

## 第6章 本格調査の概要

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### 6-1 調査目的

本調査は、ジャワバリ系統の IPP 導入を含む電源開発計画の検討ならびに、系統の潮流解析や安定度解析等を含む流通設備計画の検討を通じて最適な設備形成計画を策定することにより、電力市場開放後も安定した系統運用と、電力の質の向上に資するものである。

### 6-2 調査対象地域

ジャワバリ系統に限り最適電源開発計画を実施するものとする。(外島部分については既に ADB が包括的な調査 (Outer Island Electrification Project) を 10 月から開始する予定であり、2001 年 2 月～3 月には Interim Report も出されるであろうことから、その内容を十分に検討し重複しないようであれば地域を限定し実施するものとする。)

### 6-3 調査内容

#### (A) 電力セクターに利用可能な一次エネルギーの評価

- 1) 1998 年に制定された総合エネルギー政策及び可能であればエネルギー関連 3 法案のレビュー
- 2) 一次エネルギーを利用する際の制約条件の検討、一次エネルギーを活用する際の制約条件の評価、制約条件緩和のための技術導入の提言
- 3) 既存の一次エネルギー需要レビュー及び必要に応じた一次エネルギー量に関するデータ収集
- 4) 電力セクターに利用可能な一次エネルギー量の検討

インドネシア政府は 1998 年に総合エネルギー政策 (General Energy Policy) を発表、今後の同国のエネルギー政策全般について方向を示した。

本来、総合エネルギー政策に沿って一次エネルギー計画が策定され、その中で電力セクターに供給される一次エネルギー消費計画が策定され、電源開発計画に反映されていくべきものであるが、これでは本来の我々の調査範囲である電力分野をはるかに超える総合的調査となり、期間的にも金額的にも不可能と思料する。一次エネルギー計画全般にかかわる調査は総合エネルギー政策にまで踏み込む広範な調査となることから、今回は実施範囲から外すこととした。しかしながら、最適な電源開発計画のためには、最適な一次エネルギー利用についても考慮することが必要であることから、上記 4 項目について調査することとしたもの。

- 1) 総合エネルギー政策は尊重すべきものであり、その内容のレビューに止める。もし必要であればコメントを加えることとする。また、現在エネルギー関連 3 法案 (エネルギー法、石油・ガス法、新電力法) は改正作業中であるが、本調査の中では現状の中身、改正の動向についてレビューすることとし、もし可能であれば (法案成立後) 新法案の中身についてレビューする。
- 2) 燃料として一次エネルギーを使用する際の各種制約条件 (政策、法律、社会、環境、コスト等) について調査・検討するとともに、条件をクリアするための新技術導入等を含む対策案を提供

する。

- 3) 電力セクターで消費された過去の一次エネルギー消費データ及び関連データを収集・レビューする。
- 4) 上記データを基に今後の一次エネルギー消費動向を予測するとともに、最適電源開発の観点から一次エネルギーの有効活用について提言する。

#### (B) 最適電源開発計画、系統（送電）計画の策定

- 1) 既存の発電設備関連データ（設備出力、故障発生率、発電コスト、O&M データ、発電機定数等）の収集及び発電設備のリハビリ計画に関する提言
- 2) 計画中の発電設備のデータ（設備能力、発電コスト、O&M 計画、発電機定数等）の収集
- 3) 既存及び計画中の送変電系統に関するデータの収集（設備容量、建設コスト、送変電設備定数、現行計画基準等）
- 4) 適正な IPP 導入のための制度面の検討
- 5) 需要予測に基づく最適電源開発、系統（送変電）計画作成のためのシミュレーション検討
- 6) 最適電源開発、系統（送変電）計画の作成

1994-95 年の開発調査“インドネシア共和国電力セクター総合エネルギー開発計画”において、JICA は既に電力需要予測モデルを供与していること、その後も日本エネルギー経済研究所より新たな予測モデル（Simple-E）が与えられていることから、本調査においては新たな需要予測モデルは作成せず既存のモデルを活用する。現在 MEMR が Simple-E に基づく州単位の需要予測モデルを開発中であることから、必要に応じてその中身を精査し、修正を加える。

最適電源開発計画においては、需要予測が最も重要である。需要地域の想定、需要地域の電力消費量動向（日・月・年間最大需要電力／日・月・年間需要電力量）を予測し、需要に見合った供給力の確保を検討することが電源開発計画の基本である。燃料の多様化（インドネシアにおいては脱石油化等）、環境保全対策、立地問題など様々なファクターを考慮することは勿論のことであるが、需要予測が最も重要なファクターであることから、MEMR が作成中の需要予測モデルを確かなものとするためにも、その中身を精査することは不可欠である。

本調査においては、系統の安定度の指標となる周波数・電圧など電気の質を考慮した上での最適電源開発計画、系統（送変電）計画について検討することとする。

- 1) 最適電源開発計画の策定及び発電所リハビリ計画の策定には、各発電所の現況を把握するための詳細な現地調査が不可欠であるが、長期間に渡る膨大な調査となることから、今回の調査では全既設発電設備（PJB1、PJB2、Captive、IPP 等）の現状に関する机上ベースでの情報収集に止める。また入手したデータや情報をレビューし、経済性や系統での位置付け等を勘案し、リハビリを要する発電所のプライオリティ付け（リハビリ計画）を実施し最適電源開発計画に織り込む。
- 2) 計画中の全既設発電設備（PJB1、PJB2、Captive、IPP 等）の机上での情報収集。
- 3) 既存・建設中及び計画中の系統（送変電）及びディスパッチングセンター等系統運用に係わる

情報を収集する。

- 4) 現在の PLN の財政状況を勘案すれば、増加する電力需要に PLN 単独で対応することは難しく、今後も IPP を導入していく方針に変わりはないものと思料される。今日の IPP 問題はその入札制度に関して適切さを欠いていたことが原因であり、IPP 電源の募集・契約形態について検討する。また、調和のとれた電源開発を進めていく上で、IPP のミドルやピークへの導入の可能性についても検討する。
- 5) 大型火力電源は東ジャワ地区に設置されており、大電力消費地である西の首都ジャカルタへは長距離の基幹送電線によって電力供給が行われている。基本となる電源開発計画はネットワーク・コスト（需要地までの距離及びルート条件）、立地地点コスト（電源コスト）、運用コスト等を勘案し系統総合経費が最小となるよう立案する。これに加え最適計画の選定においては、各電源が多様な供給力特性、運用特性、経済特性を有するため、非常に複雑で膨大な手順となる。各種計画案について潮流解析及び安定度解析等技术的な検討を実施し、系統運用をシミュレーションし、その結果を比較し最適な電源配置と系統計画に反映する。
- 6) 今後の電力需要の伸びに対応するため、IPP の大量投入が予想されるが、その際の電力の質（周波数や電圧）を維持していくための Ancillary Service の確保や、IPP 導入量の上限值等について検討する。また、5) での潮流解析及び安定度解析等を踏まえ、系統安定度を考慮した適切な系統計画、電源配置計画等について検討する。

IPP は特定の燃料（石炭）に偏る傾向があることから、将来の IPP 大量導入を控え、一次エネルギー消費量予測をも勘案し燃料供給面でのベストミックスについて検討する。また、ベース、ミドル、ピークロードそれぞれに適した性格の電源のベストミックスについて検討する。

安定した系統運用を実現するため現行計画基準や系統運用ルール、組織（ディスパッチングセンターの配置）など制度面について検討する。

外島部分については、ADB が T/A “Outer Island Electrification Project” において包括的な調査を 2000 年 10 月より開始する予定であり今回の調査対象から除くこととした。しかしながら、ADB の T/A が外島の電源開発計画についてどのような調査をどこまで実施するか必ずしも明確ではないことから、その中身、進捗についてフォローし、場合によっては調査に含めることも考える。もし、外島部分について実施するとすれば、対象地域を絞り込んだモデル地域について最適電源開発計画を策定することとなる。

外島部分については、各地域ごとの垂直統合型電力会社(REC)の設立を計画しており、そこでは日本の各地域電力会社の組織、機能、地域のエネルギー資源の有効活用による電源開発計画、広域融通制度等の運営手法を移転できる可能性があり ADB の T/A の内容と重複しない場合は検討に含めることとする。

## 附属資料

- 資料－ 1 質問票及び回答
- 資料－ 2 収集資料リスト
- 資料－ 3 ADB T/A (Outer Island Electrification Project)
- 資料－ 4 Power Development of PLN-Indonesia
- 資料－ 5 要請書

## 資料－１ 質問票及び回答

<b>JAPAN INTERNATIONAL COOPERATION AGENCY</b>		<b>Ministry of Mines and Energy</b>	
<b>(JICA)</b>		<b>QIR-JICA/</b>	
<b>QUESTIONNAIRE/ INFORMATION REQUIRED</b>			
<b>PROJECT NAME:</b> The Study on the Optimal Electric Power Development and Operation		<b>Ref. No. :</b>	<b>Issue Date :</b>
			<b>Revision Date :</b>
			Aug. 25, 2000

No.	Questionnaire/Information Required	Reply	Remarks
1.	<p><b>Power Sector Restructuring Plan (herein after refer to as the Plan.)</b></p> <p>(1) The Plan is supported by ADB's Loans named Program Loan, TA Loan (Java-Bali) and TA Loan (Outer Island). Please explain us the current progress of the each Program.</p> <p>(2) Please explain us the current and future effectiveness and/or impact to not only electric industry but also other industries including household, if any.</p> <p>(3) How about the reaction of the other/related Ministries on the Plan? Is the Plan cooperated with other Ministries Policy or Framework?</p> <p>(4) Please explain us your Policy/Opinion regarding the electric market's privatization compared with ADB's Program.</p> <p>(5) Do you have any requests to us regarding above mentioned privatization, if any.</p> <p>(6) The Plan's success depends on the following three items achievement; Enact the amended Electricity Law, Implement the tariff increase, Re-negotiate the PPA. Please explain us followings, -current status and forecast of the enactment of amended Electricity Law. -recent electric tariff's change and forecast by sector (Industry, Agriculture, Commercial, Household, Public, etc.) including cross-subsidy data and number of customers.</p> <p>(7) Please explain us your Opinion regarding the PLN's future undertaking strategy as the Plan's progress. And how about the strategy of IPP, Captive Power, Cooperatives and brand-new participants.</p>	<p>(1) TA Loan (Java-Bali) TA-A, H : on going TA-G : selection process of a Consultant TA-B, C, D, E : under preparation for procuring Consultant</p> <p>*The progress of the Program Loan and TA Loan (Outer Island) has not been submitted formally.</p> <p>(2) TA Loan (Java-Bali) can not be concluded since the activities are on going.</p> <p>(3) The plan was decided by inter-Ministries.</p> <p>(4) We are in the process of restructuring the sector, and privatization has not been started yet and too early to discuss.</p> <p>(5) Not apply</p> <p>(6) Regardless the existence of TA Loan, the electricity tariff need to be increased.</p> <p>(7) Not apply</p>	See attached materials-2, No.20

<b>JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)</b>		<b>QUESTIONNAIRE/ INFORMATION REQUIRED</b>	
PROJECT NAME: The Study on the Optimal Electric Power Development and Operation		Plan Organization : Ministry of Mines and Energy	Ref. No. : QIR-JICA/
		Issue Date : Aug. 25, 2000	Revision Date :

No.	Questionnaire/Information Required	Reply	Remarks
2.	<p><b>The Study on the Optimal Electric Power Development and Operation in Indonesia</b></p> <p>A. Studies for available energy volume for electric power sector            (1) Regarding the primary energy resource survey, JICA has already executed in 1994-1995. Is there any big change in figure? Please submit us the latest data with maps regarding the primary energy resources, ex. Oil, Gas, Coal, Hydro, Geothermal, Wind, Photovoltaic, etc.            (2) In Indonesia, are there any Environmental Laws in which prescribed standard value. Ex. air, water, soil pollution etc.. Please submit us the above mentioned data, if any.            (3) The study on available primary energy for electric power sector consists of very wide sector and reaches comprehensive energy strategy in Indonesia. Is this study indispensable for above mentioned study? Please submit us the recent year's data regarding the used primary energy volume for electric power sector and your forecast of it.</p>	<p>(1) Another sub-Directorate, DGEED (Directorate General for Electricity and Energy Development) is in charge of primary energy sector. And unfortunately, primary energy strategy is not linked with the electric power development planning. The hand-book (1995-2020) of the primary energy written in Indonesia is submitted.            (2) New Regulation No. 27 (Environment) has enacted in 1999 and that Law written in Indonesia has been submitted to Mr. Chiyoda, JICA Expert of MOC from BAPEDAL. And the list of other laws related to the environmental has been submitted from DGEED.            MEMR. The standard value prescribed in the laws has not been submitted formally, however a part of it is written in the paper from PJB2.            (3) As above mentioned, primary energy strategy is not linked with the electric power development planning. Therefore, Sub-Directorate of Electric Power Planning, DGEED desires the data of primary energy demand forecast to make the optimal electric development plan in own right. The data regarding the used primary energy volume for electric power sector and its forecast has been submitted.</p>	<p>(1) See attached material-2, No.7            (2) See attached material-2, No. 2,16,18            (3) See attached material-2, No. 2,9,10,19,25</p>



<b>JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)</b>		<b>QUESTIONNAIRE/ INFORMATION REQUIRED</b>		<b>Ministry of Mines and Energy</b>	
<b>PROJECT NAME:</b> The Study on the Optimal Electric Power Development and Operation		<b>Plan Organization :</b>		QIR-JICA/	
		<b>Ref. No. :</b>		Aug. 25, 2000	
		<b>Issue Date :</b>			
		<b>Revision Date :</b>			

No.	Questionnaire/Information Required	Reply	Remarks
	<p>B. Proposal for the optimal power and transmitting plan</p> <p>(1) Regarding the electricity demand forecast, JICA has already done in 1994-95 and transferred techniques for demand forecast same as primary energy source. How is the progress of your work since that time?</p> <p>(2) Please submit us the recent and future energy and peak demand balance sheet by area (Java-Bali, Region 1-11, Batam).</p> <p>(3) Please submit us the recent energy consumption by sector (Industry, Agriculture, Commercial, Household, Public, etc.) and your forecast of energy demand. And recent generated energy by Type (Oil, Coal, Steam, Diesel, Hydro, etc.).</p> <p>(4) Please submit us the recent peak demand by sector and your forecast of it.</p> <p>(5) Please submit us the recent and future electrification ratio by area.</p> <p>(6) The daily load curve will change according to the growth process. Please submit us the typical daily and yearly load curve in recent years. And please explain us your forecast of the transition of Indonesia's load curve.</p> <p>(7) Please submit us the current situation of all existing power plants (PLN, captive power, IPPs, cooperatives) with location maps and following data, Type (Oil, Gas, Steam, Diesel, Combined, Hydro...), Character (Base load, Middle load, Peak load), Installed Capacity, Available Capacity, Commissioning date, Capacity Factor, Outage data (failure, planned), Generation Cost, Operational data, etc..</p> <p>(8) Please submit us your planned power plant developing plan with maps and above-mentioned data by area, if any.</p> <p>(9) Please submit us the existing and planned transmission system (Grid) data (voltage, length, etc.) with maps.</p> <p>(10) Please explain us the recent and future prospect of the T/D Losses by technical and non-technical (power theft).</p> <p>(11) Generally, to draw up the long-term power development strategy, we prepare the demand forecast, power plants development plan, transmission plan and best-mix concept of the power units, location's social and environmental conditions etc.. Do you have a sufficient data for the simulation studies on the optimal power and transmission (Grid) plan? And the meanings of the optimal plan is "least cost plan"? In your request, social or environmental condition's survey is not mentioned. In Indonesia, is there no social or environmental problem on location?</p>	<p>(1) The model for energy demand forecast offered by JICA in 1995 is not updated any more, because the program is so complicated and required data is numerous. Since April, the easy model named "Simple-E_" presented by IEE JAPAN (Consultant of 1995's study) is used and under remaking for calculation not by region but by province by DGEED.</p> <p>(2) Submitted</p> <p>(3) Submitted</p> <p>(4) Not submitted</p> <p>(5) Submitted</p> <p>(6) Submitted</p> <p>(7) Submitted but limited</p> <p>(8) There is no concrete plan of power plant construction. The new construction plan is under study by PLN. (reference : attached material-2, No. 8)</p> <p>(9) Submitted</p> <p>(10) Submitted</p> <p>(11) At the construction of transmission lines, the compensation for right of way will come into trouble. For not only transmission lines but also power plants, it is difficult to acquire the required land. Therefore, optimal power and transmitting plan is not decided based on the least cost plan directly.</p>	<p>(2) See attached material-2, No. 2,8,11,13,25,26,27,29</p> <p>(3) See attached material-2, No. 2,11,25,27</p> <p>(5) See attached material-2, No. 2,22,25,27</p> <p>(6) See attached material-2, No. 29</p> <p>(7) See attached material-2, No. 2,25,27,28,29</p> <p>(9) See attached material-2, No. 2,12,25,27,28,29</p> <p>(10) See attached material-2, No. 2,25,27</p>

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No.	Questionnaire/Information Required	Reply	Remarks
	<p>C. Proposal for technical and systematical and legal conditions to implement the optimal power and transmitting plan.</p> <p>(1) Please list the existing power plants which need rehabilitation and explain us the necessity of rehabilitation.</p> <p>(2) Please explain us your opinion regarding the best-mix concept of generating unit.</p> <p>(3) If you introduce the pooling system, the price of electric power corresponding to their characteristics will be determined by market automatically. Please explain us the appraisal price in detail.</p> <p>(4) Please explain us the combination of finance in detail. Is this meanings cross-subsidiary for universal and uniprice service or subsidiary from government's budget (grant or equity) for construction cost reduction?</p> <p>(5) Please explain us the Decentralization in terms of the power sector.</p>	<p>(1) Not submitted. (Not existing)</p> <p>(2) When we make the best-mix concept in the view point of financial, we should grasp the current status (efficiency) of the existing units. It is indispensable to judge which is the least cost plan, full replace, rehabilitation, new construction. As mentioned above, we don't have related data, therefore we can not make the financial best-mix concept. And except financial best-mix concept, there are many best-mix concepts, in the view point of general energy policy, generating unit's characteristic, energy security, etc.</p> <p>(3) Not submitted</p> <p>(4) Cross-subsidiary for universal service.</p> <p>(5) On 1<sup>st</sup> Jan. 2001, Law No. 22 (Autonomy Region) and No. 25 (Income Sharing) will be enacted. And REC (Regional Electric Company) will be established in the near future. In that circumstance, the regional electric power system's change is unavoidable. So various feasible studies regarding the investment from regional government to REC, rural electrification, interconnecting with captive power, power shortage, restructuring of REC's area, etc. are need.</p>	

## 資料－２ 収集資料リスト

## 収集資料リスト

No.	タイトル及び内容	使用言語	入手先	入手日
1	インドネシアー経済（2000年（平成12年）3月8日（水曜日）第823号【3】） 国営電力PLN 民間発電所との契約変更に基本合意	Japanese	JICA	9.5
2	「The Sector Study on the Optimal Electric Power Development and Operation in Indonesia」のJustification of Studyの日本語訳 別添：電力セクターの現状（統計集）	Jap./Eng.	JICA	9.5
3	The Sector Study on the Optimal Electric Power Development and Operation in Indonesia のTOR案（東京電力天野氏作成）	English	JICA	9.5
4	MEMORANDUM OF UNDERSTANDING OUTER ISLAND ELECTRIFICATION PROJECT FACT-FINDING MISSION (ADB)	English	JICA	9.5
5	JICAインドネシア事務所→JICA HQ 鉱工業開発部 資源開発調査課 インドネシア国電力セクター参考資料（赤松専門家総合報告書3部構成）	Jap./Eng.	JICA	9.5
6	GENERAL ENERGY POLICY (GEP)	English	MEMR	9.6
7	PERKIRAAN KEBUTUHAN ENERGI 1995-2020	Indonesia	MEMR	9.6
8	REVIEW SISTEM PERENCANAAN KETENAGALISTRIKAN	Ind./Eng.	MEMR	9.6
9	First Energy Demand Forecast セクター別（家庭/商業/工業/運輸）一次エネルギー消費量予測 一次エネルギー別消費量予測	Indonesia	MEMR	9.6
10	Energy Consumption by Type of Consumers セクター別（工業/家庭/運輸）・燃料別（LPG等）消費量実績	Indonesia	MEMR	9.6
11	地域別電力需要予測（ベースケース）	English	MEMR	9.6
12	電力設備の現況及び将来計画図（モノクロ）	English	MEMR	9.6
13	Power Development of PLN-Indonesia In Brief	English	PLN	9.8
14	PROFIL UNIT PEMBANGKITAN MUARA KARANG (PJB2)	Indonesia	PJB2	9.9
15	Muara Karang 発電所の概要	English	PJB2	9.9
16	Environmental Information Report (Muara Karang Power Plant)	English	PJB2	9.9
17	MEMR組織図	Ind./Eng.	MEMR	9.11
18	環境関連法案リスト	English	MEMR	9.11
19	Fuel consumption for PLN's Power Plant	Indonesia	MEMR	9.12
20	質問状に対する回答（一部） （1.Power Sector Restructuring Plan）	English	MEMR	9.12
21	Laporan Tahunan-Annual Report 99 (PT PLN)	Indonesia	MEMR	9.12
22	Empowering The Indonesian Villages (PT PLN) 2000	English	MEMR	9.12
23	Annual Report 1998 (Jawa-Bali Power Generation Company(監: PJB2)	Ind./Eng.	MEMR	9.12
24	Profil Perusahaan-Company Profile (PJB2)	Ind./Eng.	MEMR	9.12
25	STATISTIK DAN INFORMASI KETENAGALISTRIKAN DAN ENERGI TAHUN 1998/99	Ind./Eng.	MEMR	9.12
26	Energy and Load Demand Forecast PT PLN(Persero) Jawa-Bali System	English	PLN	9.13
27	PLN STATISTICS 1998 (PT PLN(PERSERO))	English	PLN	9.13
28	電力設備の現況及び将来計画図（カラー）	English	PLN	9.13
29	Statistik 1998 PT PLN Penyaluran Dan Pusat Pengatur Beban Jawa Bali	Ind./Eng.	PLN	9.13

資料－3 ADB T/A (Outer Island Electrification Project)

**ASIAN DEVELOPMENT BANK**

**TAR: INO 34100**

**TECHNICAL ASSISTANCE**

**TO THE**

**REPUBLIC OF INDONESIA**

**FOR PREPARING THE**

**OUTER ISLAND ELECTRIFICATION PROJECT**

**August 2000**

## CURRENCY EQUIVALENTS

(as of 6 July 2000)

Currency Unit	–	Rupiah (Rp)
Rp1.00	=	\$0.000107
\$1.00	=	Rp9,340

## ABBREVIATIONS

ADB	–	Asian Development Bank
EIA	–	environmental impact assessment
IEE	–	initial environmental examination
KLP	–	rural electric cooperative
KVA	–	kilovolt-ampere
LARP	–	land acquisition and resettlement plan
MW	–	megawatt
OIE	–	outer island electrification
PLN	–	Perusahaan Perseroan (Persero) PT Perusahaan Listrik Negara
REC	–	Regional Electrification Company
SBU	–	strategic business unit
TA	–	technical assistance

## NOTES

- (i) The fiscal year (FY) of the Government ends on 31 December.
- (ii) In this report, "\$" refers to US dollars.

## I. INTRODUCTION

1. During the Country Programming Mission of the Asian Development Bank (ADB) in February 2000, the Government of the Republic of Indonesia requested ADB to provide project preparatory technical assistance (TA) for outer island electrification (OIE) to the national power utility, Perusahaan Perseroan (Persero) PT Perusahaan Listrik Negara (PLN). A Fact-Finding Mission visited Indonesia in May 2000 and reached an understanding on the TA's rationale, scope, terms of reference, cost estimates and implementation arrangements with the Government and the concerned agencies. The logical framework is attached as Appendix 1.<sup>1</sup>

## II. BACKGROUND AND RATIONALE

2. Indonesia's population of 210 million is spread over 6,000 inhabited islands. About 60 percent of the nation's population are in Java, a region that has made considerable economic progress. Given the very high population density in Java, it is essential that the income gap between Java and the outer islands be gradually narrowed down. Of population in the outer islands, 23 percent are below the poverty line, as compared to 19 percent on Java. Of the 15 outer island provinces, 8 have more than 25 percent of their population living below the poverty line. The electrification ratio in the outer islands is also lower than in Java. By the end of 1999, the village electrification ratio was about 97 percent in Java, compared with 74 percent in the outer islands; PLN's consumer electrification ratio was about 61 percent in Java, compared with 37 percent in the outer islands. About 9,340 villages in the outer islands are yet to be connected to the power grid, compared to 600 in Java. Overall, the power supply system is inadequate in the outer islands, resulting in restricted operating hours and poor quality of supply, which makes delivery of basic needs such as pumped water, health care, and education difficult.

3. The Government's current poverty reduction strategy is focused on economic recovery, sustained growth, social service delivery, and regional development. Electricity services for productive uses promote economic recovery and sustained growth. To reduce imbalance and stimulate the regional economic growth, the Law on Regional Autonomy (number 22, dated 7 May 1999) provides for a greater role for local governments in development planning, including provision of electricity, if needed. Establishing reliable and efficient power facilities in the outer islands is an integral part of this strategy.

4. OIE needs to be pursued by the Government to promote social, environmental, and regional development. Introduction of electricity has a distinct impact on the quality of life for the poor. Improved lighting extends the hours for work, education, and recreation. Outdoor illumination livens communities and contributes to improved security. Reduced indoor air pollution from the displacement of kerosene lamp helps reduce the incidence of respiratory problems, with women and children being the greatest beneficiaries. Direct benefits also include increased economic opportunities, easier establishment and higher productivity of businesses, creation of employment in infrastructure service delivery, and increased individual productivity. The change to electricity allows the use of productive technologies and thereby induces structural transformation processes in rural development and catalyzes such development. A pilot rural business service<sup>2</sup> scheme in promoting productive uses of electricity in Indonesia for 84,796 preliminary business clients had the following results: 63,386 successfully used electrical equipment for productive use, 9,605 became new customers of PLN, and 16,730 new jobs were created, of which about half were full time.

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<sup>1</sup> The TA first appeared in *ADB Business Opportunities* (Internet Edition) on 30 March 2000.

<sup>2</sup> The pilot scheme was implemented by PLN under a World Bank-funded rural electrification project (1995).



5. At present, OIE is carried out mainly by PLN. In addition, three rural electric cooperatives (KLPs) function as vertically integrated utilities independent of PLN (in Lampung, South Sumatra; Luwu, South Sulawesi; and Lombok island) but they are not in a sound financial condition. Beside PLN and the KLPs, over 17,000 privately owned and unlicensed microenterprises in rural areas sell electricity to a few households (typically 5-25), usually employing a small diesel generator (1-5 kilovolt-ampere). Such arrangements, availed by well-off households, are temporary solutions until PLN supply becomes available in the area.

6. PLN is confronted with diverse operational features in Java-Bali and the outer islands. The cost of electricity supply in the outer islands is higher than in Java-Bali and each new household connection in the outer islands exerts financial pressure on PLN. This has led to lower priority being accorded to OIE. As a result, 9 of 11 regions in the outer islands are experiencing power shortages, especially in the smaller isolated systems. Based on a modest demand growth forecast, all 11 regions are expected to suffer from power shortages by 2003. To address this situation, PLN has created strategic business units (SBUs) and is empowering them to directly manage customer service including that in the outer islands. The SBUs will eventually have direct access to the resources required to carry out their mission, and will be able to take the initiative in implementing the policies and actions necessary to accelerate the pace of OIE. In future, the local and regional governments, under the Law on Regional Autonomy, may seek a larger role in provision of electricity services. This will be facilitated by the planned establishment of a new public sector Regional Electrification Company (REC), which will be entrusted with developing and managing power supply in the outer islands.

7. Since the country has uniform consumer tariffs for all regions, PLN's revenue in Java has been cross-subsidizing operations outside Java. Recognizing the higher cost of OIE, a new tariff strategy needs to be formulated. Tariffs for OIE need to be rationalized to meet the higher cost of power supply, both for grid supply and off-grid supply situations. Also, in view of the likely institutional changes, a new transfer mechanism may be required if cross-subsidy is to be continued. To help achieve these objectives, the outer islands will require a development strategy and an investment plan, which should include extending and upgrading electricity supply to new consumers, supporting delivery of basic needs like pumped water supply, health, and education; and improving opportunities for increasing household income.

8. In August 1988, the Government announced its policy to restructure the power sector and establish a competitive electricity market in Java-Bali. The generation and distribution companies in Java-Bali will eventually be privatized. Based on an intensive policy dialogue, ADB is supporting the power sector restructuring program through a program loan and a capacity building TA loan.<sup>3</sup> To provide a legal framework for the restructuring, the Government will introduce to the Parliament in 2000 a new electricity law. The restructuring will eventually increase private sector participation and improve regulation of the power sector. PLN's generation, transmission, and distribution businesses in Java-Bali will be vertically unbundled to create several buyers and sellers in the market. A regulatory body will be established to oversee the competitive market. The power sector outside Java-Bali will remain government-controlled for some time, as returns on investment are not likely to attract the private sector in the near term. As part of the unbundling, the REC will be created. The Law on Regional Autonomy, which is to be implemented in May 2001, will devolve more powers for economic development to regional governments. New organizations with joint or regional government ownership may

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<sup>3</sup> Loan 1673-INO: *Power Sector Restructuring Program*, for \$ 380 million and Loan 1674-INO: *Capacity Building for Establishment of a Competitive Electricity Market*, for \$20 million, both approved on 23 March 1999.

be established to extend energy services within provinces. The institutional capacity of such organizations will have to be developed to ensure that investment projects are properly designed and implemented. Focus and ownership will improve after the power sector in the outer islands is developed through the REC and other organizations that may be created by regional and local governments. Improved power supply, particularly in the rural regions of the outer islands, will also help manage the deforestation problem by reducing the use of firewood.

9. The Government's current emphasis on outer island development and electrification is supported by ADB to (i) ensure pro-poor sustainable economic growth, and increase the access to modern forms of energy, particularly for the poor; (ii) facilitate the establishment of a framework that makes the sector financially viable; and (iii) promote the development and use of cleaner energy. Indonesia has considerable renewable energy sources such as geothermal, micro and mini hydropower, solar, and biomass, which can be exploited to provide electricity in remote areas.<sup>4</sup> So far, Indonesia's renewable energy experience has remained mainly a demonstration effort and there is a need to develop such sources within the framework of a least-cost outer island electrification strategy. In line with ADB's overarching objective of poverty reduction and ADB's energy sector policy, the TA will emphasize (i) a socially inclusive development strategy for outer island electrification, (ii) environmentally sound renewable energy sources, (iii) improved efficiency of public sector investment and management, (iv) participatory rural appraisal approach, and (v) poverty reduction.

### III. THE TECHNICAL ASSISTANCE

#### A. Objectives

10. The TA will establish a development strategy and investment plan for OIE with special emphasis on extending and upgrading electricity supply to new and poor consumers; supporting delivery of basic needs like pumped water supply, health, and education; improving opportunities for additional household income or productive uses of electricity through rural business service; and using renewable energy sources. The TA will assess the social, institutional, and environmental aspects of OIE, and recommend tariff structures and strategies. It will also identify, carry out a feasibility study for, and develop an OIE project suitable for financing by ADB and other external funding agencies, and assess its long-term sustainability.

#### B. Scope

11. The TA will consist of (i) a full review of the electricity supply in the outer islands; (ii) prioritization of development strategy and investment plans to reduce poverty and yield maximum benefits in terms of social, environmental, economic, and financial returns; and (iii) preparation of a project suitable for financing by ADB and other agencies. The TA will be implemented in two phases.

12. Phase I will (i) review the situation and relevant studies by the Government and other agencies with regard to OIE in Indonesia; (ii) through surveys and other participatory approaches, forecast electricity demand in the outer islands; (iii) formulate a long-term power development strategy and least-cost option to meet the assessed demand, that will maximize economic, social, and poverty impact; and (iv) in close consultation with stakeholders, formulate

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<sup>4</sup> The estimated potential for micro and mini hydro, geothermal and biomass are about 16,000 megawatt (MW), 500 MW, and 50,000 MW respectively, while installed capacity by 1996 was only 312 MW, 21 MW, and 178 MW.

a realistic five-year investment plan for extension of electricity supply through expansion or upgrading of existing power systems and construction of new systems.

13. Based on the results of phase I, phase II will develop an OIE project suitable for ADB financing. Phase II will (i) identify the highest priority components of the project for ADB financing in terms of poverty impacts and environmental benefits; (ii) prepare a feasibility-level design for the project, including scope, components, cost estimates, implementation arrangements, and operation and maintenance procedures; (iii) undertake a detailed socioeconomic survey, initial environmental examination, and financial and economic evaluation of the project; assess the implementation capacity and future operation and maintenance capacity; and propose institutional improvements suitable to ensure efficient implementation of the project; (iv) provide inputs for developing regulatory frameworks including the possibility of introducing a nonuniform tariff structure; and (v) recommend sustainable measures to be adopted to ensure that the poor can avail of electricity services.

14. The study will take into account ADB's policies on poverty reduction, energy, private sector development, environment, social dimensions, participatory development process, good governance, and anticorruption. The outline terms of reference for consultants is in Appendix 2.

#### **C. Cost Estimates and Financing Plan**

15. The total cost of the TA is estimated at \$1.15 million equivalent, consisting of \$710,000 in foreign exchange costs and \$440,000 equivalent in local currency cost. The Government has requested ADB to finance \$800,000 equivalent, covering the entire foreign exchange cost and \$90,000 equivalent of the local cost. The TA will be financed by ADB initially as a grant from the ADB-funded TA Program, with a provision for recovering the portion exceeding \$250,000 in the event that the TA results in a loan from ADB. The Government and PLN will finance the remaining local currency cost of \$350,000 equivalent. The detailed cost estimates and financing plan are shown in Appendix 3. The Government has been advised that ADB's approval of the TA does not commit ADB to finance any ensuing program or project.

#### **D. Implementation Arrangements**

16. PLN will be the Executing Agency for the TA. Within PLN's headquarters, the task force responsible for coordinating the activities of all SBUs for the outer islands will be directly associated with the study. The person in charge of the task force will be responsible for overall coordination among ADB, the Government, the consultants, and other government and nongovernment agencies. Suitable SBU counterpart staff will be appointed on a full-time basis, to participate in the day-to-day activities of the TA. A project steering committee, chaired by PLN's Director for Operations, will be established and will include representatives from Ministry of Finance, National Development Planning Agency (BAPPENAS), Ministry of State-owned Enterprises, Directorate General for Electricity and Energy Development, and PLN. The steering committee will supervise and monitor the output of the TA and will meet at every second month. A representative from ADB's Indonesia Resident Mission will be included in the steering committee and will convene the steering committee meetings. The Government has agreed to provide all available relevant information and facilitate collection of socioeconomic data. The Government will also help ensure adequate cooperation from local government bodies and nongovernment organizations active in the project area.

17. ADB will engage international and domestic consultants according to its *Guidelines on the Use of Consultants* and other arrangements satisfactory to ADB on the engagement of domestic consultants. Since the tasks to be carried out by consultants are specifically stated in the terms of reference and the methodology is well defined, ADB's simplified technical proposals for consultant selection will be adopted. The international consultants will have expertise in (i) power system planning, design, construction, and operations; (ii) power utility organization; (iii) renewable energy sources and rural electrification; (iv) power system financial and economic analysis; (v) poverty impact assessment; and (vi) environmental, regulatory, and social analysis. The domestic consultants will have expertise in (i) power economics, (ii) renewable energy, and (iii) socioeconomic analysis. About 43 person-months of consulting services will be required: 25 for international and 18 for domestic consultants.

18. The PLN's task force comprising specialists in relevant areas will assist the consultants in carrying out the study in a timely manner. SBUs will be responsible for conducting the countrywide surveys based on methodology and questionnaires prepared by the consultants. PLN will provide office space, local transport, and communication facilities, other administrative support (including secretarial and translation services), and arrangements for consultant travel outside Jakarta. Office equipment financed under the TA will be procured by international consultants in accordance with ADB's *Guidelines for Procurement*.

19. The TA is to commence in October 2000. Within two weeks after commencement, the consultants will submit an inception report detailing initial findings and a refined action plan for conducting the study. A phase I report will be submitted within two months from commencement of the TA, and will set forth the findings of phase I and make recommendations for the direction of work for phase II. Within two weeks of the receipt of the phase I report, the Government (including PLN) and ADB will convene the first tripartite meeting in Jakarta to review the report. Within two months of this first tripartite meeting (or about five months from the commencement of the TA), the consultants will submit a draft final report covering phases I and II. The Government/PLN, ADB, and the consultants will discuss the draft final report within two weeks of its submission at a second tripartite meeting. Based on these discussions, the consultants will finalize and submit the final report within one month. Based on this schedule, the TA will be completed within seven months of start of the assignment.

20. Upon completion of the TA, the Government (including PLN) will communicate to ADB in writing its responses to the recommendations of the TA.

#### IV. THE PRESIDENT'S DECISION

21. The President, acting under the authority delegated by the Board, has approved the provision of technical assistance to the Government of the Republic of Indonesia in an amount not exceeding the equivalent of \$800,000 for the purpose of preparing the Outer Island Electrification Project, and hereby reports such action to the Board. This technical assistance will be financed initially as a grant, but will be subject to the reimbursement arrangements set forth in the Board papers on *Technical Assistance Operations* (Doc. R51-77, dated May 1977) and *Streamlining of Technical Assistance Operations* (Doc. R44-88, dated 21 March 1988), including the provision that, in the event of the technical assistance resulting in a loan from ADB, ADB may charge against such loan, and recover from it, the portion of the initial grant that exceeds \$250,000 equivalent.

## TECHNICAL ASSISTANCE FRAMEWORK

Design Summary	Performance Indicators/Targets	Monitoring Mechanisms	Assumptions and Risks
<p><b>Goal</b></p> <p>To accelerate sustainable economic development and poverty reduction in the outer islands through upgrading power supply systems and increased use of renewable energy resources.</p>	<ul style="list-style-type: none"> <li>• Increased electrification ratio and improved quality of electricity supply in the outer islands</li> <li>• Improved delivery of basic needs like pumped water, health care, and education</li> <li>• Incidence of poverty reduced in outer islands</li> <li>• Use of renewable energy expanded</li> </ul>	<ul style="list-style-type: none"> <li>• Annual national statistics</li> <li>• Sector reviews</li> <li>• Annual report of regional electricity company</li> </ul>	<ul style="list-style-type: none"> <li>• Government's will and commitment</li> <li>• Availability of funds for implementing basic need projects</li> <li>• New electricity law enacted and regional electricity company created</li> </ul>
<p><b>Purpose</b></p> <p>Establish appropriate development strategies for outer island electrification and formulate a project for possible financing by the Asian Development Bank (ADB).</p>	<ul style="list-style-type: none"> <li>• Formulation of a socially inclusive development strategy for efficient supply and operation of power supply in outer islands</li> <li>• Recommend policy, institutional measures, and tariff strategies suitable for outer island electrification</li> <li>• Sustainable outer island electrification by using renewable energy sources</li> </ul>	<ul style="list-style-type: none"> <li>• ADB missions</li> <li>• Review of progress reports</li> <li>• Tripartite meetings</li> </ul>	<ul style="list-style-type: none"> <li>• Inadequate information and human resources with appropriate skill mix</li> <li>• Difficulties resulting from the country's dispersed geographic characteristics</li> <li>• Inaccessibility of certain regions because of civil disorder</li> </ul>
<p><b>Outputs</b></p> <ul style="list-style-type: none"> <li>• General conclusion on the current state of power supply systems in outer islands</li> <li>• A perspective expansion program for power supply in outer islands</li> <li>• An investment plan for a five-year period</li> <li>• Recommendations to increase impact of electrification on the poor</li> <li>• Preparation of an outer islands electrification project according to ADB guidelines</li> </ul>	<ul style="list-style-type: none"> <li>• Inception report within two weeks after the commencement of the technical assistance (TA)</li> <li>• Phase I report within two months of TA commencement</li> <li>• Draft final report within five months of TA commencement</li> <li>• Final report within seven months of TA commencement</li> </ul>	<ul style="list-style-type: none"> <li>• ADB missions</li> <li>• Tripartite meetings</li> <li>• TA final report</li> </ul>	<ul style="list-style-type: none"> <li>• Good coordination among key parties</li> <li>• Dialogue with civil society and Project beneficiaries</li> <li>• Availability and reliability of necessary data and statistics</li> <li>• Weak performance of consultants</li> </ul>

(Reference in text: page 1, para. 1)

Design Summary	Performance Indicators/Targets	Monitoring Mechanisms	Assumptions and Risks
<p><b>Activities</b></p> <ul style="list-style-type: none"> <li>• Gather and review all relevant statistics, studies, laws, and regulations</li> <li>• Analysis of power demand growth and options for expansion</li> <li>• Examining policy options for increasing use of renewable energy</li> <li>• Examining obstacles that prevent the poor from using electricity and options for the poor to use electricity for income generation</li> <li>• Analysis of poverty impacts and environmental benefits</li> <li>• Economic and financial evaluation of the Project</li> <li>• Consultation and preparation of various reports</li> </ul>	<p><b>Inputs</b></p> <ul style="list-style-type: none"> <li>• 25 person-months of international and 18 person-months of local consultants will be financed</li> <li>• Counterpart financing and services</li> </ul>	<ul style="list-style-type: none"> <li>• ADB missions</li> <li>• Tripartite meetings</li> <li>• Review of progress reports</li> <li>• TA final report</li> </ul>	<ul style="list-style-type: none"> <li>• Availability of data and information</li> <li>• Willingness of government agencies and cooperation of local communities</li> </ul>

## OUTLINE TERMS OF REFERENCE FOR CONSULTANTS

### A. Phase I

1. The consultants will perform tasks in the general review, development of a program for the outer islands' electrification, and formulation of an investment plan for the electrification:
2. For the general review, the consultants will
  - (i) gather and review all available relevant statistics, including population, demographics, income, poverty, and other information about the characteristics of the outer islands in Indonesia;
  - (ii) review all currently available and ongoing studies related to outer island electrification, including studies on electrification with diesel and renewable energy as appropriate for applying in outer islands; and<sup>1</sup>
  - (iii) review the Government's development policies and investment plans prepared and/or implemented for outer island electrification and renewable energy.
3. To develop a program for outer islands electrification, the consultants will
  - (i) present a concise and clear picture of outer island electrification in Indonesia, with particular attention to electrification ratio and use of fuels, regulatory framework, and institutional arrangements;
  - (ii) conduct socioeconomic surveys to collect and compile data required for developing an outer island electrification strategy,<sup>2</sup> and identify major policy issues and constraints impeding the development and efficient operation of power supply in outer islands;
  - (iii) develop electricity demand forecasts and prepare a 15 year perspective plan for outer island electrification; assess quantitatively and qualitatively the impact of providing electricity to outer islands in terms of ability and willingness to pay for the energy consumed, reduction in poverty, improvement in health and education services, improvement in the status of women, and environmental benefits;
  - (iv) identify (a) the least-cost option for meeting the projected demand including the use of renewable energy forms for increasing supply and associated

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<sup>1</sup> Ministries and institutions in Indonesia that share the responsibility of development of rural electrification and use of renewable resources include the Agency for Application and Assessment of Technologies (BPPT), National Economic Development Agency (BAPPENAS), Directorate General of Electricity and Energy Development (formerly Directorate General of Electric Power and New Energy), Institute for Aeronautics and Space (LAPAN- for wind), Ministry of Cooperatives and Small Enterprise Development, Ministry of Public Works (hydropower), and Perusahaan Listrik Negara (PLN). A large number of agencies have provided support for studies and projects in these areas, including the Australian Agency for International Development, E-7, Dutch and Swiss governments, German Agency for Technical Assistance, Japan International Cooperation Agency, United States Agency for International Development, and the World Bank.

<sup>2</sup> The consultants will design the survey including the questionnaire and carry out the analysis. The responsibility for distributing the questionnaire and collecting the filled forms from the sample population will be that of PLN

(Reference in text: page 4, para. 14)

transmission and distribution networks, and (b) opportunities for improving supply-side efficiencies and energy conservation that form part of the least-cost plan;

- (v) estimate the public and private sector investments likely to occur and determine the financing gap to meet the increasing electricity demand in outer islands in next 10 years;
- (vi) draw up an economically feasible power supply expansion program (generation, transmission, and distribution) to be implemented over a 10 year period; and
- (vii) in accordance with the Poverty Reduction Strategy of the Asian Development Bank (ADB), demonstrate qualitatively and quantitatively how the program will help Indonesia achieve socially inclusive development in terms of pro-poor growth, social development, and good governance.

4. To formulate a medium-term investment plan for outer island electrification using the following approach, the consultants will do the following

- (i) in consultation with the Government, select a representative sample of islands that can derive maximum benefit from electrification, expansion, or upgrading of power supply in the next five years based on the expansion program under para. 3(vi); the islands should have a reasonable geographic balance and spread within the country;
- (ii) carry out two feasibility studies;
- (iii) in the first study, focus on extension of electricity supply to the agreed sample of islands through expansion or upgrading of existing systems and construction of new systems; develop outline projects for extension of supply in each sample island to meet the existing loads and load growth; prepare basic cost estimates and estimate the economic and financial internal rates of return of each individual project in accordance with ADB's guidelines, and quantify, where possible, economic and social indicators described in para. 3(iii);
- (iv) in the second study, assess the market potential for commercially proven renewable energy technologies such as photovoltaic, wind, biomass, and micro-and mini-hydropower systems (up to 350 kilovolt-ampere [kVA] and 350–5000 kVA, respectively) to augment power generation capacity in the agreed sample islands;
- (v) ensure that in carrying out the studies above, the opinion of key stakeholders (consumer groups, government staff, electricity producers, and nongovernment organizations) is reflected, particularly, to make certain that poor and vulnerable consumers benefit from the Project.
- (vi) assess the opportunities for demand-side management in the sample islands, describe current energy conservation measures, review the institutional arrangements for energy conservation, outline the scope of potential new demand-side management projects, and prepare cost estimates;



- (vii) examine the impediments that poor people face in availing of power supply (e.g., connection charges and house wiring) and income generation (e.g., initial credit for purchase of implements);
- (viii) based on the studies for a sample of islands, formulate an economically and financially feasible investment plan for the Perusahaan Listrik Negara (PLN) over a five-year period, and recommend elements and components of this investment plan that could form the Project for ADB financing.

**B. Phase II**

- 5. The consultants will prepare a complete feasibility study for the Project.
- 6. For the engineering and planning aspects, the consultants will
  - (i) confirm the least-cost generation expansion plans for each island in the Project, including an analysis of (stand-alone) renewable energy alternatives;
  - (ii) provide technical justifications for the Project and necessary technical specifications for each component, taking into account existing safety and quality standards and selection criteria for proposed islands;
  - (iii) prepare detailed cost estimates for the Project and present the cost estimates in ADB format using the COSTAB model;
  - (iv) outline the Project implementation and procurement arrangements including contract packaging and the Project implementation schedule;
  - (v) outline the financing requirements of the Project and identify possible sources of financing including opportunities for commercial, export credit, and official cofinancing, as well as the possibility of future private sector participation; and
  - (vi) assess the likely technical risks facing various aspects of the Project and carry out a sensitivity analysis to check the viability of the Project under these risks.
- 7. For the economic and financial analysis, the consultants will
  - (i) carry out an economic analysis based on ADB's *Guidelines for Economic Analysis of Projects*; specifically including power demand analysis, least cost and equalizing discount rate analysis, poverty impact analysis, economic viability analysis, and risk analysis;
  - (ii) incorporate into the economic analysis an economic quantification of environmental impact due to the Project following ADB's *Environmental Guidelines for Selected Industrial and power Development Projects and Environmental Assessment Requirements and Environmental Review Procedures and Economic Valuation of Environmental Impacts: a Workbook, 1996*; and discuss clearly and present the assumptions and methodology.

- (iii) incorporate into the economic analysis an assessment of pro-poor impact of the Project in terms of ADB's poverty reduction strategy, taking into account outer island electrification and other linkage effects;
  - (iv) perform a comprehensive and detailed financial analysis of the Project based on ADB's *Guidelines for Preparation and Presentation of Financial Analysis*; include an analysis of cost recovery, willingness to pay, affordability, and subsidy;
  - (v) prepare a financing plan for the Project using COSTAB; identify the sources and options for mobilizing financial resources for implementing PLN's short-term investment plan developed in phase I and specifically the Project;
  - (vi) estimate future tariff increases needed for PLN to generate satisfactory financial performance indicators and ensure financial viability of the Project; and
  - (vii) assess the likely financial uncertainties and risks facing the Project, carry out sensitivity analysis, and develop measures to mitigate the risks identified and propose a suitable risk management program.
8. For the tariff analysis, the consultants will
- (i) review and describe the current tariff structure and end-consumer tariff levels in the Project area, and review information available on consumption and expenditure of fuels in rural communities concerned;
  - (ii) based on the long-run marginal cost and the existing end-consumer tariff levels, estimate the economic subsidies in tariff for different consumer categories under consideration; present aggregate amounts of subsidies, and establish the rationale for subsidies and impacts on the power supply;
  - (iii) discuss the impact of existing tariff structure/levels on efficient use of existing power system facilities and private sector participation; evaluate the impact of the possible tariff increase required to meet financial targets of the Project and affordability of that increase to different users; and
  - (iv) recommend an appropriate tariff strategy and subsidy mechanism for outer islands that would make a basic supply of electricity affordable to the poor users.
9. For the environmental, social, and poverty reduction aspects, the consultants will
- (i) prepare an initial environmental examination (IEE) or environmental impact assessment (EIA) for the Project, following ADB's *Environmental Guidelines for Selected Industrial and Power Development Projects and Environmental Assessment Requirements and Environmental review Procedures*;
  - (ii) prepare a summary IEE or EIA following ADB's format prescribed in the *Environmental Assessment Requirements and Environmental review Procedures*; submit the draft summary for review, and incorporate any subsequent comments in completing the summary;
  - (iii) assess the role of women as contributors to and beneficiaries of the project, and the benefits for or adverse impacts on minority nationalities, if any, in accordance

with ADB's *Policy on Indigenous Peoples*; prepare a social analysis in accordance with ADB's *Guidelines for Incorporation of Social Dimensions in ADB Operations*;

- (iv) if significant numbers of Project-affected persons are identified, develop a land acquisition and resettlement plan (LARP) in accordance with the principles set out in ADB's *Policy on Involuntary Resettlement*, ADB's *Handbook on Resettlement: A Guide to Good Practice* and ADB format for presentation of such a plan;
- (v) prepare a summary LARP, submit a draft summary LARP for review, and incorporate any subsequent comments in completing the summary LARP;
- (vi) assess the impact of electrification on incomes, manner of living, and incidence of poverty; assess household income and expenditure patterns, and ability and willingness to pay for electrification; and test the sensitivity to tariff increases necessary to make the Project sustainable;
- (vii) identify the poor to nonpoor ratio of the project beneficiaries, the extent to which project benefits were relevant and important to the poor as compared with the nonpoor, and the likely distribution of the Project benefits among the poor and nonpoor, and ways to ensure the Project is pro-poor;
- (viii) review availability of data for the construction of a semi input-output table that can be used to study direct and indirect benefits to the poor from rural electrification, and construct such a table as a first approximation; and
- (ix) design a community participation/awareness program for the Project to avoid resistance and encourage participation from local communities.

10. Regarding institutional issues, the consultants will

- (i) present the organizational aspects of implementation arrangements for the Project; identify areas that require assistance from international consultants for institutional strengthening; and prepare terms of reference for the consultants, inter alia, full institutional assessment on both institution and Project basis; and
- (ii) in anticipation of the creation of entities that will be spun-off from PLN and be responsible for development and management of the power sector outside Java, identify possible impacts on the Project during the transition period, and recommend necessary measures to mitigate any adverse impacts.

**COST ESTIMATES AND FINANCING PLAN**  
(\$ '000)

<b>Item</b>	<b>Foreign Exchange</b>	<b>Local Currency</b>	<b>Total Cost</b>
<b>A. Asian Development Bank Financing</b>			
1. Consultants			
a. Remuneration and Per Diem			
i. International Consultants	560	0	560
ii. Domestic Consultants	0	72	72
b. International and Local Travel	50	8	58
c. Reports and Communications	14	0	14
2. Equipment	20	0	20
3. Representative for Contract Negotiations	6	0	6
4. Contingencies	60	10	70
<b>Subtotal (A)</b>	<b>710</b>	<b>90</b>	<b>800</b>
<b>B. Government Financing</b>			
1. Office Accommodation and Transport	0	30	30
2. Remuneration and Per Diem of Counterpart Staff	0	60	60
3. Surveys	0	150	150
4. Communications	0	10	10
5. Translation Services Related to Consultants' Reports, Secretarial Support, and Office Suppliers	0	50	50
6. Contingencies	0	50	50
<b>Subtotal (B)</b>	<b>0</b>	<b>350</b>	<b>350</b>
<b>Total</b>	<b>710</b>	<b>440</b>	<b>1,150</b>

Source: Perusahaan Perseroan (Persero) PT Perusahaan Listrik Negara, Staff estimates.

(Reference in text: page 4, para. 15)

## 資料－4 Power Development of PLN-Indonesia

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# Power Development of PLN-Indonesia

## In Brief

### INTRODUCTION

After Indonesia hit by economy crisis that was emerged in the mid 1997, at a slow pace the economy moves for a new equilibrium. A few of macro indicators have showed that recently the country has achieved substantial progress and development in economy and political aspects which are considered as pre-requisite for recovery. The Central Bureau of Statistics of Indonesia also has up-dated the prediction on Indonesia's GDP growth rate, to be in the rate of 3 - 6 % per annum for the next five years.

If focus given to power sector, it is a fact that a substantial electricity sales growth of PLN experienced in 1999 is another key factor that support opinion that the country is in stage for recovery. To anticipate the changes PLN has reviewed its electricity demand forecast in February 2000, and as one of important outcomes, it gives a strong signal that the existing facilities may not be adequate to serve consumers in near terms.

To cope with the high-energy sales growth, PLN needs to provide facility addition in broad manners covering generation, transmission and distribution networks. However, the financial insolvency of PLN due to sharp decreased of its revenue in US dollar terms has made the company potentially unable to implement a new investment program.

This paper summarizes the overview of PLN-Indonesia condition in year 2000 and its planning development perspective for the next 5 years. Brief descriptions also made on efforts in efficiency improvement, implication of under-planning approach and anticipation efforts for power sector restructuring includes preparation for transmission pricing setting.

### CURRENT STAGE

#### ENERGY SALES

For the period of 1999 PLN experienced a substantial energy growth sales, it was 71,3346 GWh, or an increased of 9.3 % on year-to-year. The demand growth revealed almost in all regions and propelled by industry and commercial consumers, followed by residential.

It is however important to notice that under normal circumstances, or before the economy crisis, for over two decades PLN had experienced a consecutive sales growth at the rate of 13-14 % per-annum.

Given the pattern of sales growth rate in the past as depicted in Table-1, two phenomena recorded. Firstly, the up most implication of economic crisis on energy demand was in 1998

that grew only by 1.5 %. Secondly, the relatively high growth rate of energy sales in year 1999 is another additional factor that can support opinion that the Indonesia's economy encompasses and en routes to recovery condition.

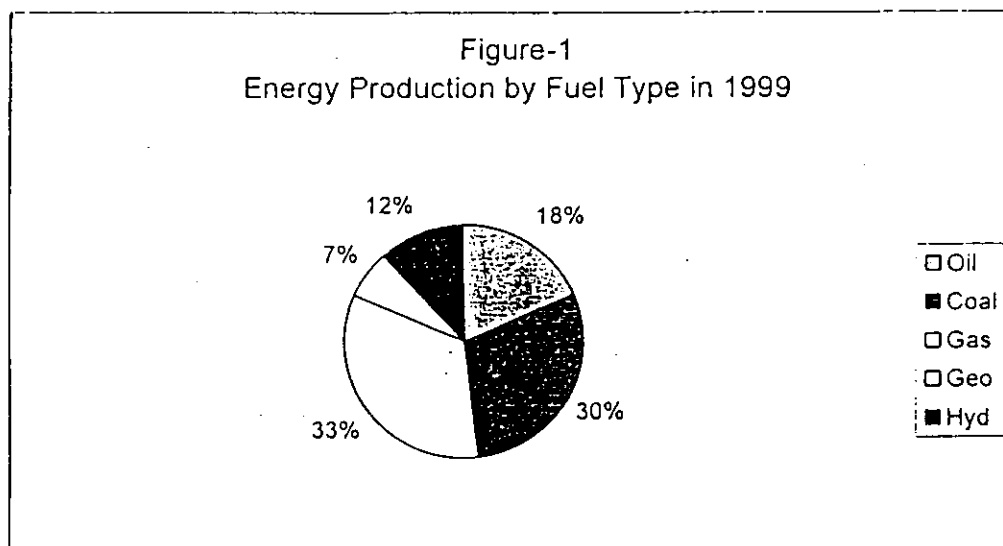
In view of utilization, over 57 % of the electricity is purposed for industry and commercial thus it is justifiable to say that electricity utilization is for highly productive.

Table-1. PLN's Energy Sales

Year	1996	1997	1998	1999
Sales (TWh)	56.9	64.3	65.3	71.3
Growth (%)	14.4	13.0	1.5	9.3

## ENERGY PRODUCTION

Production of PLN in year 1999 is 85,038 GWh including purchased from IPP's of 4,260 GWh. The fuels consumption dominated by natural gas and coal, shared for 63 %, as shown in Figure-1. Volume of fuels consumption in the period composed of: natural gas 230 bcf, coal 11.9 million ton and oil 4.6 million liter.



To optimize energy production cost, power plants in an interconnected system operate following a set of merit order. In the case of Java-Bali system the merit as follows:

- Run off river hydro.
- Must run units thermal power plant (geothermal)
- Generation with minimum TOP contract
- Steam coal power plant.
- Oil-fired plant
- Reservoir hydro

## EXISTING FACILITIES

The generating capacity of PLN installed is 20,592 MW as showed in Table-2, and it comprises variety of plants. As base plant type, there are: coal fired plant, natural gas combined cycle, geothermal and run of river hydro plant; and as medium and peaking plant type there are: gas turbine, oil-fired steam plant, diesel plant and reservoir hydro plant.

Over 75 % of the capacity plant is located in the PLN's largest Java-Bali system, and a substantial portion of renewable energy. The latter is in line with the national energy policy that promotes the non-oil resources to be used for generating plant. The system peak load was over 11 000 MW and the yearly Load Factor was about 72 %. Most of large-scale plants connected through 500 kV grids, and to ease system operation a sophisticated dispatching centers has been installed.

Table-2 Installed Capacity of Generating Plants

Power Plant	Outside Java-Bali	Java-Bali	Total
Hydro	586	2,374	2,960
Combine Cycle			
- Gas Fired	860	3,786	4,646
- Oil Fired	-	1,707	1,707
Steam			
- Gas Fired	-	1,000	1,000
- Oil Fired	310	750	1,060
- Coal	460	4,200	4,660
Geothermal	-	360	360
Gas Turbine	520	1,434	1,954
Diesel	2,153	92	2,245
Total	4,889	15,703	20,592

The condition in Outside Java-Bali is generally quite contrast because of its scatter geography, and most of the plants operate under isolated system that constitute of small diesel. Due to these conditions, couple with reality that consumers in the scatter islands are predominantly residential that having low load factor has made plants in isolated system generally operate at relatively low efficiency. Exception given to condition in big islands such as: Sumatra, Sulawesi and part of Kalimantan that are undertaking transformation from isolated to robust interconnected systems.

The existing transmission line and substation generally consist of three tiers, i.e.: 500kV or 275 kV as inter-regional link, 150kV and 70kV as regional link. While distribution facilities are generally consist of two tiers, i.e.: 20 or 12 kV as medium voltage network, and 380/220 volts as low voltage network. Resume of network facilities showed in Table-3.



Table-3 Transmission Lines, Substation and Distribution \*)

Description	Existing Facilities	
	Java Bali	Outside Java
Transmission		
- 70 kV (kmc)	4,019	953
- 150 kV (kmc)	10,337	5,605
- 275 kV (kmc)	-	-
- 500 kV (kmc)	2,665	-
Substation		
- 70 kV (MVA)	3,302	768
- 150 kV (MVA)	23,776	4,218
- 275 kV (MVA)	-	80
- 500 kV (MVA)	13,000	-
Distribution		
- MV lines (kmc)	94,547	103,871
- LV lines (kmc)	149,862	111,064
- Dist. Transf. (MVA)	18,052	6,558
- No. of Cons. (106)	18.8	8.7

\*) Data based on 1998

## FINANCIAL ASPECTS

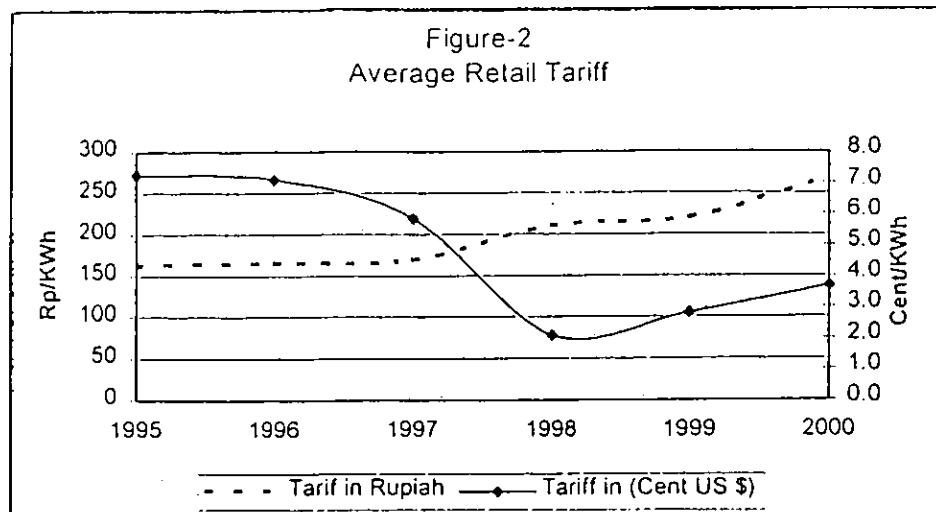
### FINANCIAL AND TARIFF

The financial crisis which was started in 1997 has made PLN become insolvent. Its profitability, liquidity, and equity have continued to deteriorate. This has happened mainly because most of PLN's expenses (about 70 %) are in foreign currencies, while the retail tariff level that is denominated in rupiah is almost constant since 1994. PLN's current average tariff (about 3 US cents/kwh) is among the lowest in the world. Figure-2 exhibits how the average retail tariff deteriorated if valued in US \$, in spite of the absolute retail tariff increased in rupiah imposed to consumers in the past few years.

Gradual tariff increase to bring electricity back into its economic value, along with efficiency improvement are two efforts need to pursue for achieving a healthy corporate financial condition.

It is understood that the government intends to implement gradual tariff increases, paying special attention to: (a) affordability of tariffs; (b) targeted protection of small residential consumers; and (c) PLN's competitiveness with alternative energy supply, most notably self-generation by industrial users. Based on GOI's recent agreement with the IMF on rationalization of energy prices, PLN's average tariff is expected to be increased by about 30 % in April 2000, with small consumers not subjected to any tariff increase.

After having comprehensive and long discussions with the stock-holders and the special commission of parliament, eventually GOI has agreed to raise the average retail tariff by 29 % beginning in April 2000.



### GOVERNMENT SUBSIDY

As a trade-off to tariff hike, GOI made record high levels of support to PLN over the past two years. However, such massive drain on the GOI resources is not sustainable over the longer run. Thus rationalization of tariffs is one of the important factors in restoring the sustainability of the electricity sectors. This would, in turn encourage energy conservation by consumers and free up government funds to provide more targeted, direct support to protect the poor.

As part of its national policy, the government envisages to continue to provide regional subsidies and special electricity rates to the poor. However, it intends to make these subsidies explicit and transparent, through the establishment of a social electricity development fund to finance these subsidies.

### POWER SECTOR RESTRUCTURING

Over the short to medium term, PLN is faced with challenge to cope with a difficult period of transition, within the context of a highly uncertain operating environment that is beyond the control of the company. With a view to restoring the financial sustainability of the sector, GOI publicly launched a power sector restructuring policy in August 1998. International consultants are being procured and expected to be mobilized in the next few months to assist GOI/PLN in the implementation of the corporate and financial restructuring of PLN.

Within the context of GOI's restructuring policy, various remedial measures have recently been initiated by GOI/PLN to put the company on the road to financial recovery, including: (a) expenditure reduction and efficiency enhancement; (b) tariff rationalization; (c) rationalization of IPP contracts; and (d) debt relief.

## SYSTEM EXPANSION PLAN

### DEMAND FORECASTING

It is admitted that doing a forecast for the future is always an interesting subject arguable because it contains uncertainties. Varieties of models and approaches have been developed and practiced in many utilities. PLN adopts a forecasting system, which is based on formulation, that driven by three key factors, i.e.: GDP growth rate, level of electrification ratio and efforts on captive taking over.

To understand the PLN's forecasting concept it's important to notice that until today only about 52 % of the population that have enjoyed electricity, and a part of industries prefer and have invested their own generation plants off the PLN's grids. These captive powers have significant capacity, estimated about 10,000 MW with a growth-rate of 10% per annum.

Recently The Central Bureau of Statistics of Indonesia has up-dated the prediction on Indonesia's GDP growth rate, to be in the rate of 3 - 6 % per annum for the next five years. Based on this macro economic prediction, PLN has conducted an energy demand forecast in February 2000, the result showed in Table-4. Salient information obtained from the forecasting includes: (i) the potential sales volume for whole Indonesia will be 111 TWh in year 2005, (ii) the average growth-rate 7.7 % per annum, (iii) the peak load of Jawa-Bali system is expected to be over 16,000 MW in year 2005.

Table-4 Demand Forecast

Description	2000	2001	2002	2003	2004	2005
Java Bali						
- Sales (TWh)	61.1	65.2	69.7	74.6	79.8	85.5
- Growth (%)	6.4	6.8	6.9	7.0	7.0	7.1
- Peak Demand (MW)	11,704	12,469	13,295	14,188	15,149	16,178
- No. of Customers (106)	19.2	19.7	20.4	21.2	22.2	23.1
Outside Java						
- Sales (TWh)	14.9	16.3	17.8	20.0	22.6	25.6
- Growth (%)	7.4	8.9	9.3	12.7	12.9	13.1
- Peak Demand (MW)	3,524	3,829	4,174	4,692	5,285	5,960
- No. of Customers (106)	9.2	9.6	10.2	10.9	11.7	12.6

### GENERATION EXPANSION

Generation expansion plan formulated based on reserve criteria. An adequate generation reserve should be provided to anticipate the outages, due to force outage or planned outage that required for maintenance, and to ensure services at an acceptable and desired degree of reliability.

The reliability criteria used in Java Bali generation expansion plan is equivalent to 1 day/year of loss of load probability (LOLP), and 4 days/year in outside Java. In some isolated and small systems in the remote places, a more simple deterministic approach is used.

According to PLN' plan, generation expansion capacity of 4653 MW is required between year 2000-2005 (see the detailed in Table-5).

The plan also foresees in short-term PLN to face a potential of power imbalance due to high growth demand in Java-Bali system. IPP's that are on the pipelines, comprises of 3770 MW of coal fired and 240 MW of geothermal, are option to fill-up the gap attributed to short-term power imbalance. However it is still subject to renegotiation results that being conducted between IPP's and PLN. In addition, medium-term capacity plant-up for peaking plants which equivalent to 12 x 120 MW (approximated by open-cycle gas turbine) is still required.

The systems in Outside Java-Bali partially are facing supply constraint. No quick yields over the on-going power plant projects can be expected as remedy to short-term power imbalance. Deterioration of services and system reliability assumes unavoidable unless significant capacity added. The capacity addition in the regions is 3,250 MW.

Overall, the estimate investment of PLN yearly needed for those generation additions is in the average of US \$ 455 Million excluding IPP's.

Table-5 Generation Capacity Addition Until Year 2005\*

Power Plants	Additional Capacity	
Hydro	796	16 %
Steam Coal	315	7 %
Geothermal	55	1 %
Combine Cycle	0	0 %
Gas Turbine	3,258	71 %
Diesel	229	5 %
Total	4,653	100 %

\* Excludes IPP

## TRANSMISSION EXPANSION

The operational of EHV 500kV in Java-Bali System and 275kV in Sumatra, is especially developed for: (a) as backbone of the system and supplying to HV grid; (b) as the associate lines from large scale power plant; (c) retaining system stability. While the HV network, mainly 150 kV, is developed for: (i) as the associate lines from medium scale power plant; (ii) as the supply lines to load centers within region.

The reliability criterion (N-1) adopts in designing EHV and HV lines, and the line addition plan showed in Table-6.

Table-6 Transmission Expansion Plan.

Description	Additional Plan	
	Java Bali	Outside Java
Transmission		
- 70 kV (kmc)	-	-
- 150 kV (kmc)	366	4,317
- 275 kV (kmc)	-	1,004
- 500 kV (kmc)	1,250	-
Substation		
- 70 kV (MVA)	-	-
- 150 kV (MVA)	4,580	1,150
- 275 kV (MVA)	-	-
- 500 kV (MVA)	6,000	-

## 500 kV Java Bali

The 500 kV transmission line plays role as backbone for inter-region transferring power. It is stretched from Suralaya SCPP in the west to Paiton SCPP in the east through northern route. All of line sections is double circuit line and designed with Quadra poles that having capacity equivalent to about 1800 MVA per-circuit.

To anticipate the expansion of generation plants and load centers, a new 500 kV lines stretched from east to west parts of the island through southern route, together with 4 new substations, is being constructed. The total length of these new lines is almost 1,000 km to be completed in stages, few of sections schedule to operate this year and the last stage will be in year 2002.

When the on-going 500 kV project operated couples with the existing EHV lines, this is a modality to establish a bidding system for power generation as directed in GOI's power sector restructuring program.

## 275 kV Development

Due to its geography and load density in Sumatra Island, PLN has decided to establish 275 kV as its long-term grid's backbone. A few 275 kV lines are being constructed in Sumatra, but at the early stage they are operated as 150 kV level. Generally the 275 kV network is developed as interconnection lines between regions.

Nowadays transmission system in Sumatra consists of three main 150 kV networks, i.e.: northern region, central region and southern region. The interconnection lines between central (Kiliran Jao S/S) and southern region (Lubuk Linggau S/S) scheduled operational in this year. While northern to central regions interconnection will implement at the latter stage due economy and financial consideration.

## Transmission Pricing

One of the important tasks in Java Bali's sector reform is to develop a comprehensive transmission-pricing framework. The transmission-pricing framework will enable the transmission company to set transmission service charges for various transmission services it provides. The methodology to apply in Java Bali system must able to provide price signals to promote efficient operation and expansion of transmission system, and offer a reasonable rate of return for investment in the transmission system.

In general, the framework classifies all the transmission services provided by transmission company into four categories: (i) entry connection service, (ii) exit connection service, (3) transmission use of system service (TUOS), (iv) common service. For each category of service, specific pricing method is recommended.

Currently an extensive review on combining the postage stamp and MW-Kilometer method is pursued. Dividing postage stamp into regional is a setting to accommodate each province specific endowment. Whilst MW-Km charge to use homogeneously in the entire EHV network.

## DISTRIBUTION EXPANSION

A view of main objectives on distribution expansion plan, includes: (i) provide sufficient capacity of distribution network in line with marketing programs, (ii) new customer connection, (iii) reduce distribution technical losses, (iv) maintain service quality and reliability.

By using statistic, to derive correlative models, the physical requirements for long-range expansion plan can be estimated. Some of indices commonly use to facilitate distribution

planning are, i.e.: utilization of MV and LV networks measured in kmc/100 MWh sales, utilization of distribution transformers in kVA/100 MWh, etc.

A particular case for Java-Bali system, the distribution development plan in the area can be addressed for both extensification and intensification. However extensification program will require more capital that today's weak economy condition is susceptible to. Considering the present average loading of feeders in Java system is in between 52 – 63 % of nominal capacity, then intensification program is more affordable to implement. The expansion plan of distribution system for period 2000-2005 showed in Table-7.

Table-7 Distribution Physical Requirements.

Description	Additional Plan	
	Java Bali	Outside Java
MV Lines (kmc)	16,967	23,193
LV Lines (kmc)	14,196	17,872
Distribution Transf. (MVA)	2,706	1,786
Consumer connections (unit)	5,794,336	3,945,928

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## 資料－5 要請書

## Digest

Project Title: The Study on the Optimal Electric Power Development and Operation in Indonesia

Sector: Mines and Energy

Sub-sector: Energy

Program: Development of Oil, Coal and Alternative Energy

Location(s): All area of Republic of Indonesia

Duration: 15 months

Executing Agency: Directorate General of Electricity and Energy Development, Ministry of Mines and Energy

### 1. Background and Justification

Economic and currency crisis of 1997 had serious impact on the Republic of Indonesia. Reform is being carried out in various sectors to cope with its effect.

For the electric power industry, "structural reformation in the power generation sector" is necessary for efficient power supply, while "determination of the optimal power development" is necessary for efficient administration of each individual power utility companies.

For the "structural reformation of the power generation sector," Ministry of Mines and Energy is planning to subdivide or convert PLN into private companies in the year 2000, and introduce the principle of competition into the industry thereafter. "Determination of the optimal power development," which forms a basis for these plans, would play an important role in administration of each power utility companies after division, as described below. However, a power development needs to make, since it was laid out before the crisis. Hence, the application for technical cooperation is made in order to establish "the optimal power development" which reflects consequences of the economic and currency crisis.

On the other hand, electric power demand has shown a sharp rise and a lightning peak. This tendency has not changed even after the economic and currency crisis of 1997, and it is anticipated that even sharper rise and a peak in the future would be observed when



economic situations in Indonesia recover.

Hence, it could well be anticipated that the current power supply system is unable to cope efficiently and economically with future changes in the peak demand. Administration of PLN and utility companies after subdivision of PLN may be pressurized due to decrease in the usage of existing PLN power source facilities, increasing payment for non-consumed contracted fuel for thermal power generation, and to increase in the payment to IPPs. This, in turn, may lead to rise in electricity tariff.

As for system safety, now there is practically no facility to compensate for loss of quality in the power supply, such as instantaneous emergency power supply facility in case of disconnection in the power system with power sources, and frequency adjustment facility used during fluctuation of loads. It is anticipated that current power system may lose its balance if demand increases in the future, which may result in problems threatening system safety, such as power failure in the whole system.

Moreover, it goes without saying that the power development planning follows the general energy policy which identifies the strategies for making the best use of abundant domestic energy resources. Therefore, in order to maximize the benefits of the power development planning, it is also of great importance to re-establish the strategic framework of energy planning to reflect current and projected economic conditions.

The effect means implementation of decentralization system in all Indonesian automatically would increase the electric demand in a certain area/province. In the circumstances, the GOI has issued the law 22/1999 and 25/1999.

## 2. Objectives

The project aims at a proposal for optimal power plan and power transmitting line, in order to improve situations of generating costs, stability of supply, poverty, the environmental preservation.

Also the project aims at a proposal for technical and systematical conditions to implement the optimal power and transmitting plan.

In the process of making the proposal for the optimal power and transmitting plan, the plan will be proposed on simulation studies depending on available energy volume for electric power sector, electricity demand forecast, and data existing and planned power sources.

## 3. Activities

In order to achieve the objective of the project describe above, the project will be execute the following. Those are (A) Studies for available energy volume for electric power sector,

(B) Proposal for the optimal power and transmitting plan and (C) Proposal for technical and systematical and legal conditions to implement the optimal power and transmitting plan. As the result, the Government of Indonesia achieves the Optimal Electric Power Development and Operation as follows; i.e. (A) Technical aspect, 1) Rehabilitation plan of existing power sources with low efficiency, 2) Plan of power sources of generating characteristic, distribution of power sources and so on, (B) Legal and systematical aspect, 1) Appraisal prices of electric power corresponding to their characteristics of generation, combination of finance, 2) Combination of finances (including subsidiary), 3) Demand side management and so on, (C) Decentralization aspect  
 (D) Environmental aspect.

#### 4. Cost

##### Project Cost:

##### (1) Project Cost:

a. Foreign Exchange Cost:	USD1,500,000
b. Local Cost:	USD100,000
Total Cost:	USD1,600,000

##### (2) Cost Component:

a. Studies for available energy volume for electric power sector:	USD300,000
b. Proposal for the optimal power and transmitting plan:	USD800,000
c. Proposal for technical and systematical and legal conditions to implement the optimal power and transmitting plan:	USD500,000
Total Cost	USD1,600,000

##### (3) External Assistance Requirement:

a. Grant:	USD1,500,000
b. Soft Loan:	USD0
c. Expert Credits:	USD0
Total EAR USD:	1,500,000

Application for the  
Technical Cooperation (Development Study)  
by the Government of Japan

1. Study digest

(1) Study Title

The Sector Study on the Optimal Electric Power Development and Operation in Indonesia

(2) Location

All area of Republic of Indonesia

(3) Implementing Agency

Directorate General of Electricity and Energy Development, Ministry of Mines and Energy

(4) Justification of Study

Economic and currency crisis of July 1997 had serious impact on the Republic of Indonesia. Reform is being carried out in various sectors to cope with its effect.

For the electric power industry, "structural reformation in the power generation sector" is necessary for efficient power supply, while "determination of the optimal power development" is necessary for efficient administration of each individual power utility companies.

For the "structural reformation of the power generation sector," Ministry of Mines and Energy is planning to subdivide or convert PLN into private companies in the year 2000, and introduce the principle of competition into the industry thereafter. "Determination of the optimal power development," which forms a basis for these plans, would play an important role in administration of each power utility companies after division, as described below. However, a power development needs to make, since it was laid out before the crisis. Hence, the application for technical cooperation is made in order to establish "the optimal power development" which reflects consequences of the economic and currency crisis.

On the other hand, electric power demand has shown a sharp rise and a lightning peak, which appears for four to five hours in the evening due to domestic use. This tendency has not changed even after the economic and currency crisis of 1997, and it is anticipated that even sharper rise and a peak in the future would be observed when

economic situations in Indonesia recover.

Hence, it could well be anticipated that the current power supply system is unable to cope efficiently and economically with future changes in the peak demand. Administration of PLN and utility companies after subdivision of PLN may be pressurized due to decrease in the usage of existing PLN power source facilities, increasing payment for non-consumed contracted fuel for thermal power generation, and to increase in the payment to IPPs. This, in turn, may lead to rise in electricity tariff.

As for system safety of Java-Bali power system, now there is practically no facility to compensate for loss of quality in the power supply, such as instantaneous emergency power supply facility in case of disconnection in the power system with power sources, and frequency adjustment facility used during fluctuation of loads. It is anticipated that current power system may lose its balance if demand increases in the future, which may result in problems threatening system safety, such as power failure in the whole system.

Also, electric power demand for the Sumatra system and the other outer island has shown a sharp rise and a peak. This tendency has not changed even after economic and currency crisis of 1997, and it is anticipated that even sharper rise and peak in future would be observed when economic situations in Indonesia recover.

More over, it goes without saying that the power development planning follows the general energy policy which identifies the strategies for making the best use of abundant domestic energy resources. Therefore, in order to maximize the benefits of the power development planning, it is also of great importance to re-establish the strategic framework of energy planning to reflect current and projected economic conditions.

The effect means implementation of decentralization system in all Indonesian automatically would increase the electric demand in a certain area/province: In the circumstances, the GOI has issued the law 22/1999 and 25/1999.

#### (5) Object of Study

The project aims at a proposal for optimal power plan and power transmitting line, in order to improve situations of generating costs, stability of supply, poverty, the environmental preservation.

Also the project aims at a proposal for technical and systematical conditions to implement the optimal power and transmitting plan.

In the process of making the proposal for the optimal power and transmitting plan, the plan will be proposed on simulation studies depending on available energy volume for

electric power sector, electricity demand forecast, and data existing and planned power sources.

(6) Content of Study

(A) Studies for available energy volume for electric power sector

- 1) Collection of data of present primary energy resources and future prospects.
- 2) Collection of constraints (protecting environment and so on) of using primary energy resources, evaluation of influence of constraints to using the resources and recommendation for introducing new technique to using the sources, if possible.
- 3) Collection of data of primary energy demand forecast.
- 4) Studies on available energy volume for electric power sector, based on the data mentioned in 1)-3).

(B) Proposal for the optimal power and transmitting plan

- 5) Studies on data of electricity demand forecast (including daily load profiles).
- 6) Collection of data from existing power plants (capacity, failure rate, power generation cost, operational data, etc.).
- 7) Collection of data for planned power sources (capacity, failure rate, power generation cost, operational data, etc.).
- 8) Collection of data on both existing and planned transmission system.
- 9) Simulation studies on power demand and supply based on the data mentioned in 4)-8).
- 10) Proposal for the optimal power and transmitting plan

C) Proposal for technical and systematical and legal conditions to implement the optimal power and transmitting plan

11) Technical aspect

- Rehabilitation plan of existing power sources with low efficiency
- Plan of power sources of generating characteristic, distribution of power sources and so on

12) Legal and systematical aspect

- Appraisal prices of electric power corresponding to their characteristics of generation, combination of finance
- Combination of finances (including subsidiary)
- Demand side management and so on

13) Decentralization aspect

14) Environmental aspect

## 2. Facilities and information for the Study

- (1) Assignment of counterpart personnel of the implementing agency for the study  
(number, academic background, etc)

Director of Electric Power Planning

Directorate General of Electricity and Energy Development

Ministry of Mines and Energy

- (2) Available data, information, document, maps etc. related to the Study

- Unit data of thermal, hydro, and geothermal power plants in the study area (capacity, fuel type and price, efficiency, forced outage rate, etc)
- Projected data of power demand and supply

- (3) Information on the security conditions in Study Area

The study area has good security conditions.

## 3. Project Cost, Cost Components and External Assistance Requirement

- (1) Project Cost:

a. Foreign Exchange Cost: USD 1,500,000

b. Local Cost: USD 100,000

Total Cost: USD 1,600,000

- (2) Cost Component:

a. Studies for available energy volume for electric power sector: USD 300,000

b. Proposal for the optimal power and transmitting plan: USD 800,000

c. Proposal for technical and systematical and legal conditions to implement the optimal power and transmitting plan: USD 500,000

Total Cost: USD 1,600,000

- (3) External Assistance Requirement:

a. Grant: USD 1,500,000

b. Soft Loan: USD 0

c. Expert Credits: USD 0

Total EAR USD: 1,500,000

#### 4. Duration of Study

- (1) Studies for available energy volume for electric power sector: 4 months
  - (2) Proposal for the optimal power and transmitting plan: 8 months
  - (3) Proposal for technical and systematical and legal conditions to implement the optimal power and transmitting plan: 3 months
- (1)+(2)+(3) Total 15 months

#### 5. Undertakings of the Government of Republic of Indonesia

In order to facilitate the smooth and efficient conduct of the Study, the Government of Republic of Indonesia shall take necessary measures:

- (1) to secure the safety of the Study team
- (2) to permit the members of the Study Team to enter, leave and sojourn in Republic
- (3) Indonesia in connection with their assignment therein, and exempt them from foreign registration requirements and consular fees
- (4) to exempt the Study Team from taxes, duties and any other charges on equipment, machinery and other materials brought into and out of Republic of Indonesia for the conduct of the Study
- (5) to exempt the Study Team from income tax and charges of any Kind imposed on or in connection with any emoluments or allowance paid to the members of the Study Team for their services in connection with the implementation of the Study
- (6) to provide necessary facilities to the Study team for remittance as well as utilization of the funds introduced in Republic of Indonesia from Japan in connection with the implementation of the Study
- (7) to secure permission for entry into private properties or restricted area for the conduct of the Study
- (8) to secure permission for the Study team to take all data, documents and necessary materials related to the Study out of Republic of Indonesia to Japan
- (9) to provide medical services as needed. Its expenses will be chargeable to member of the Study Team.

6. The Government of Republic of Indonesia shall bear claims, if any arise against member(s) of the Japanese Study Team resulting from, occurring in the course of or otherwise connected with the discharge of their duties in the implementation of the Study, except, when such claims arise from gross negligence or willful misconduct on the part of the member of the Study Team.

7. Japan International Cooperation Agency shall act as counterpart agency to the Japanese Study Team and also as coordinating body in relation with other governmental and non-governmental organizations concerned for the smooth implementation of the Study.

The government of Republic of Indonesia assures that the matters referred to in this form will be ensured for the smooth conduct of the Development Study by the Japanese Study Team.