	212,118	456,310	1,948	557	257,749	498,887
October	1,509	495	188,929	383,104	1,745	508	221,297	479,750	1,950	559	259,137	512,497
November	1,569	480	173,380	411,941	1,761	513	190,874	479,191	1,956	623	259,790	533,946
December	1,606	500	181,431	353,338	1,771	515	221,556	391,238	1,983	572	249,328	471,255
Total	18,728	5,928	2,181,096	4,727,352	19,734	6,389	2,507,004	5,463,297	22,056	6,673	2,921,926	6,014,445

Note: D = Domestic and C = Commercial

表 4.8 消費者あたりの年間電力消費量 (1/2)

(1) Domestic Sector

Year	Kuching		Sibu	
	Annual Power Consumption per consumer, kWh	Growth Rate %	Annual Power Consumption per consumer, kWh	Growth Rate %
1980	1,428		1,429	5.7
1981	1,541	7.9	1,510	3.2
1982	1,476	4.2	1,559	16.0
1983	1,660	12.5	1,808	-
1985	1,686	-	1,782	5.2
1986	1,736	3.0	1,874	
Average Growth Rate		3.3		4.6

Remarks : Data for the year 1984 not available.

表 4.8 消費者あたりの年間電力消費量 (2 / 2)

Year	(2) Commercial Sector	
	Kuching	Sibu
	Annual Power Consumption per consumer, kWh	Annual Power Consumption per consumer, kWh
	Growth Rate %	Growth Rate %
1980	12,137	9,650
1981	12,166	10,183
1982	12,706	10,753
1983	13,100	11,373
1985	13,617	11,595
1986	14,567	10,736
Average Growth Rate	3.1	1.8

Remarks: Data for the year 1984 not available.

表 4.9 電力消費量の計算 (リンパン地区)

Sector Year	DOMESTIC (MWh)	COMMERCIAL (MWh)	INDUSTRIAL (MWh)	PUBLIC LIGHTING(MWh)	TOTAL (MWh)
1980	1,001 (898)	3,650 (332)	67 (1)	35 (1)	4,753 (1,232)
1981	1,232 (1,131)	3,908 (360)	75 (2)	"	5,247 (1,493)
1982	1,508 (1,285)	4,108 (465)	681 (485)	"	6,331 (1,753)
1983	2,019 (1,472)	4,381 (500)	1,052 (515)	"	7,499 (1,960)
1984	2,181 (1,606)	4,727 (572)	1,123 (572)	"	8,083 (2,109)
1985	2,507 (1,771)	5,463 (572)	1,215 (572)	"	9,239 (2,289)
1986	2,922 (1,983)	6,014 (572)	1,206 (572)	"	10,212 (2,558)
1987	1.62MWh x 2,057= 3,394	11.13MWh x 590=6,567	1,206MWh x (1+0.12) =1,351	70MWh x (1+0.1)= 77	11,389
1988	1.70MWh x 2,207=3,752	11.46MWh x 630=7,220	1,206MWh x (1+0.12) ² =1,513	70MWh x (1+0.1) ² = 85	12,570
1989	1.78MWh x 2,333=4,153	11.80MWh x 660=7,788	1,206MWh x (1+0.12) ³ =1,694	70MWh x (1+0.1) ³ = 93	13,728
1990	1.86MWh x 2,462=4,579	12.15MWh x 690=8,384	1,206MWh x (1+0.12) ⁴ =1,898	70MWh x (1+0.1) ⁴ =102	14,963
1995	2.07MWh x 3,200=6,624	14.09MWh x 905=12,751	1,898MWh x (1+0.10) ⁵ =3,057	102MWh x (1+0.08) ⁵ =150	22,582
2000	2.52MWh x 3,780=9,526	16.33MWh x 1,020 =16,657	3,057MWh x (1+0.09) ⁵ =4,704	102MWh x (1+0.08) ¹⁰ =220	31,107
2005	2.73MWh x 4,460=12,176	18.48MWh x 1,180 =21,806	4,704MWh x (1+0.08) ⁵ =6,912	220MWh x (1+0.06) ⁵ =294	41,188
2010	2.95MWh x 5,270=15,547	20.38MWh x 1,370 =27,921	4,704MWh x (1+0.08) ¹⁰ =10,156	220MWh x (1+0.06) ¹⁰ =394	54,018

Note: () shows the number of consumers at the end of year from 1980 to 1986.

表 5.1 既設、建設中および建設予定の発電所（リンバン地区）

No.	Type	Installed Cap., kW	Unit	Inst. Year	Designated Retirement	Annual Max. Operation Rate, %
1.	Diesel	225	1		-	60
2.	"	225	1		-	"
3.	"	225	1		-	"
4.	"	460	1		-	"
5.	"	600	1	1975	-	"
6.	"	600	1	1981	-	"
7.	"	200	1	1980	-	"
8.	"	1,050	1	1985	-	"
9.	"	600	1	1987	-	"
10.	"	1,000	1	1987	-	"
11.	Hydro	150	2	1987	-	-
			(75x2)			

表 5.2 ディーゼル発電所の建設費と運転維持費

Class, kW	Annual Max. Operation rate, %	Lead Time year	Construction Time Period, year	Life Time, year	Construction Cost, M\$/kW	O & M		Fuel Cost M\$/kWh
						Fixed, %	Variable, M\$/kWh	
500 to 1,000	60	0	1	15	2,700	3	0.02/0.03 ^{2/}	0.12/0.18 ^{3/}
1,000 to 2,000	"	"	"	"	2,200	"	"	"
2,000 to 3,000	"	"	"	"	1,900	"	"	"

Notes: ^{1/} Annual fixed O & M cost is expressed by percentage of construction cost.

^{2/} Variable O & M cost of M\$0.02/kWh is for the Kapit system, whilst M\$0.03/kWh for Limbang.

^{3/} Fuel cost of M\$0.18/kWh is for the diesel plant in Kapit using diesel, whilst M\$0.12/kWh is for the diesel plant in Limbang using light fuel oil.

The increase rates of future fuel costs to the price in 1987 are assumed on the basis of the projection of World Bank as follows:

Year	1987	1988	1989	1990	1995	2000	2010
Ratio to 1987 price	1.00	1.00	1.00	1.06	1.31	1.81	1.81 ^{4/}

^{4/} Fuel price is assumed to be constant after 2000 onward, since no projection is given for the crude oil price after that time.

表 5.3 主要工事单·価

Work Item	Unit	Price
1. Civil Works		
a. Excavation in common	m3	5.0
b. " in rock	"	18.0
c. Concrete in dam	"	210.0
d. " in structures	"	290.0
e. " in powerhouse	"	350.0
f. Reinforcement	ton	1,900.0
g. Access road, new	Km	160,000.0
h. " " , improve	"	65,000.0
2. Metal Works		
a. Gates	ton	12,000.0
b. Penstock	"	6,800.0

表 5.4 ムダミット 2 計画における最適案

Case	FSL (El;M)	Plant Discharge (cms)	Installed Capacity (MW)	Construction Cost (million M\$)	B/C	Net Benefit (million M\$)	EIRR (%)
Alt-1	1	140.000	4.26	40.618	0.943	-5.219	7.402
	2	140.000	3.19	37.584	0.952	-4.353	7.646
	3	140.000	2.13	33.381	0.940	-5.509	6.450
	4	140.000	1.42	33.926	0.914	-8.020	4.906
	5	150.000	32.9	52.127	0.937	-5.746	7.815
	6	150.000	24.7	48.225	0.954	-4.117	8.315
	7	150.000	16.5	43.964	0.955	-4.009	8.128
	8	150.000	11.0	42.841	0.925	-6.952	6.600
Alt-2	1	140.000	5.01	45.585	0.940	-5.441	7.559
	2	140.000	3.75	41.903	0.951	-4.382	7.873
	3	140.000	2.50	37.747	0.944	-5.127	7.150
	4	140.000	1.66	36.820	0.914	-8.039	5.259
	5	150.000	32.9	57.940	0.928	-6.614	7.759
	6	150.000	24.7	53.239	0.949	-4.574	8.323
	7	150.000	16.5	47.994	0.953	-4.258	8.215
	8	150.000	11.0	46.083	0.926	-6.833	6.894
Alt-3	ROR-1	130.500	3.21	43.293	1.012	0.989	10.484
	ROR-2	131.500	5.10	49.881	1.054	4.369	11.652
	ROR-3	131.839	13.5	58.449	1.038	3.139	10.959
	ROR-4	132.000	18.1	65.802	1.002	0.189	10.058
	5	135.000	19.8	72.158	0.971	-2.534	9.410
	6	135.000	14.8	63.775	1.016	1.343	10.410
	7	135.000	9.9	54.073	1.035	2.891	10.966
	8	135.000	6.6	46.604	1.026	2.169	10.911
	9	140.000	17.4	72.193	0.982	-1.560	9.652
	10	140.000	11.6	61.911	1.029	2.407	10.729
	11	140.000	7.8	53.771	1.030	2.505	10.890
	12	140.000	5.0	53.262	0.921	-5.674	9.125
	13	150.000	23.2	90.858	0.939	-5.578	8.883
	14	150.000	15.5	76.628	1.042	1.719	10.442
	15	150.000	10.3	71.788	1.023	1.908	10.527
	16	150.000	7.7	64.609	1.024	2.030	10.632

表 5.5 プロジェクト評価ーキャッシュフロー表 (1/2)

Description	Unit	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Demand, peak power	MW	2.61	2.84	3.06	3.28	3.56	3.91	4.25	4.59	4.94	5.33	5.76	6.20	6.64	7.07
, energy	GWh	12.30	13.70	15.10	16.50	18.08	19.83	21.58	23.33	25.08	26.93	28.89	30.85	32.81	34.77
Annual load factor		.54	.55	.56	.57	.58	.58	.58	.58	.58	.58	.57	.57	.56	.56
Reserve capacity	MW	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.07	1.15	1.24	1.33	1.41
Required total capacity	MW	3.61	3.84	4.06	4.28	4.56	4.91	5.25	5.59	5.94	6.39	6.92	7.44	7.96	8.49
Diesel retirement	MW	.00	.00	.00	.00	-.60	-.60	.00	-.46	.00	-.20	-.60	.00	.00	.00
Diesel transferred	MW	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Power addition, hydro	MW	.00	.00	.00	.00	.00	.00	.00	.00	.00	5.10	.00	.00	.00	.00
, diesel	MW	.00	1.60	.00	.00	.00	1.00	1.00	1.00	.00	.00	.00	.00	.00	.00
System capacity, installed	MW	3.60	5.20	5.20	5.20	4.60	4.92	5.92	6.46	6.46	11.36	10.76	10.76	10.76	10.76
, guaranteed	MW	3.60	5.20	5.20	5.20	4.60	4.92	5.92	6.46	6.46	8.74	8.39	8.69	8.84	8.99
(hydro, guaranteed)	MW	.00	.00	.00	.00	.00	.00	.00	.00	.00	2.48	2.73	3.02	3.18	3.33
(diesel, L.O.unit)	MW	3.60	5.20	5.20	5.20	4.60	4.92	5.92	6.46	6.46	6.26	5.66	5.66	5.66	5.66
(diesel, cold reserve)	MW	.00	.00	.00	.00	.00	.00	.00	.00	.00	2.31	1.42	1.03	.67	.31
Installation cost, hydro	m.M\$	.00	.00	.00	.00	.73	8.23	12.73	17.44	10.75	.00	.00	.00	.00	.00
, diesel	m.M\$	3.67	.00	.00	.76	3.06	3.06	2.30	.00	.00	.00	.00	.00	1.53	4.59
Power generation, hydro	GWh	.00	.00	.00	.00	.00	.00	.00	.00	.00	24.07	24.67	25.08	25.35	25.53
, diesel	GWh	12.30	13.70	15.10	16.50	18.08	19.83	21.58	23.33	25.08	2.86	4.22	5.77	7.46	9.24
Hydro OM cost	m.M\$	.00	.00	.00	.00	.00	.00	.00	.00	.00	.39	.39	.39	.39	.39
Diesel OM cost, fixed	m.M\$	.28	.41	.41	.41	.36	.39	.47	.51	.51	.31	.33	.36	.39	.42
, variable	m.M\$	.36	.40	.44	.48	.53	.58	.63	.68	.73	.08	.12	.17	.22	.27
, fuel(HSD)	m.M\$	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
, fuel (LO)	m.M\$	1.31	1.46	1.60	1.86	2.13	2.44	2.77	3.12	3.49	.43	.68	.99	1.36	1.78
Total cost	m.M\$	5.62	2.26	2.45	3.51	6.81	14.70	18.89	21.75	15.48	1.22	1.53	1.91	3.89	7.45

表 5.5 プロジェクト評価一キャッシュフロー表 (2/2)

Description	Unit	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Demand, peak power	MW	7.53	8.00	8.47	8.94	9.41	9.95	10.55	11.15	11.76	12.36
, energy	GWh	36.91	39.23	41.54	43.86	46.18	48.82	51.76	54.72	57.67	60.61
Annual load factor		.56	.56	.56	.56	.56	.56	.56	.56	.56	.56
Reserve capacity	MW	1.51	1.60	1.69	1.79	1.88	1.99	2.11	2.23	2.35	2.47
Required total capacity	MW	9.03	9.60	10.16	10.73	11.30	11.94	12.66	13.39	14.11	14.83
Diesel retirement	MW	-1.05	.00	-1.60	.00	.00	.00	-1.00	-1.00	-1.00	.00
Diesel transferred	MW	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Power addition, hydro	MW	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
, diesel	MW	2.00	.00	2.00	.00	1.00	.00	1.00	2.00	2.00	1.00
System capacity, installed	MW	11.71	11.71	12.11	12.11	13.11	13.11	13.11	14.11	15.11	16.11
, guaranteed	MW	10.09	10.27	10.90	11.20	12.23	12.61	12.73	14.11	15.11	16.11
(hydro, guaranteed)	MW	3.48	3.66	3.89	4.19	4.22	4.59	4.72	5.10	5.10	5.10
(diesel, L.O.unit)	MW	6.61	6.61	7.01	7.01	8.01	8.01	8.01	9.01	10.01	11.01
(diesel, cold reserve)	MW	.87	.60	.64	.25	1.00	.58	.04	.43	.71	.98
Installation cost, hydro	m.M\$	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
, diesel	m.M\$	1.53	4.59	.76	2.30	.76	3.83	6.12	5.36	2.30	.00
Power generation, hydro	GWh	25.74	25.97	26.15	26.29	26.41	26.50	26.57	26.60	26.60	26.60
, diesel	GWh	11.17	13.26	15.40	17.57	19.78	22.32	25.20	28.12	31.06	34.01
Hydro OM cost	m.M\$	.39	.39	.39	.39	.39	.39	.39	.39	.39	.39
Diesel OM cost, fixed	m.M\$	.45	.47	.50	.53	.55	.58	.63	.67	.73	.79
, variable	m.M\$	.33	.39	.45	.51	.58	.65	.73	.82	.90	.99
, fuel(HSD)	m.M\$	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
, fuel (LO)	m.M\$	2.15	2.55	2.96	3.38	3.80	4.29	4.85	5.41	5.98	6.54
Total cost	m.M\$	4.85	8.39	5.07	7.11	6.09	9.75	12.72	12.65	10.30	8.72

表 5.6 ディーゼル発電によるキャッシュフロー表 (リンパン地区)(1/2)

Description	Unit	1907	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Demand, peak power	MW	2.61	2.84	3.06	3.28	3.56	3.91	4.25	4.59	4.94	5.33	5.76	6.20	6.64	7.07
, energy	GWh	12.30	13.70	15.10	16.50	18.08	19.83	21.58	23.33	25.08	26.93	28.09	30.85	32.81	34.77
Annual load factor		.54	.55	.56	.57	.58	.58	.58	.58	.58	.58	.57	.57	.56	.56
Reserve capacity	MW	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.07	1.15	1.24	1.33	1.41
Required total capacity	MW	3.61	3.84	4.06	4.28	4.56	4.91	5.25	5.59	5.94	6.39	6.92	7.44	7.96	8.49
Diesel retirement	MW	.00	.00	.00	.00	-.60	-.68	.00	-.46	.00	-.20	-.60	.00	.00	.00
Diesel transferred	MW	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Power addition, hydro	MW	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
, diesel	MW	.00	1.60	.00	.00	.00	1.00	1.00	1.00	.00	1.00	1.00	.00	1.00	.00
System capacity, installed	MW	3.60	5.20	5.20	5.20	4.60	4.92	5.92	6.46	6.46	7.26	7.66	7.66	8.66	8.66
, guaranteed	MW	3.60	5.20	5.20	5.20	4.60	4.92	5.92	6.46	6.46	7.26	7.66	7.66	8.66	8.66
(hydro, guaranteed)	MW	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
(diesel, L.O.unit)	MW	3.60	5.20	5.20	5.20	4.60	4.92	5.92	6.46	6.46	7.26	7.66	7.66	8.66	8.66
(diesel, cold reserve)	MW	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Installation cost, hydro	m.M\$	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
, diesel	m.M\$	3.67	.00	.00	.76	3.06	3.06	2.30	.76	3.06	2.30	.76	2.30	1.53	4.59
Power generation, hydro	GWh	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
, diesel	GWh	12.30	13.70	15.10	16.50	18.08	19.83	21.58	23.33	25.08	26.93	28.09	30.85	32.81	34.77
Hydro OM cost	m.M\$	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Diesel OM cost, fixed	m.M\$	.28	.41	.41	.41	.36	.39	.47	.51	.51	.57	.60	.60	.68	.68
, variable	m.M\$	.36	.40	.44	.48	.53	.58	.63	.68	.73	.78	.84	.90	.95	1.01
, fuel(HSD)	m.M\$	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
, fuel (LO)	m.M\$	1.31	1.46	1.60	1.86	2.13	2.44	2.77	3.12	3.49	4.04	4.64	5.28	5.96	6.69
Total cost	m.M\$	5.62	2.26	2.45	3.51	6.08	6.47	6.16	5.08	7.79	7.69	6.84	9.07	9.13	12.97

表 5.6 ディーゼル発電によるキャッシュフロー表 (リンパン地区)(2/2)

Description	Unit	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Demand, peak power	MW	7.53	8.00	8.47	8.94	9.41	9.95	10.55	11.15	11.76	12.36
, energy	GWh	36.91	39.23	41.54	43.86	46.18	48.82	51.76	54.72	57.67	60.61
Annual load factor		.56	.56	.56	.56	.56	.56	.56	.56	.56	.56
Reserve capacity	MW	1.51	1.60	1.69	1.79	1.88	1.99	2.11	2.23	2.35	2.47
Required total capacity	MW	9.03	9.60	10.16	10.73	11.30	11.94	12.66	13.39	14.11	14.83
Diesel retirement	MW	-1.05	.00	-1.60	.00	.00	.00	-1.00	-1.00	-1.00	.00
Diesel transferred	MW	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Power addition, hydro	MW	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
, diesel	MW	2.00	.00	3.00	.00	2.00	.00	2.00	2.00	1.00	1.00
System capacity, installed	MW	9.61	9.61	11.01	11.01	13.01	13.01	14.01	15.01	15.01	16.01
, guaranteed	MW	9.61	9.61	11.01	11.01	13.01	13.01	14.01	15.01	15.01	16.01
(hydro, guaranteed)	MW	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
(diesel, L.O.unit)	MW	9.61	9.61	11.01	11.01	13.01	13.01	14.01	15.01	15.01	16.01
(diesel, cold reserve)	MW	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Installation cost, hydro	m.M\$	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
, diesel	m.M\$	2.29	6.89	1.53	4.59	1.53	6.12	5.36	3.06	2.93	2.75
Power generation, hydro	GWh	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
, diesel	GWh	36.91	39.23	41.54	43.86	46.18	48.82	51.76	54.72	57.67	60.61
Hydro OM cost	m.M\$	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Diesel OM cost, fixed	m.M\$	.76	.76	.87	.87	1.02	1.02	1.10	1.18	1.18	1.26
, variable	m.M\$	1.07	1.14	1.21	1.28	1.34	1.42	1.51	1.59	1.68	1.76
, fuel(HSD)	m.M\$	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
, fuel (LO)	m.M\$	7.10	7.55	7.99	8.44	8.89	9.39	9.96	10.53	11.09	11.66
Total cost	m.M\$	11.23	16.33	11.60	15.17	12.78	17.95	17.92	16.36	16.25	14.68

表 7.1 建設費の算定

(Unit : M\$)

Description	Foreign Currency	Local Currency	Total
1. Preparatory Works			
1.1 Access Road	719,000	867,000	1,586,000
1.2 Field investigation	10,000	190,000	200,000
1.3 Camp facilities	108,000	432,000	540,000
Sub-total	837,000	1,489,000	2,326,000
2. Civil Works			
2.1 River diversion	474,357	436,713	911,070
2.2 Intake dam	2,077,632	1,817,018	3,894,650
2.3 Headrace tunnel	9,955,398	8,509,552	18,464,950
2.4 Surge tank	804,001	648,329	1,452,330
2.5 Penstock line	911,923	772,757	1,684,680
2.6 Powerhouse	1,190,307	922,363	2,112,670
2.7 Tailrace	185,050	146,970	332,020
2.8 Drainage channel	136,695	107,105	243,800
Sub-total	15,735,363	13,360,807	29,096,170
3. Metal Work	2,387,600	603,200	2,990,800
4. Generating Equipment	4,782,000	761,000	5,543,000
5. Transmission line and Substation	3,238,000	1,387,700	4,625,700
6. Direct Construction Cost	26,979,963	17,601,707	44,581,670
7. Engineering Services	4,458,170	0	4,458,170
8. Administration Cost	0	2,229,080	2,229,080
9. Physical Contingency	4,715,720	2,974,620	7,690,340
10. Total Construction Cost	36,153,853	22,805,407	58,959,260

表 7.2 建設費の内訳 (1 / 4)

(Unit:MS\$)

Description	Unit	Q'ty	Foreign currency Unit	Amount	Local currency Unit	Amount	Equivalent cost Unit	Amount
1. PREPARATORY WORKS								
1.1 ACCESS ROAD								
New road	m	1,100	70.0	77,000	90.0	99,000	160	176,000
Improved road	m	19,000	29.0	551,000	36.0	684,000	65	1,235,000
New bridge	L.S.			91,000		84,000		175,000
1.2 FIELD INVESTIGATION								
	L.S.			10,000		190,000		200,000
1.3 CAMP FACILITIES								
	L.S.			108,000		432,000		540,000
Total of 1				837,000		1,489,000		2,326,000
2. CIVIL WORKS								
2.1 RIVER DIVERSION								
Earth embankment	cu.b.m	6,760	1.6	10,816	2.4	16,224	4	27,040
Concrete wall	cu.b.m	1,859	156.0	290,004	144.0	267,696	300	557,700
Reinforcement	ton	56	1,463.0	81,928	437.0	24,472	1,900	106,400
Gabion protection	sq.m	1,450	35.0	50,750	65.0	94,250	100	145,000
Removal of embankment	cu.b.m	6,310	2.9	18,299	2.1	13,251	5	31,550
Others	L.S.			22,560		20,820		43,380
Sub total of 2.1				474,357		436,713		911,070
2.2 INTAKE DAM								
Excavation in common	cu.b.m	34,530	2.9	100,137	2.1	72,513	5	172,650
" weathered rock	cu.b.m	31,420	5.4	169,668	5.6	175,952	11	345,620
" rock	cu.b.m	15,380	9.5	146,110	8.5	130,730	18	276,840
Concrete in dam body	cu.b.m	7,362	114.0	841,548	106.0	782,492	220	1,624,040
" pier and intake	cu.b.m	2,741	156.0	427,596	144.0	394,704	300	822,300
Reinforcement	ton	101	1,463.0	147,763	437.0	44,137	1,900	191,900
Drilling grout hole	m	928	40.0	37,120	50.0	46,400	90	83,520
Cement in grouting	ton	186	590.0	109,740	410.0	76,260	1,000	186,000
Backfill, random material	cu.b.m	3,700	1.6	5,920	2.4	8,880	4	14,800
Others	L.S.			92,030		84,950		176,980
Sub total of 2.2				2,077,632		1,817,018		3,894,650

表 7.2 建設費の内訳 (2 / 4)

(Unit: \$)

Description	Unit	Q'ty	Foreign currency		Local currency		Equivalent cost	
			Unit	Amount	Unit	Amount	Unit	Amount
2.3 HEADRACE TUNNEL								
Excavation in tunnel	cub.m	35,670	160	5,707,200	120.0	4,280,400	280	9,987,600
Concrete	cub.m	13,334	192	2,560,128	178.0	2,373,452	370	4,933,580
Reinforcement	ton	100	1,463	146,300	437.0	43,700	1,900	190,000
Formwork, steel form	sq.m	35,735	28	1,000,580	38.0	1,357,930	66	2,358,510
Drilling, grout hole	m	1,800	40	72,000	50.0	90,000	90	162,000
Cement in grouting	ton	180	590	106,200	410.0	73,800	1,000	180,000
Backfill grout	cub.m	910	192	174,720	128.0	116,480	320	291,200
Others	L.S.			188,270		173,790		362,060
Sub total of 2.3				9,955,398		8,509,552		18,464,950
2.4 SURGE TANK								
Excavation in common	cub.m	17,690	2.9	51,301	2.1	37,149	5	88,450
in weathered rock	cub.m	9,380	5.4	50,652	5.6	52,528	11	103,180
in rock	cub.m	1,970	9.5	18,715	8.5	16,745	18	35,460
in shaft, tunnel	cub.m	1,360	240	326,400	180.0	244,800	420	571,200
Concrete, above ground	cub.m	109	156	17,004	144.0	15,696	300	32,700
underground	cub.m	792	307	243,144	283.0	224,136	590	467,280
Reinforcement	ton	35	1,463	51,205	437.0	15,295	1,900	66,500
Drilling grout holes	m	312	40	12,480	50.0	15,600	90	28,080
Cement in grouting	ton	31	590	18,290	410.0	12,710	1,000	31,000
Others	L.S.			14,810		13,670		28,480
Sub total of 2.4				804,001		648,329		1,452,330
2.5 PENSTOCK LINE								
Excavation in common	cub.m	23,480	2.9	68,092	2.1	49,308	5	117,400
in weathered rock	cub.m	12,710	5.4	68,634	5.6	71,175	11	139,810
in rock	cub.m	790	9.5	7,505	8.5	6,715	18	14,220
in shaft, tunnel	cub.m	710	160	113,600	120.0	85,200	280	198,800
Concrete in backfill	cub.m	447	132	59,004	88.0	39,336	220	98,340
in anchor block, etc.	cub.m	1,266	156	197,496	144.0	182,304	300	379,800
Reinforcement	ton	28	1,463	40,964	437.0	12,236	1,900	53,200
Backfill grout	ton	19	192	3,648	128.0	2,432	320	6,080
Shotcrete	sq.m	4,600	73	335,800	67.0	308,200	140	644,000
Others	L.S.			17,180		15,850		33,030
Sub total of 2.5				911,923		772,757		1,684,680

表 7.2 建設費の内訳 (3/4)

(Unit:MS)

Description	Unit	Q'ty	Foreign currency		Local currency		Equivalent cost	
			Unit	Amount	Unit	Amount	Unit	Amount
2.6 POWERHOUSE								
Excavation in common	cub.m	5,940	2.9	17,226	2.1	12,474	5	29,700
" weathered rock	cub.m	4,560	5.4	24,624	5.6	25,536	11	50,160
" rock	cub.m	640	9.5	6,080	8.5	5,440	18	11,520
Concrete above generator floor	cub.m	661	187	123,607	173.0	114,353	360	237,960
below generator floor	cub.m	1,282	156	199,992	144.0	184,608	300	384,600
in switchyard	cub.m	451	187	84,337	173.0	78,023	360	162,360
Reinforcement	ton	85	1,463	124,355	437.0	37,145	1,900	161,500
Superstructure	cub.m	3,021	168	507,528	122.0	368,562	290	876,090
Backfill, random material	cub.m	1,680	1.6	2,688	2.4	4,032	4	6,720
Others	L.S.			99,870		92,190		192,060
Sub total of 2.6				1,190,307		922,363		2,112,670
2.7 TAILRACE								
Excavation in common	cub.m	3,580	2.9	10,382	2.1	7,518	5	17,900
" weathered rock	cub.m	2,410	5.4	13,014	5.6	13,496	11	26,510
" rock	cub.m	120	9.5	1,140	8.5	1,020	18	2,160
Concrete	cub.m	633	156	98,748	144.0	91,152	300	189,900
Reinforcement	ton	32	1,463	46,816	437.0	13,984	1,900	60,800
Backfill, random material	cub.m	3,650	1.6	5,840	2.4	8,760	4	14,600
Rock riprap	cub.m	440	13	5,720	18.0	7,920	31	13,640
Others	L.S.			3,390		3,120		6,510
Sub total of 2.7				185,050		146,970		332,020
2.8 DRAINAGE CHANNEL								
Excavation in common	cub.m	2,964	2.9	8,596	2.1	6,224	5	14,820
Concrete	cub.m	627	156	97,812	144.0	90,288	300	188,100
Reinforcement	ton	19	1,463	27,797	437.0	8,303	1,900	36,100
Others	L.S.			2,490		2,290		4,780
Sub total of 2.8				136,695		107,105		243,800
Total of 2				15,735,363		13,360,807		29,096,170

表 7.2 建設費の内訳 (4 / 4)

Description	Unit	Q'ty	Foreign currency		Local currency		Equivalent cost	
			Unit	Amount	Unit	Amount	Unit	Amount
3. METAL WORK								
Spillway gate	ton	80	9,600	768,000	2,400	192,000	12,000	960,000
Sand flushing gate	ton	46	9,600	441,600	2,400	110,400	12,000	552,000
Intake gate	ton	5	9,600	48,000	2,400	12,000	12,000	60,000
Draft gate	ton	6	9,600	57,600	2,400	14,400	12,000	72,000
Intake trashrack	ton	20	4,600	92,000	1,100	22,000	5,700	114,000
Raking equipment	ton	12	16,000	192,000	4,000	48,000	20,000	240,000
Steel penstock with support	ton	146	5,400	788,400	1,400	204,400	6,800	992,800
Total of 3				2,387,600		603,200		2,990,800
4. GENERATING EQUIPMENT								
				4,782,000		761,000		5,543,000
5. TRANSMISSION LINE AND SUBSTATION								
Transmission line	L.S.			2,836,480		1,215,620		4,052,100
Substation	L.S.			401,520		172,080		573,600
Total of 5				3,238,000		1,387,700		4,625,700
6. LAND COMPENSATION								
7. DIRECT CONSTRUCTION COST								
				26,979,963		17,601,707		44,581,670
8. ENGINEERING SERVICES								
				4,458,170				4,458,170
9. ADMINISTRATION COST								
						2,229,080		2,229,080
10. PHYSICAL CONTINGENCY								
				4,715,720		2,974,620		7,690,340
11. TOTAL CONSTRUCTION COST								
				36,153,653		22,805,407		58,959,260

表 7.3 建設費の支出スケジュール(1/4)

Description	1991		1992		1993		1994		1995	
	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.
TOTAL										
1. PREPARATORY WORKS										
1.1 ACCESS ROAD										
New road	77,000	99,000	7,700	9,900	69,300	89,100				
Improved road	551,000	684,000	275,500	342,000	275,500	342,000				
New bridge	91,000	84,000			91,000	84,000				
1-2 FIELD INVESTIGATION	10,000	190,000	10,000	190,000						
1.3 CAMP FACILITIES	108,000	432,000			108,000	432,000				
Total of 1	837,000	1,489,000	293,200	541,900	543,800	947,100				
2. CIVIL WORKS										
2.1 RIVER DIVERSION										
Earth embankment	10,816	16,224			5,408	8,112				
Concrete wall	290,004	267,696			232,003	214,357				
Reinforcement	81,928	24,472			65,542	19,578				
Gabion protection	50,750	94,250			25,375	47,125				
Removal of embankment	18,299	13,251			1,830	1,325			8,235	5,963
Others	22,560	20,820			13,536	12,492			2,256	2,082
Sub total of 2.1	474,357	436,713			343,695	302,769			10,491	8,045
2.2 INTAKE DAM										
Excavation in common	100,137	72,513			60,082	43,508				
Excavation in weathered rock	169,668	175,952			101,801	105,571				
Excavation in rock	146,110	130,730			87,666	78,438				
Concrete in dam body	841,548	782,492			84,155	78,249			252,464	234,748
Concrete in pier and intake	427,596	394,704			42,760	39,470			128,279	118,411
Reinforcement	147,763	44,137			14,776	4,414			44,329	13,241
Drilling grout hole	37,120	46,400			3,712	4,640			11,136	13,920
Cement in grouting	109,740	76,260			10,974	7,626			32,922	22,878
Backfill, random material	5,920	8,880			592	888			2,664	3,996
Others	92,030	84,950			36,812	33,980			9,203	8,495
Sub total of 2.2	2,077,632	1,817,018			443,330	396,784			1,153,305	1,004,545
Sub total of 2.1									480,997	415,689

表 7.3 建設費の支出スケジュール (2/4)

(Unit:MS)

Description	1991		1992		1993		1994		1995	
	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.
TOTAL										
2.3 HEADRACE TUNNEL										
Excavation in tunnel	5,707,200	4,280,400	2,282,880	1,712,160	2,853,600	2,140,200	570,720	428,040	1,024,051	949,381
Concrete	2,560,128	2,373,452	255,013	237,345			1,280,064	1,185,726	58,520	17,480
Reinforcement	146,300	43,700	14,630	4,370			73,150	21,850	408,232	543,172
Formwork, steel form	1,000,580	1,357,930	100,058	135,793			506,290	678,965	64,800	81,000
Drilling grout hole	72,000	90,000	7,200	9,000					95,580	66,420
Cement in grouting	106,200	73,800	10,620	7,380					157,248	104,832
Backfill grout	174,720	116,480	17,472	11,648					37,654	34,758
Others	188,270	173,790	37,654	34,758						
Sub total of 2.3	9,955,398	8,509,552	2,726,527	2,152,454	2,810,081	2,192,337	2,480,705	2,367,718	1,838,085	1,797,043
2.4 SURGE TANK										
Excavation in common	51,301	37,149	5,130	3,715	46,171	33,434				
in weathered rock	50,652	52,528	5,065	5,252	45,587	47,275				
in rock	18,715	16,743	1,672	1,673	16,844	15,071				
in shaft, tunnel	326,400	244,800	32,640	24,480	293,760	220,320				
Concrete, above ground	17,004	15,696	1,700	1,570	15,304	14,126				
underground	243,144	224,136	24,314	22,414	218,830	201,722				
Reinforcement	51,205	15,295	5,121	1,530	46,085	13,766				
Drilling grout holes	12,480	15,600	1,248	1,560	11,232	14,040				
Cement in grouting	18,290	12,710	1,829	1,271	16,461	11,438				
Others	14,810	13,670	1,481	1,367	13,328	12,303				
Sub total of 2.4	804,001	648,329	80,400	64,833	723,601	583,495				
2.5 PENSTOCK LINE										
Excavation in common	68,092	49,308	68,092	49,308						
weathered rock	68,634	71,176	68,634	71,176						
rock	7,505	6,715	7,505	6,715						
tunnel	113,600	85,200	113,600	85,200						
Concrete in backfill	59,004	39,336	5,900	3,934						
in anchor block, etc.	197,495	182,304	19,750	18,230	177,746	164,074	53,104	35,402		
Reinforcement	40,964	12,235	4,096	1,224	36,868	11,012				
Backfill grout	3,648	2,432	365	243						
Shotcrete	335,800	308,200	33,580	30,820	302,220	277,380	3,283	2,189		
Others	17,180	15,850	17,180	15,850	3,436	3,170				
Sub total of 2.5	911,923	772,757	335,266	279,530	520,270	455,636	56,387	37,591		

表 7.3 建設費の支出スケジュール (3/4)

Description	TOTAL		1991		1992		1993		1994		(Units)	
	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.
2.6 POWERHOUSE												
Excavation in common	17,226	12,474	1,723	1,247	15,503	11,227	88,886	91,482	12,361	11,435		
" weathered rock	24,824	25,536	2,462	2,554	22,162	22,982	159,994	147,686	19,599	18,461		
" rock	6,080	5,440	608	544	5,472	4,896						
Concrete above generator floor	123,607	114,353	12,361	11,435								
below generator floor	139,992	184,608	19,999	18,461								
in switchyard	84,337	78,023	8,434	7,802								
Reinforcement	124,355	37,145	12,436	3,715								
Superstructure	507,528	368,562	50,753	36,856								
Backfill, random material	2,688	4,032	269	403								
Others	99,870	92,190	9,987	9,219	34,955	32,266	44,942	41,486	9,987	9,219		
Sub total of 2.6	1,190,307	922,363	119,031	92,236	78,092	71,372	716,233	551,930	276,952	206,825		
2.7 TAILRACE												
Excavation in common	10,382	7,518	1,038	752								
" weathered rock	13,014	13,496	1,301	1,350								
" rock	1,140	1,020	114	102								
Concrete	98,748	91,152	9,875	9,115								
Reinforcement	46,816	13,984	4,682	1,390								
Backfill, random material	5,840	8,760	584	876								
Rock riprap	5,720	7,920	572	792								
Others	3,390	3,120	339	312								
Sub total of 2.7	185,050	146,970	18,505	14,697								
2.8 DRAINAGE CHANNEL												
Excavation in common	8,596	6,224	860	622	7,736	5,602						
Concrete	97,812	90,288	9,781	9,029	82,031	81,259						
Reinforcement	27,797	8,303	2,780	830	25,017	7,473						
Others	2,450	2,290	249	229	2,241	2,061						
Sub total of 2.8	136,695	107,105	13,670	10,711	123,026	96,395						
Total of 2	15,735,363	13,360,807	4,080,423	3,314,034	5,628,546	4,529,659	3,911,357	3,513,246	2,115,037	2,003,868		

表 7.3 建設費の支出スケジュール (4/4)

(Units:MS)

Description	1991		1992		1993		1994		1995	
	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.
3. METAL WORK										
Spillway gate	768,000	192,000	76,800	19,200	76,800	19,200	691,200	172,800		
Sand flushing gate	441,600	110,400	441,600	110,400						
Intake gate	48,000	12,000	48,000	12,000						
Draft gate	57,600	14,400	5,760	1,440					51,840	12,960
Intake trashrack	92,000	22,000	92,000	22,000						
Raking equipment	192,000	48,000	192,000	48,000						
Steel penstock with support	788,400	204,400					788,400	204,400		
Total of 3	2,397,600	603,200	856,160	213,040	856,160	213,040	1,479,600	377,200	51,840	12,960
4. GENERATING EQUIPMENT	4,782,000	761,000					1,912,800	304,400	2,869,200	456,600
5. TRANSMISSION LINE AND SUBSTATION										
Transmission line	2,836,480	1,215,620					2,259,184	972,496	567,296	243,124
Substation	401,520	172,080					321,216	137,664	80,304	34,416
Total of 5	3,238,000	1,387,700					2,580,400	1,110,160	647,600	277,540
6. LAND COMPENSATION	0	0								
7. DIRECT CONSTRUCTION COST	26,979,963	17,601,707	293,200	541,900	4,624,223	4,261,134	6,484,706	4,742,699	9,894,157	5,305,006
									1,159,124	557,270
8. ENGINEERING SERVICES	4,458,170	2,229,080		44,582		512,688				
9. ADMINISTRATION COST										
10. PHYSICAL CONTINGENCY	4,715,720	2,974,620	43,980	87,970	840,750	716,070	1,146,570	795,000	1,657,990	879,340
11. TOTAL CONSTRUCTION COST	36,153,853	22,805,407	337,180	674,452	6,445,770	5,489,892	8,790,400	6,094,969	12,711,271	6,741,616
									7,869,222	3,804,478

表 8.1 経済費用への変換係数リスト

Type of goods	Conversion Factor		
	Imports	Exports	Combined
Tradeable goods			
1. Petroleum (refined)	0.47	1.13	0.67
2. Petroleum (crude oil)	0.84	1.13	0.86
3. Construction material	0.82	1.12	0.88
4. Investment goods	0.82	1.12	0.85
Non-tradeable goods/ service			
5. Construction	-	-	0.77
6. Government services	-	-	0.88

Source : National Parameters for Project Appraisal
Malaysian Data (EPU) 1977

表 8. 2 経済的建設費の算定 (ムダミット 2 計画)

Work Item	Financial Cost	Economic Cost	Ratio of E/F (%)
1. Preparatory Works	2,326,000	1,699,140	73
2. Civil Works			
2.1 River diversion	911,070	698,540	77
2.2 Intake dam	3,894,650	3,022,090	78
2.3 Headrace tunnel	18,464,950	14,698,080	80
2.4 Surge tank	1,452,330	1,148,550	79
2.5 Penstock line	1,684,680	1,323,500	79
2.6 Power house	2,112,670	1,658,000	78
2.7 Tailrace	332,020	256,060	77
2.8 Drainage channel	243,800	188,040	77
Total of 2	29,096,170	22,992,860	79
3. Metal Works	2,990,800	2,633,920	88
4. Generating Equipments	5,543,000	5,406,350	98
5. Transmission Line and Substation	4,625,760	4,401,020	95
6. Land Acquisition	-	-	
Direct Cost	44,581,670	37,133,290	83
7. Engineering Service	4,458,170	4,458,170	100
8. Administration	2,229,080	1,783,260	80
9. Physical Contingency	7,690,340	6,506,210	85
Total Cost	58,959,260	49,880,930	85

Note: Ratio of E/F indicates the conversion factor from financial to economic cost.

表 8.3 ムダミットー 2 を含む電力投入計画

(Unit: MW)

Year	Installation year of the Medamit-2							
	1996		1997		1998		1999	
	Diesel	Hydro	Diesel	Hydro	Diesel	Hydro	Diesel	Hydro
1988	1.60		1.60		1.60		1.60	
1989								
1990								
1991								
1992	1.00		1.00		1.00		1.00	
1993	1.00		1.00		1.00		1.00	
1994	1.00		1.00		1.00		1.00	
1995								
1996		5.10	1.00		1.00		1.00	
1997				5.10				
1998						5.10	1.00	
1999								5.10
2000								
2001	2.00		1.00		1.00			
2002								
2003	2.00		2.00		2.00		2.00	
2004								
2005	1.00		1.00		1.00		1.00	
2006								
2007	1.00		1.00		1.00		1.00	
2008	2.00		2.00		2.00		2.00	
2009	2.00		2.00		2.00		2.00	
2010	1.00		1.00		1.00		1.00	

表 8.4 経済的費用－便益のキャッシュフロー (1/2)

Unit: Million M\$

Year	Benefit Streams			Cost Streams				
	Capital	Fuel	O & M	Total	Capital	Fuel	O & M	Total
1987	3.672	1.307	0.641	5.620	3.672	1.307	0.641	5.620
1988	-	1.456	0.807	2.263	-	1.456	0.807	2.263
1989	-	1.605	0.848	2.453	-	1.605	0.848	2.453
1990	0.765	1.859	0.889	3.513	0.765	1.859	0.889	3.513
1991	3.060	2.133	0.887	6.080	3.788	2.133	0.887	6.808
1992	3.060	2.444	0.964	6.468	11.295	2.444	0.964	14.703
1993	2.295	2.775	1.093	6.163	15.020	2.775	1.093	18.888
1994	0.765	3.124	1.187	5.076	17.438	3.124	1.187	21.749
1995	3.060	3.492	1.238	7.789	10.754	3.492	1.238	15.483
1996	2.295	4.036	1.354	7.686	-	0.428	0.788	1.216
1997	0.765	4.637	1.443	6.845	-	0.677	0.850	1.527
1998	2.295	5.280	1.500	9.075	-	0.987	0.926	1.913
1999	1.530	5.964	1.636	9.129	1.530	1.356	1.004	3.890
2000	4.590	6.690	1.693	12.927	4.590	1.777	1.084	7.451
2001	2.295	7.101	1.830	11.226	1.530	2.149	1.170	4.849
2002	6.885	7.547	1.897	16.329	4.590	2.551	1.253	8.394
2003	1.530	7.993	2.074	11.597	0.765	2.962	1.343	5.071
2004	4.590	8.439	2.142	15.171	2.295	3.380	1.437	7.113
2005	1.530	8.885	2.366	12.781	0.765	3.805	1.521	6.091
2006	6.120	9.392	2.443	17.955	3.825	4.293	1.628	9.747
2007	5.355	9.959	2.608	17.922	6.120	4.847	1.754	12.721
2008	3.060	10.527	2.772	16.359	5.355	5.409	1.887	12.651
2009	2.984	11.095	2.858	16.247	2.295	5.976	2.030	10.301
2010	2.754	11.662	3.022	14.684	-	6.544	2.172	8.717
2011	2.066	11.662	3.022	16.750	-	6.544	2.172	8.717
2012	0.688	11.662	3.022	15.373	-	6.544	2.172	8.717
2013	2.066	11.662	3.022	16.750	-	6.544	2.172	8.717
2014	1.377	11.662	3.022	16.061	1.377	6.544	2.172	10.094
2015	4.131	11.662	3.022	18.815	4.131	6.544	2.172	12.848

表 8. 4 経済的費用—便益のキャッシュフロー (2/2)

(Unit: Million M\$)

Year	Benefit Streams			Cost Streams			
	Capital	Fuel	O & M	Capital	Fuel	O & M	Total
2016	2.066	11.622	3.022	1.377	6.544	2.172	10.094
2017	6.197	11.662	3.022	4.131	6.544	2.172	12.848
2018	1.377	11.662	3.022	0.688	6.544	2.172	9.405
2019	4.131	11.662	3.022	2.066	6.544	2.172	10.782
2020	1.377	11.662	3.022	0.688	6.544	2.172	9.405
2021	5.508	11.662	3.022	3.442	6.544	2.172	12.159
2022	4.819	11.662	3.022	5.508	6.544	2.172	14.225
2023	2.754	11.662	3.022	4.819	6.544	2.172	13.536
2024	2.754	11.662	3.022	2.066	6.544	2.172	10.782
2025	2.754	11.662	3.022	-	6.544	2.172	8.717
2026	2.066	11.662	3.022	-	6.544	2.172	8.717
2027	0.688	11.662	3.022	-	6.544	2.172	8.717
2028	2.066	11.662	3.022	-	6.544	2.172	8.717
2029	1.377	11.662	3.022	1.377	6.544	2.172	10.094
2030	4.131	11.662	3.022	4.131	6.544	2.172	12.848
2031	2.066	11.662	3.022	1.377	6.544	2.172	10.094
2032	6.197	11.662	3.022	4.131	6.544	2.172	12.848
2033	1.377	11.662	3.022	0.688	6.544	2.172	9.405
2034	4.131	11.662	3.022	2.066	6.544	2.172	10.782
2035	-	11.662	3.022	-	6.544	2.172	8.717
2036	-	11.662	3.022	-	6.544	2.172	8.717

表 8.5 過去及び1995年における S E S C O の財務状況

Item	1978	1979	1980	1981	1982	1983	1984	1985	1986	1995
Energy sales (GWh)	223	275	305	344	383	445	474	535	569	1,342
Revenue (M\$10 ⁶)	47	57	71	101	112	132	140	159	161	375
Tariff (M\$/kWh)	0.20	0.21	0.23	0.29	0.29	0.29	0.29	0.30	0.28	0.28
Expenses (M\$10 ⁶)	33	38	55	79	89	97	103	108	92	220
Net income (M\$10 ⁶)	14	19	16	22	23	35	37	51	69	155
Fixed assets (M\$10 ⁶)	168	176	191	210	239	305	326	825	867	2,294
Acc. Depreciation (M\$10 ⁶)	50	58	66	76	86	100	117	144	173	693
Net assets (M\$10 ⁶)	118	118	125	134	153	205	209	681	694	1,601
ROR (%)	12	16	13	16	15	17	18	7	10	9.7
Peak demand (MW)	61	69	74	84	101	107	116	133	141	331

Note: Acc. Depreciation means accumulated depreciation
 Net fixed assets is equal to fixed assets minus accumulated depreciation.

ROR is expressed by the ratio of net income to net fixed assets on annual basis.

表 8.6 ムコ計画の財務的キャッシュフロー

No	Year	Cost		Revenue
		Foreign	Local	
1	1987			
2	1988			
3	1989			
4	1990			
5	1991	359,560	691,460	
6	1992	7,114,090	5,684,660	
7	1993	10,041,390	6,374,320	
8	1994	15,028,460	7,121,110	
9	1995	9,629,360	4,058,830	
10	1996		480,060	6,491,680
11	1997		480,060	6,653,500
12	1998		480,060	6,764,080
13	1999		480,060	6,836,900
14	2000		480,060	6,885,440
15	2001		480,060	6,942,080
16	2002		480,060	7,004,110
17	2003		480,060	7,052,660
18	2004		480,060	7,090,440
19	2005		480,060	7,122,780
20	2006		480,060	7,147,050
21	2007		480,060	7,165,930
22	2008		480,060	7,174,020
23	2009		480,060	7,174,020
24	2010		480,060	7,174,020
.	.		.	.
.	.		.	.
.	.		.	.
50	2036		480,060	7,174,020

表 8.7 財 務 表

No	Year	Local Currency Portion		Foreign Portion		Revenue	Balance	Accumulated Balance
		O & M Cost	Interest	Repayment	Interest				Repayment
1	1991		510,680		14,380		-66,060	- 66,060
2	1992		478,210		298,950		-777,160	- 843,220
3	1993		956,280		700,600		- 1,656,880	- 2,500,100
4	1994		1,490,370		1,301,740		- 2,792,110	- 5,292,210
5	1995		1,830,780		1,686,910		- 3,517,690	- 8,809,900
6	1996	480,060		2,348,050		6,491,680	1,976,660	- 6,833,240
7	1997	480,060		2,348,050		6,653,500	2,138,480	- 4,694,760
8	1998	480,060		2,348,050		6,764,080	604,740	- 4,090,020
9	1999	480,060		2,348,050		6,836,900	677,560	- 3,412,460
10	2000	480,060		2,348,050		6,885,440	726,100	- 2,686,360
11	2001	480,060		2,348,050		6,942,080	782,740	- 1,903,620
12	2002	480,060		2,348,050		7,004,110	844,770	- 1,058,850
13	2003	480,060		2,348,050		7,052,660	893,320	- 165,540
14	2004	480,060		2,348,050		7,090,410	931,070	765,540
15	2005	480,060		2,348,050		7,122,780	963,440	1,728,980
16	2006	480,060		2,348,050		7,147,050	987,710	2,716,690
17	2007	480,060		2,348,050		7,165,930	1,006,590	3,723,280
18	2008	480,060		2,348,050		7,174,020	1,014,680	4,737,960
19	2009	480,060		2,348,050		7,174,020	1,014,680	5,752,640
20	2010	480,060		2,348,050		7,174,020	1,014,680	6,767,320
21	2011	480,060		2,348,050		7,174,020	1,014,680	7,782,000
22	2012	480,060		2,348,050		7,174,020	1,014,680	8,796,680
23	2013	480,060		2,348,050		7,174,020	1,014,680	9,811,360
24	2014	480,060		2,348,050		7,174,020	1,014,680	10,826,040
25	2015	480,060		2,348,050		7,174,020	1,014,680	11,840,720

表 8.8 財 務 表

(Unit : M\$)

No	Year	Cost	Interest	Repayment	Revenue	Balance	Accumulation
1	1991	691,460	14,380			-705,840	-705,840
2	1992	5,684,660	293,650			-5,983,610	-6,689,450
3	1993	6,374,320	700,600			-7,074,920	-13,764,370
4	1994	7,121,110	1,301,740			-8,422,850	-22,187,220
5	1665	4,058,830	1,686,910			-5,745,740	-27,932,960
6	1996	480,060	1,686,910		6,491,680	4,324,710	-23,608,250
7	1997	480,060	1,686,910		6,653,500	4,486,530	-19,121,720
8	1998	480,060		3,331,230	6,764,080	2,952,790	-16,168,930
9	1999	480,060		3,331,230	6,836,900	3,025,610	-13,143,320
10	2000	480,060		3,331,230	6,885,440	3,074,150	-10,069,170
11	2001	480,060		3,331,230	6,942,080	3,130,790	-6,938,380
12	2002	480,060		3,331,230	7,004,110	3,192,820	-3,745,560
13	2003	480,060		3,331,230	7,052,660	3,241,370	-504,190
14	2004	480,060		3,331,230	7,090,410	3,329,120	2,774,930
15	2005	480,060		3,331,230	7,122,780	3,311,490	6,086,420
16	2006	480,060		3,331,230	7,147,050	3,335,760	9,422,180
17	2007	480,060		3,331,230	7,165,930	3,354,640	12,776,820
18	2008	480,060		3,331,230	7,174,020	3,362,730	16,139,550
19	2009	480,060		3,331,230	7,174,020	3,362,730	19,502,280
20	2010	480,060		3,331,230	7,174,020	3,362,730	22,865,010
21	2011	480,060		3,331,230	7,174,020	3,362,730	26,227,740
22	2012	480,060		3,331,230	7,174,020	3,362,730	29,590,470
23	2013	480,060		3,331,230	7,174,020	3,362,730	32,953,200
24	2014	480,060		3,331,230	7,174,020	3,362,730	36,315,930
25	2015	480,060		3,331,230	7,174,020	3,362,730	39,678,660

表 8.9 財 務 表

No	Year	Local Currency Portion			Foreign Portion			Accumulated		
		O & M Cost	Interest	Repayment	Interest	Repayment	Revenue	Balance	Balance	
1	1991		51,680		28,760				-80,440	-80,440
2	1992		478,210		597,890				-1,076,100	-1,156,540
3	1993		956,280		1,401,190				-2,357,470	-3,514,010
4	1994		1,490,370		2,603,480				-4,093,850	-7,607,860
5	1995		1,830,780		3,373,840				-5,204,620	-12,812,480
6	1996	480,060		2,348,050		4,927,070	6,491,680		-1,263,500	-14,075,980
7	1997	480,060		2,348,050		4,927,070	6,653,500		-1,101,680	-15,177,660
8	1998	480,060		2,348,050		4,927,070	6,764,080		-991,100	-16,168,760
9	1999	480,060		2,348,050		4,927,070	6,836,900		-918,280	-17,087,040
10	2000	480,060		2,348,050		4,927,070	6,885,440		-859,740	-17,956,780
11	2001	480,060		2,348,050		4,927,070	6,942,080		-813,100	-18,769,880
12	2002	480,060		2,348,050		4,927,070	7,004,110		-751,070	-19,520,950
13	2003	480,060		2,348,050		4,927,070	7,052,660		-702,520	-20,223,470
14	2004	480,060		2,348,050		4,927,070	7,090,410		-664,770	-20,888,240
15	2005	480,060		2,348,050		4,927,070	7,122,780		-632,400	-21,520,640
16	2006	480,060		2,348,050		4,927,070	7,147,050		-608,130	-22,128,770
17	2007	480,060		2,348,050		4,927,070	7,165,930		-589,250	-22,718,020
18	2008	480,060		2,348,050		4,927,070	7,174,020		-581,160	-23,299,180
19	2009	480,060		2,348,050		4,927,070	7,174,020		-581,160	-23,880,340
20	2010	480,060		2,348,050		4,927,070	7,174,020		-581,160	-24,461,500
21	2011	480,060		2,348,050		4,927,070	7,174,020	4,345,910	4,345,910	-20,115,590
22	2012	480,060		2,348,050		4,927,070	7,174,020	4,345,910	4,345,910	-15,769,680
23	2013	480,060		2,348,050		4,927,070	7,174,020	4,345,910	4,345,910	-11,423,770
24	2014	480,060		2,348,050		4,927,070	7,174,020	4,345,910	4,345,910	-7,077,860
25	2015	480,060		2,348,050		4,927,070	7,174,020	4,345,910	4,345,910	-2,731,950

表 8.10 リンパン・系統の財務表 (ディーゼル発電)

Unit: Million M\$

Year	Fuel	O&M	Depre- ciation	Expense	Revenue		Balance		Accumula- tion		Accumula- tion II
					I	II	I	II	I	II	
1987	1.52	0.66	0.29	2.47	3.31	3.31	0.84	0.84	0.84	0.84	0.84
1988	1.91	0.84	0.29	3.04	3.70	3.70	0.66	0.66	1.50	1.50	1.50
1989	2.09	0.89	0.29	3.27	4.07	4.07	0.80	0.80	2.30	2.30	2.30
1990	2.43	0.94	0.35	3.72	4.45	4.45	0.73	0.73	3.03	3.03	3.03
1991	2.79	0.95	0.60	4.34	4.87	4.87	0.53	0.53	3.56	3.56	3.56
1992	3.20	1.04	0.86	5.10	5.35	5.35	0.25	0.25	3.81	3.81	3.81
1993	3.62	1.19	1.06	5.87	5.82	5.82	-0.05	-0.05	3.76	3.76	3.76
1994	4.08	1.30	1.13	6.51	6.29	6.29	-0.22	-0.22	3.54	3.54	3.54
1995	6.35	1.37	1.40	9.12	6.76	6.76	-2.36	-2.36	1.18	1.18	1.18
1996	7.35	1.50	1.61	10.46	7.26	7.26	-3.20	-3.20	-2.02	-2.02	-1.55
1997	8.44	1.60	1.68	11.72	7.80	8.12	-3.92	-3.60	-5.94	-5.94	-5.15
1998	9.60	1.67	1.89	13.16	8.32	8.85	-4.84	-4.31	-10.78	-10.78	-9.46
1999	10.83	1.81	2.03	14.67	8.85	9.42	-5.91	-5.25	-16.69	-16.69	-14.71
2000	19.45	1.88	2.45	23.78	9.38	9.98	-14.40	-13.80	-31.09	-31.09	-28.51
2001	20.65	2.04	2.66	25.35	9.95	10.60	-15.40	-14.75	-46.49	-46.49	-43.26
2002	21.95	2.12	3.01	27.08	10.58	11.26	-16.50	-15.82	-62.99	-62.99	-59.08
2003	23.23	2.31	3.15	28.69	11.21	11.93	-17.48	-16.76	-80.47	-80.47	-75.84
2004	24.53	2.40	3.57	30.50	11.83	12.59	-18.67	-17.91	-99.14	-99.14	-93.75
2005	25.85	2.62	3.65	32.12	12.46	13.26	-19.66	-18.86	-118.80	-118.80	-112.61
2006	27.30	2.72	3.96	33.98	13.16	14.02	-20.82	-19.96	-139.62	-139.62	-132.57
2007	28.95	2.91	4.19	36.05	13.96	14.86	-22.09	-21.19	-161.71	-161.71	-153.76
2008	30.60	3.09	4.27	37.96	14.76	15.71	-23.20	-22.25	-184.91	-184.91	-176.01
2009	32.25	3.19	4.47	39.91	15.56	16.56	-24.35	-23.35	-209.26	-209.26	-199.36
2010	33.90	3.36	4.31	41.57	16.35	17.40	-25.22	-24.17	-234.48	-234.48	-223.53

Remarks: Revenue I is calculated based on present tariff (M\$0.32/kWh).
Revenue II is calculated based on the tariff of M\$0.34/kWh.

表 8.11 リンパン・系統の財務表 (ディーゼル発電)

Unit: Million MS

Year	Fuel	O&M	Depre- ciation	Expense		Revenue		Balance		Accumula- tion	
				I	II	I	II	I	II		
1987	1.52	0.66	0.29	2.47	3.31	0.84	0.84	0.84	0.84	0.84	0.84
1988	1.91	0.84	0.29	3.04	3.70	0.66	0.66	0.66	1.50	1.50	1.50
1989	2.09	0.89	0.29	3.27	4.07	0.80	0.80	0.80	2.30	2.30	2.30
1990	2.43	0.94	0.35	3.72	4.45	0.73	0.73	0.73	3.03	3.03	3.03
1991	2.79	0.95	0.60	4.34	4.87	0.53	0.53	0.53	3.56	3.56	3.56
1992	3.20	1.04	0.86	5.10	5.35	0.25	0.25	0.25	3.81	3.81	3.81
1993	3.62	1.19	1.06	5.87	5.82	-0.05	-0.05	-0.05	3.76	3.76	3.76
1994	4.08	1.30	1.13	6.51	6.29	-0.22	-0.22	-0.22	3.54	3.54	3.54
1995	4.57	1.37	1.40	7.34	6.76	-0.58	-0.58	-0.58	2.96	2.96	2.96
1996	5.29	1.50	1.61	8.40	7.26	-1.14	-0.67	-0.67	1.82	1.82	2.29
1997	6.08	1.60	1.68	9.36	7.80	-1.56	-1.24	-1.24	0.26	0.26	1.05
1998	6.91	1.67	1.89	10.47	8.32	-2.15	-1.62	-1.62	-1.89	-1.89	-0.57
1999	7.80	1.81	2.03	11.64	8.85	-2.79	-2.22	-2.22	-4.68	-4.68	-2.79
2000	8.75	1.88	2.45	13.08	9.38	-3.70	-3.10	-3.10	-8.38	-8.38	-5.89
2001	9.29	2.04	2.66	13.99	9.95	-4.04	-3.39	-3.39	-12.42	-12.42	-9.28
2002	9.88	2.12	3.01	15.01	10.58	-4.43	-3.75	-3.75	-16.85	-16.85	-13.03
2003	10.45	2.31	3.15	15.91	11.21	-4.70	-3.98	-3.98	-21.55	-21.55	-17.01
2004	11.04	2.40	3.57	17.01	11.83	-5.18	-4.42	-4.42	-26.73	-26.73	-21.43
2005	11.63	2.62	3.65	17.90	12.46	-5.44	-4.64	-4.64	-32.17	-32.17	-26.07
2006	12.29	2.72	3.96	18.97	13.16	-5.81	-4.95	-4.95	-37.98	-37.98	-31.02
2007	13.03	2.91	4.19	20.13	13.96	-6.17	-5.27	-5.27	-44.15	-44.15	-36.29
2008	13.77	3.09	4.27	21.13	14.76	-6.37	-5.42	-5.42	-50.52	-50.52	-41.71
2009	14.51	3.19	4.47	22.17	15.56	-6.61	-5.61	-5.61	-57.13	-57.13	-47.32
2010	15.26	3.36	4.31	22.93	16.35	-6.58	-5.53	-5.53	-63.71	-63.71	-52.85

表 8.12 リンパン・系統の財務表 (小水力+ディーゼル発電)

Unit: Million M\$

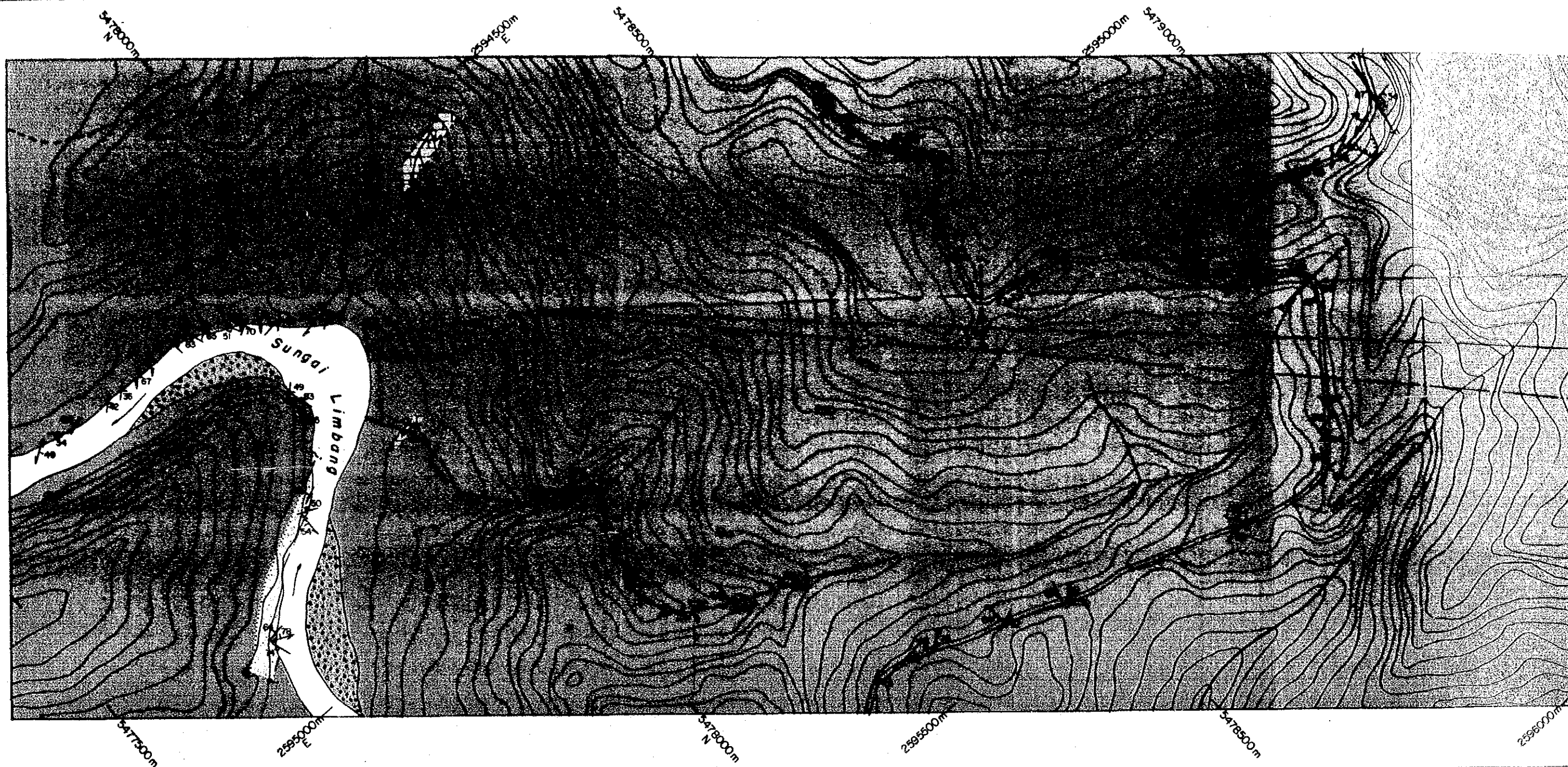
Year	Fuel	O&M	Depreciation Payment	Expense	Revenue		Balance		Accumula- tion	
					I	II	I	II	I	II
1987	1.52	0.66	0.29	2.47	3.31	3.31	0.84	0.84	0.84	0.84
1988	1.91	0.84	0.29	3.04	3.70	3.70	0.66	0.66	1.50	1.50
1989	2.09	0.89	0.29	3.27	4.07	4.07	0.80	0.80	2.30	2.30
1990	2.43	0.94	0.35	3.72	4.45	4.45	0.73	0.73	3.03	3.03
1991	2.79	0.95	1.12	4.86	4.87	4.87	0.01	0.01	3.04	3.04
1992	3.20	1.04	1.64	5.88	5.35	5.35	-0.53	-0.53	2.51	2.51
1993	3.62	1.19	2.71	7.52	5.82	5.82	-1.70	-1.70	0.81	0.81
1994	4.08	1.30	3.85	9.23	6.29	6.29	-2.94	-2.94	-2.13	-2.13
1995	6.35	1.32	4.58	12.25	6.76	6.76	-5.49	-5.49	-7.62	-7.62
1996	0.78	0.86	5.10	6.74	7.26	7.26	0.52	0.99	-7.10	-6.63
1997	1.23	0.94	5.10	7.27	7.80	8.12	0.53	0.85	-5.78	-5.78
1998	1.80	1.03	6.74	9.57	8.32	8.85	-1.25	-0.72	-6.50	-6.50
1999	2.47	1.11	6.88	10.46	8.85	9.42	-1.61	-1.04	-7.54	-7.54
2000	5.18	1.20	7.30	13.68	9.38	9.98	-4.30	-3.70	-11.24	-11.24
2001	6.25	1.31	7.44	15.00	9.95	10.60	-5.05	-4.40	-15.64	-15.64
2002	7.43	1.39	7.57	16.39	10.58	11.26	-5.81	-5.13	-20.77	-20.77
2003	8.60	1.49	7.64	17.73	11.21	11.93	-6.52	-5.80	-26.57	-26.57
2004	9.83	1.59	7.85	19.27	11.83	12.59	-7.44	-6.68	-33.25	-33.25
2005	11.05	1.70	7.86	20.61	12.46	13.26	-8.15	-7.35	-40.60	-40.60
2006	12.48	1.80	7.96	22.24	13.16	14.02	-9.08	-8.22	-48.82	-48.82
2007	14.10	1.94	8.26	24.30	13.96	14.86	-10.34	-9.44	-58.26	-58.26
2008	15.73	2.10	8.55	26.38	14.76	15.71	-11.62	-10.67	-68.93	-68.93
2009	17.38	2.25	8.76	28.39	15.56	16.56	-12.83	-11.83	-80.76	-80.76
2010	19.23	2.42	8.76	30.41	16.35	17.40	-14.06	-13.01	-93.77	-93.77

表 8.13 リンパン・系統の財務表 (小水力+ディーゼル発電)

Unit: Million M\$

Year	Fuel	O&M	Depreciation Repayment	Expense		Revenue		Balance		Accumula- tion		Accumula- tion II
				I	II	I	II	I	II			
1987	1.52	0.66	0.29	2.47	3.31	0.84	0.84	0.84	0.84	0.84	0.84	0.84
1988	1.91	0.84	0.29	3.04	3.70	0.66	0.66	0.66	1.50	1.50	1.50	1.50
1989	2.09	0.89	0.29	3.27	4.07	0.80	0.80	0.80	2.30	2.30	2.30	2.30
1990	2.43	0.94	0.35	3.72	4.45	0.73	0.73	0.73	3.03	3.03	3.03	3.03
1991	2.79	0.95	1.12	4.86	4.87	0.01	0.01	0.01	3.04	3.04	3.04	3.04
1992	3.20	1.04	1.64	5.88	5.35	-0.53	-0.53	-0.53	2.51	2.51	2.51	2.51
1993	3.62	1.19	2.71	7.52	5.82	-1.70	-1.70	-1.70	0.81	0.81	0.81	0.81
1994	4.08	1.30	3.85	9.23	6.29	-2.94	-2.94	-2.94	-2.13	-2.13	-2.13	-2.13
1995	4.57	1.32	4.58	10.47	6.76	-3.71	-3.71	-3.71	-5.84	-5.84	-5.84	-5.84
1996	0.56	0.86	5.10	6.52	7.26	0.74	0.74	1.21	-5.10	-5.10	-4.63	-4.63
1997	0.89	0.94	5.10	6.93	7.80	0.87	0.87	1.19	-4.23	-4.23	-3.44	-3.44
1998	1.29	1.03	6.74	9.06	8.32	-0.74	-0.74	-0.21	-4.97	-4.97	-3.65	-3.65
1999	1.78	1.11	6.88	9.77	8.85	-0.92	-0.92	-0.35	-5.89	-5.89	-4.00	-4.00
2000	2.33	1.20	7.30	10.83	9.38	-1.45	-1.45	-0.85	-7.34	-7.34	-4.85	-4.85
2001	2.81	1.31	7.44	11.56	9.95	-1.61	-1.61	-0.96	-8.95	-8.95	-5.81	-5.81
2002	3.34	1.39	7.57	12.30	10.58	-1.72	-1.72	-1.04	-10.67	-10.67	-6.85	-6.85
2003	3.87	1.49	7.64	13.00	11.21	-1.79	-1.79	-1.07	-12.46	-12.46	-7.92	-7.92
2004	4.42	1.59	7.85	13.86	11.83	-2.03	-2.03	-1.27	-14.49	-14.49	-9.19	-9.19
2005	4.97	1.70	7.86	14.53	12.46	-2.07	-2.07	-1.27	-16.56	-16.56	-10.46	-10.46
2006	5.61	1.80	7.96	15.37	13.16	-2.21	-2.21	-1.35	-18.77	-18.77	-11.81	-11.81
2007	6.35	1.94	8.26	16.55	13.96	-2.59	-2.59	-1.69	-21.36	-21.36	-13.50	-13.50
2008	7.08	2.10	8.55	17.73	14.76	-2.97	-2.97	-2.02	-24.33	-24.33	-15.52	-15.52
2009	7.82	2.25	8.76	18.83	15.56	-3.27	-3.27	-2.27	-27.60	-27.60	-17.79	-17.79
2010	8.65	2.42	8.76	19.83	16.35	-3.48	-3.48	-2.43	-31.08	-31.08	-20.22	-20.22

付 図



RECENT



Riverine Deposit : Consisting mainly of boulders of fine grained sandstone and shale in a matrix of sand. Found mainly along rivers and side streams.

OLIGOCENE - MIOCENE

Setap Shale



Shale Unit : Consisting mainly slaty hard shale with very little amount of sandstone intercolation (3%). Thinly bedded (2 to 3 cm thick), regionally metamorphosed, folded, faulted and fractured with infilling quartz veins.



Sandstone Unit : Consisting of hard, fine grained, dark grey sandstone. Thickly bedded, slightly metamorphosed, faulted, fractured and slightly folded. Quartz veins are commonly infill cracks within the

EOCENE - MIOCENE

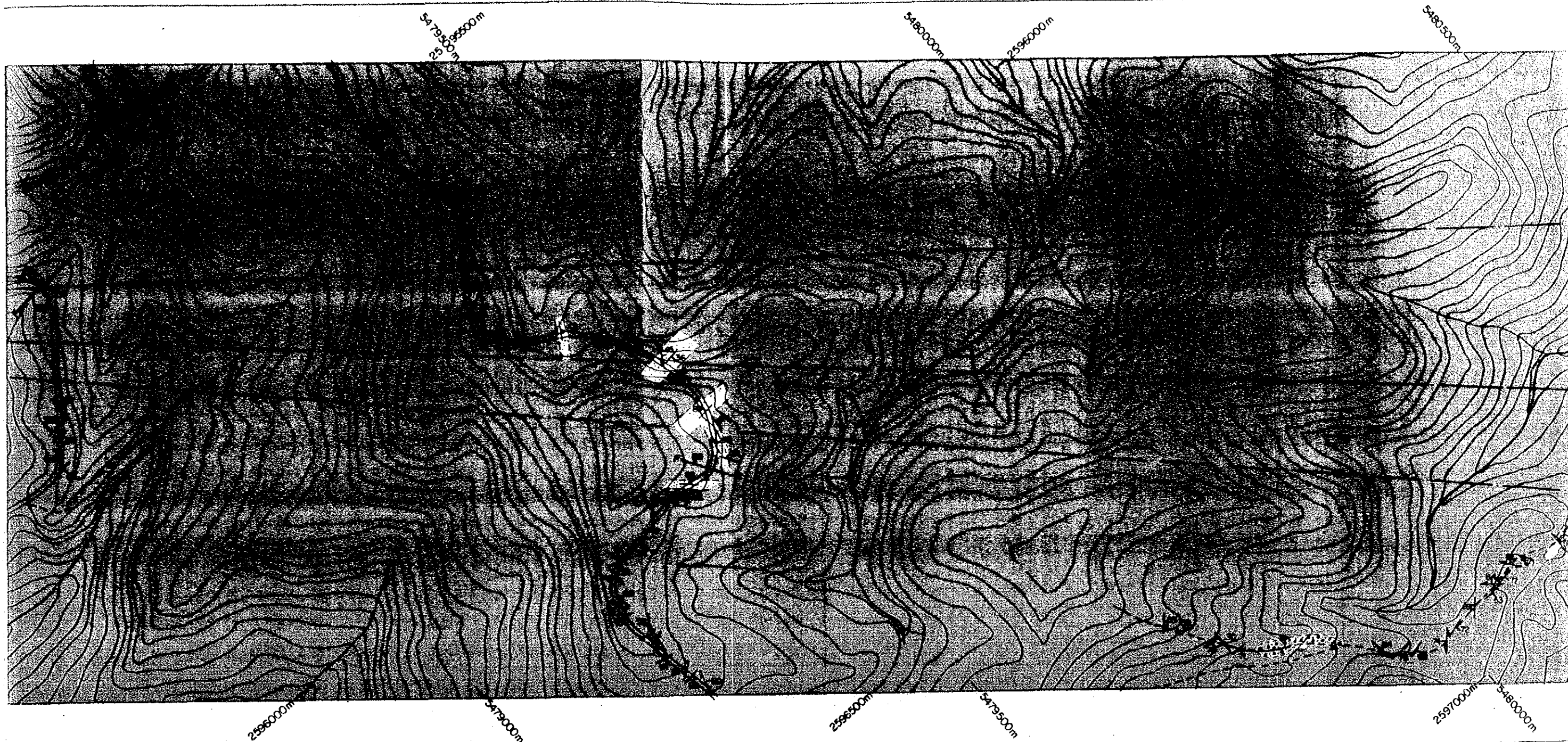


Melinau Limestone : Argillaceous, fossiliferous, thickly bedded (about 1 m), faulted and fractured with infilling calcite veins.

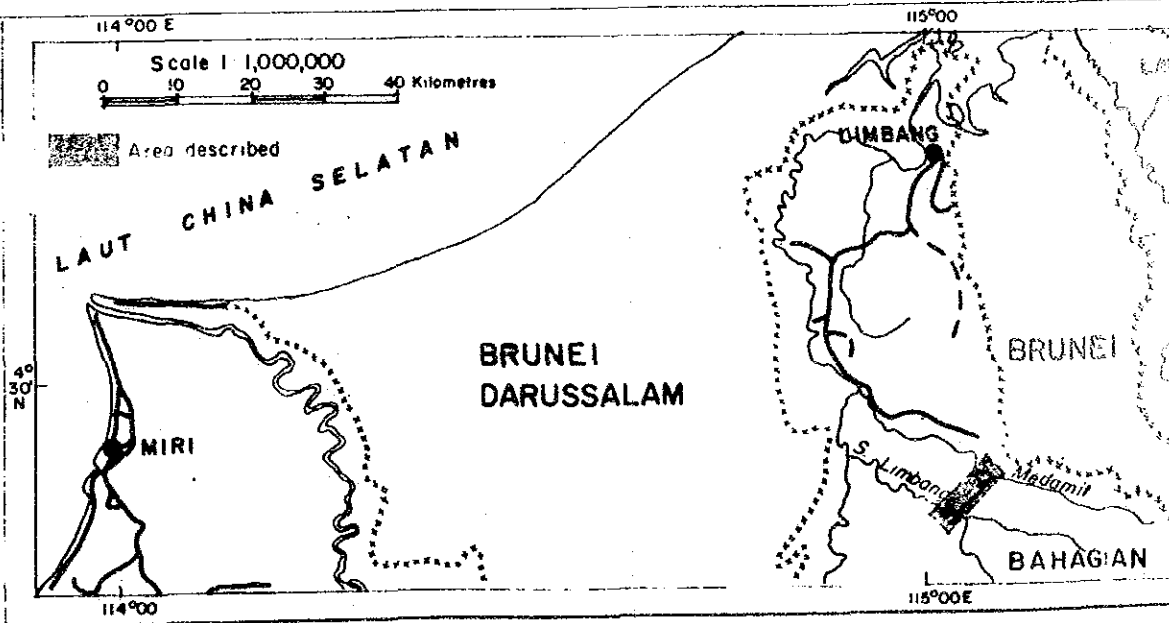
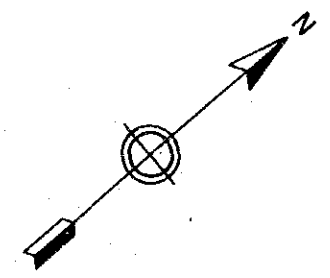
L E G E N D

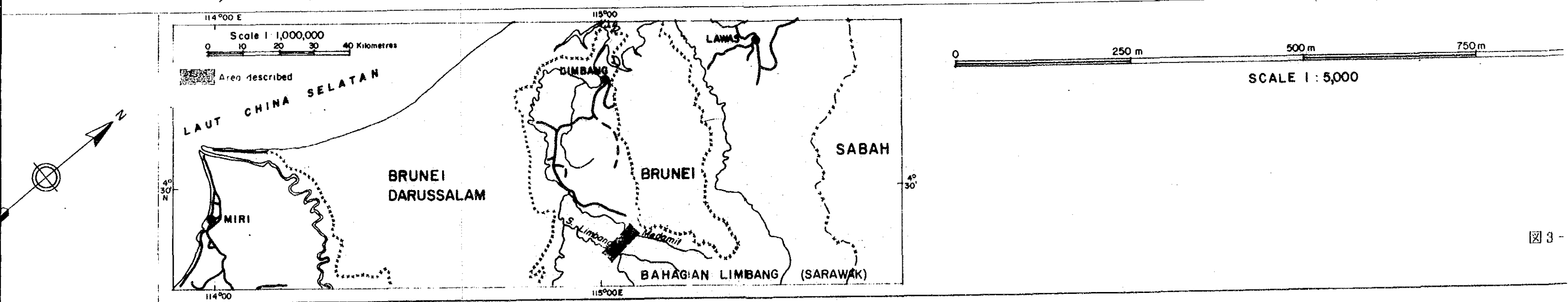
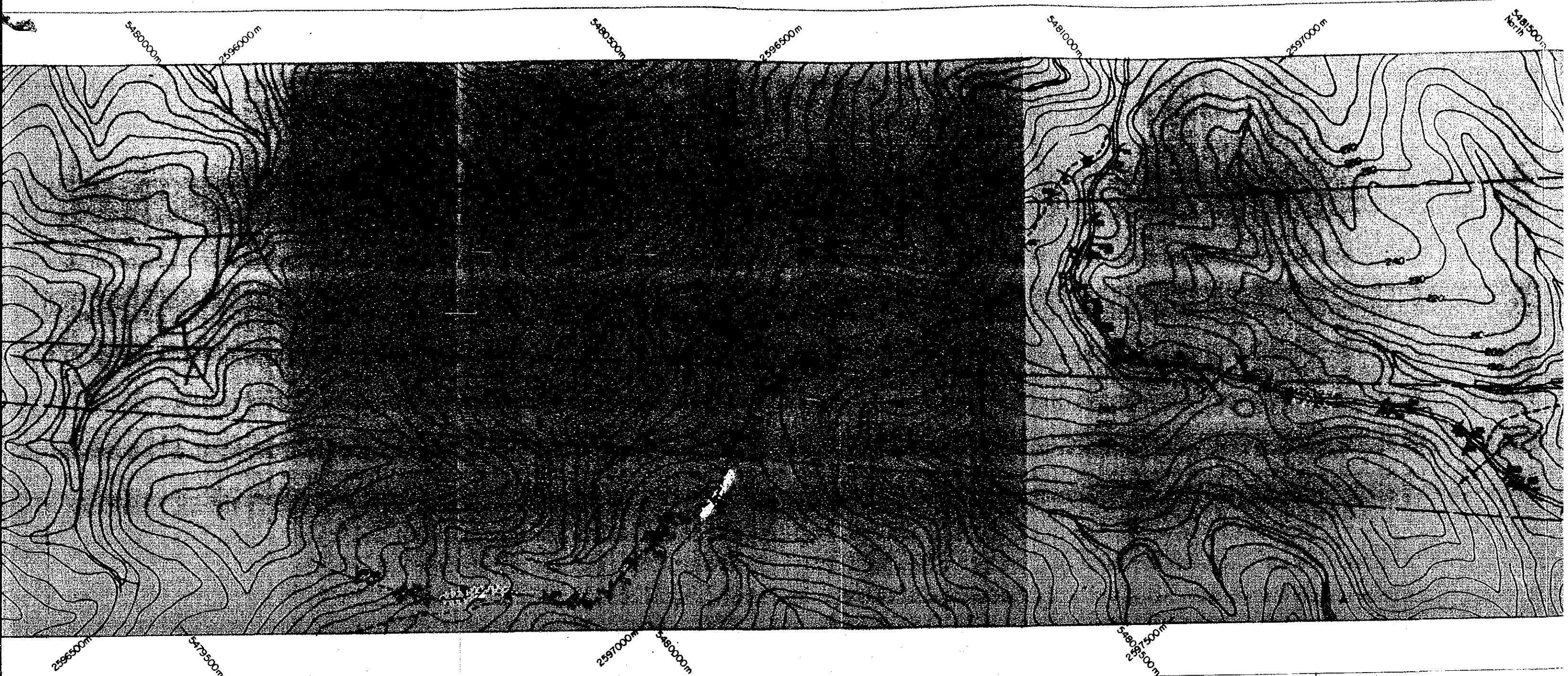
sandstone. Occurs as thick lenses (about 30m) at the proposed dam site. Friable soft, light yellow, fine grained sandstone lenses (10-20m thick) found in the central part of the area.

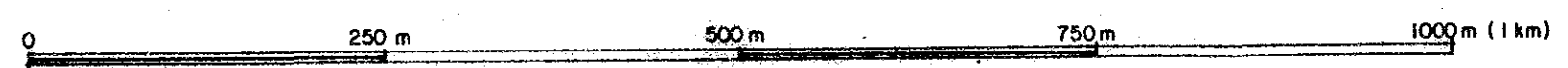
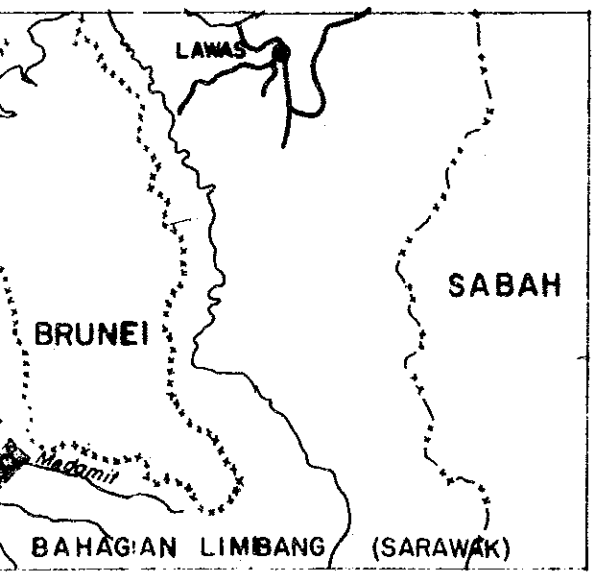
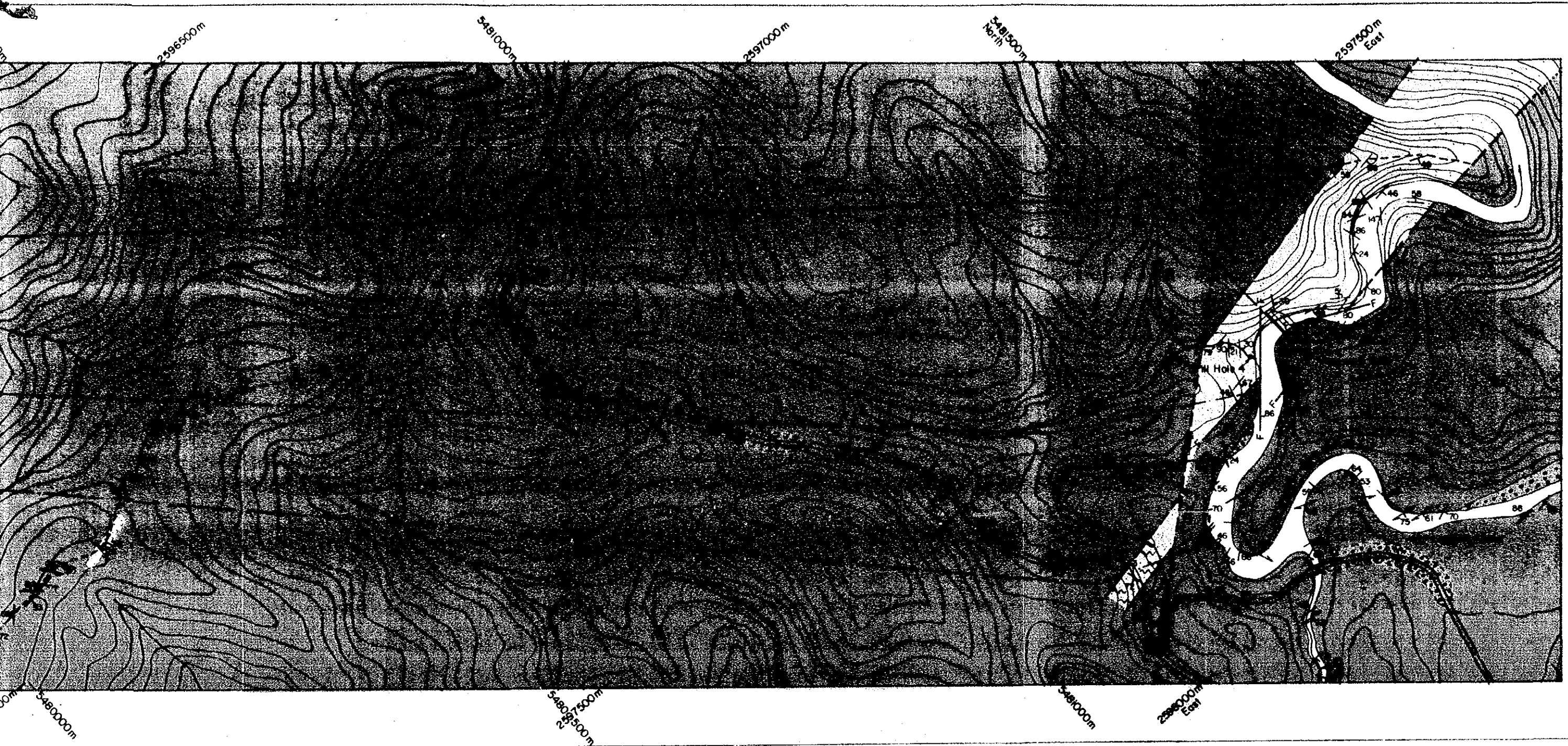
- Attitude of beds
- Attitude of cleavages
- Attitude of joints
- Attitude of faults, inferred
- Geological boundary, definite
- Fault zone
- Landslide
- Contour at 10m interval
- Logging road



- Attitude of beds
- Attitude of cleavages
- Attitude of joints
- Attitude of faults, inferred fault
- Geological boundary, defined, inferred
- Fault zone
- Landslide
- Contour at 10m interval
- Logging road
- River flow direction
- Timber tracks







SCALE 1 : 5,000

図 3-1 ムダミット-2 地区の地質図

GOVERNMENT OF MALAYSIA
 FEASIBILITY STUDY
 SMALL SCALL HYDROELECTRIC POWER PROJECT IN SARAWAK
 JAPAN INTERNATIONAL COOPERATION AGENCY

