資料５　議事録

インドネシア石炭鉱業技術向上実施協議調査団議事録

10月16日　09:00～09:30　JICAインドネシア事務所表敬･打合せ

（面談者）

庵原所長

米田次長

安藤企画調査員

上原個別専門家（この後、調査団に同行）

（内容）

調査団より今回の調査の目的とプロジェクト活動中の安全対策及びインドネシアの省庁再編に伴う組織改革等に対するR/D締結に際しての懸案事項を説明した。これを受け、事務所側の意見は、安全確保は、非常に重要な問題であり、安全対策に甘んじることないプロジェクト運営を期待する旨の要望が出された。また、インドネシア側の組織改変については、来年1月からの予算年度開始に合わせて各省庁内で進行中であるが、その完了時期は年末になっても分からないという不確実性を含んでいるので、今回のR/Dではその対策を協議し、それを盛り込んでR/Dを調印し、専門家派遣前にその組織再編成の進行を調査団もしくは事務所で再度、確認するという手段が最良であると判断される。

さらに、インドネシア国内では、住民運動やNGO活動の高揚により、それらに配慮のないプロジェクト実施は困難な状況になってきている。また、JICAのアカンタビリティからいっても、石炭のプロジェクトを実施する際には、特に環境への配慮が肝要である。したがって、プロジェクトを大局的に眺め、本案件の技術移転分野にはない石炭の利用による環境負荷等に関する個別専門家派遣による対処を検討し、現状調査による環境負荷提言リコメンデーションを積極的に推進していただきたい。

最後に、プロジェクト実施段階におけるインドネシアの国民性に十分に配慮した技術移転の希望が出された。

10月16日　10:00～11:10　エネルギー鉱物資源省表敬・要請背景聴取

（面談者）

Mr. Djoko Darmono, Secretary General (ME&M)

Mr. Supriatna SUHARA, Head of Bureau of Foreign Cooperation (ME&M)

Mr. Thamrin Sihite, Head of Bureau of Environment and Technology (ME&M)

Mr. A. Thabri Akma, Head of MDCM (MDCM)

Mr. Mulyono Hadiprayitmo, Head of Mining Engineering Manpower Division (MDCM)

Mr. Zul Ichwan, Head of Mineral Processing Sub Division, (MDCM)

（議事）

協議に先立ち、エネルギー鉱物資源省並びに実施協議調査団間で挨拶が交換された。これに引き続き標記協議を実施したところ、協議出席者の主な意見、質問は以下のとおり。

（事務次官）エネルギー鉱物資源省は、本プロジェクトを非常に重要視しており、オンビリン鉱業専門学校（OMTC）の立ち上げによる鉱業人材育成と日本側からの供与機材を使用しての研修による坑内採掘技術向上の発展が図れることを期待する旨の説明があった。さらに、現在は、石炭公社（PTBA）とプロジェクトへの協力について最終的な調整をしているが、鉱業人材開発センター（MDCM）とともに統括官庁は当省であるので、プロジェクト開始にはには支障がない旨

の説明が追加された。また、予算の確保も当エネルギー鉱物資源省が責任を持って実施するのでご懸念には及びません。また、この他の分野での協力も期待が表明された。

（調査団）この説明を受け、調査団は、供与機材、専門家派遣、C/P 研修などの事業実施のために本案件に約８億円の予算を準備している旨の説明を行い、インドネシア側のカウンター予算の確実なる配置を要請した。また、予算の他にもプロジェクト実施には優秀なカウンターパート配置が不可欠であることを説明し、それに対する事務次官の助力を依頼した。

（事務次官）予算の配置には当エネルギー鉱物資源省は、最善の努力をする旨の説明があり、C/P の配置については、MDCM の所長と調整していただきたいとの希望が示された。プロジェクト終了後に、インドネシア独自で OMTC が運営できるような状態になり、プロジェクトが成功してよかったといいたい。

（MDCM 所長）現在、C/P は MDCM スタッフのズル氏を校長に配置し、OMTC 及び PTBA（合計 26 名）、地方鉱山事務局（カンウィル）などで州政府に吸収されなかった人などからの選定を考えている。

（調査団）エネルギー鉱物資源省の再編成の進行状況を説明願いたい。

（事務次官）再編成は、いつ実施されるか現在のところ不明である。しかし、この再編成が、本案件に与える影響はないと判断される。MDCM の存続は、決定しているし、DGM がたとえ他の総局と統合されても、R/D はインドネシア政府との契約なので、政府が責任を負う。

（調査団）そのことを、M/M に追記可能か。

（事務次官）必要ないと判断される。DGM の統合はスリム化が目的である。いずれにしても。エネルギー鉱物資源省が責任を持つ。

（調査団）DGM が、他の総局と統合され新 DGM となり MDCM はそこに所属し、その機構は存続されるということか。

（事務次官）そういう可能性も考えられる。今回の再編成は、本省の下部機関である各局や各センターは存続し、総局などの上位機関が統合を目的にしている。いずれにしても、エネルギー鉱物資源省の下に DGM がありさらにその下に MDCM があるので心配なさらないでください。

（環境技術局長）日本側に配慮して、事務次官が R/D にサインされてはいかがか。

（MDCM 所長）MDCM の存続は決定しているので、現在の上位機関である DGM がサインをするのがよいのではないか。

（調査団）心配はしていないが、やはり追記か、エネルギー鉱物資源省がサインするのが最善であると思われる。

（事務次官）R/D への調印は、政府間の契約である、履行する義務があり、たとえ組織が変更されても政府がその契約を確実に履行する。DGM 自体が、まだ存在しているので、既存の機構を飛び越えて次官がサインするのは困難である。したがって、組織変更の場合にはエネルギー鉱物資源省が、責任を持って引き継ぐというように追記することとしたい。内部情報では、MDCM が DGM の管理を外れて次官の管轄になるという可能性もある。

（調査団）内閣改造に伴う本案件に係る要請背景の変化はあるのか。また、新たな５ヵ年計画は策定されたか。

（事務次官）これまでの 5 カ年計画に変わるものとして、国家開発計画が新たに法律化された。毎年予算計画を立て、その中には石炭の開発計画も盛り込まれる。石炭は、石油の代替エネルギー源として非常に有望で、埋蔵量は石油に比べてはるかに多く、300 年持続可能であると予想さ

れているいるのでインドネシアにとっては重要なエネルギー源である。現在、豆炭（ブリケット）の使用は、補助金を上乗せした価格体系のため、(灯油 350Rp/l、ブリケット 500～600Rp/kg)少量にとどまっているが、これからは補助金を無くしていき、市場原理に任せる予定である。このような処置により、価格は低下し、次第に需要は伸びていくものと考えられる。

（調査団）省庁名変更の目的はなにか。

（事務次官）上部が決めたことなので真意はわからないが、地方分権化の流れをくみ、鉱山分野に係る権限は地方に委譲されるため、中央官庁もそれに合わせて考えていくためであると思われる。エネルギーを先に出して政策を考えていくことだ。許認可は地方に移す。

（調査団）地方監督官の要請については、インドネシア側の積極的な協力を要請する。

（事務次官）地方人材育成は、まだまだ、これからなので政府も積極的に協力していく予定である。

（調査団）監督官の要請に加え、民間炭鉱からの研修生の受け入れ、ひいては坑内堀移行へのインセンティブ形成は非常に重要な問題なので、これについてもインドネシア側の協力を要請したい。

（事務次官）そのように努めさせていただく。

（MDCM 所長）地方監督官に関しては、現在、インドネシアの州または県が約 400 存在し、その各州または県に、少なくとも２名の監督官の配置を仮定しても合計 800 名になるので、ご心配なく。

（調査団）PTBA との調整が残っているということであったが、オンビリン炭鉱が民営化されてもプロジェクトへの協力は得られるのか。

（事務次官）たとえ民営化されても協力体制は得られると考えている。民営化については、100%民間に移行するのではなく、一部の株は残り管理を行う予定にしている。協力事業が円滑に進むように努力する。

（調査団）これまで踏み込んだ質問や依頼を行ったが、これもひとえにプロジェクトを成功させるためのものであるのでご理解いただきたい。

（事務次官）有意義な協議ができてうれしく思っている。情報公開は、非常に重要なことなのでこれからも透明性をもって情報を提供していきたい。今後、インドネシアのため、日本のために、本案件が鉱工業分野の発展に大いに寄与することを期待する。

10 月 16 日　16:30～17:20　鋳造技術分野裾野産業育成計画（IRDMMI）視察

（面談者）

Mr. J. SUYANO, Project Manager（MIDC）

安井チーフアドヴァイザー

本間業務調整員

プロジェクト専門家

（内容）

ローカルコストの確保に非常に苦労している。誘導加熱炉を使用しているが、電気代が払えない状態にある。来年度、C/P 一名増員予定。民間企業対象のセミナーは、年間数回開催。運営経費の 30%を自己捻出しなければならない。しかし、自動車生産上向きという明るい兆しもあり、受注は微増している。とにかく予算確保に苦労している。政府予算は、40%がカットされるので、それをプロジェ

クトで補わなければならない。

10月17日　9:00～18:00　鉱業人材開発センター（MDCM）プロジェクト内容協議

（面談者）

Mr. A. Thabri Akma, Head of MDCM

Mr. Asmara Karma, Deputy Principle of OMTC

Ms. Hirawati, English Lecturer of MDCM

Mr. Farid Rachim S.A., Section Manager of DOC

Mr. Zul Ichwan, Staff of MDCM

Mr. Mulyono H.P., Head of Mining Engineering of MDCM

Mr. Wawan Supriatna, Staff of MDCM

Mr. Dedih Budiwan, Staff of MDCM

Mr. Irwan Bahar, Coordinator, MDCM

Mr. Marsudi S., Staff of MDCM

（議事）

協議に先立ち、MDCM と調査団の間で挨拶が交換された。標記協議を R/D 案及び M/M 案に基づき実施したところ、これに対する出席者の主な意見、質問は以下のとおり。協議の主な内容は以下の通り。

R/D 案について

（MDCM）Ⅰ．2．の Annex Ⅰのマスタープランは、もう少し詳細に書く必要はないのか。

（調査団）詳細は、M/M に規定されているのでその必要はないと判断される。また、R/D はコロンボプランに則っていることをご承知おきいただきたい。

（MDCM）Ⅱ．のコロンボプランに関する記述は、削除できないか。

（調査団）このコロンボプランの技術協力スキームを基本にしているので、不可能である。

（MDCM）Ⅱ．2．の AnnexⅢの供与機材の詳細は添付する必要はないのか。

（調査団）M/M に添付してあるので、必要ない。

（MDCM）Ⅲ．6．（1）の AnnexⅣの C/P リストにプロジェクトダイレクターやプロジェクトマネージャ等を含む必要はあるのか。

（調査団）ここでいう C/P とは、本案件の責任者を含む関係者を指しており、これまでに論議してきたものはテクニカルカウンターパートとして理解いただきたい。

（MDCM）Ⅲ．6．（2）の AnnexⅤの2．のトレーニングスペースは具体的に何を指しているのか。

（調査団）教室や実習施設だけではなく、研修に用いる OMTC の用地を指している。

（MDCM）Ⅲ．6．（4）専門家の旅費は、インドネシア側の負担か。

（調査団）インドネシア側の負担である。

（MDCM）Ⅳ．5．の Annex 6 の JCC 開催の際の経費負担は、どちらが行うのか。

（調査団）日本側で発生するものは、日本側で、インドネシア側で発生するものはインドネシア側で負担する。

（調査団）Ⅵ．については本案件の R/D については、問題が専門家の過失または故意に帰するのか判断する主体者を追記した。この点については、何か問題はないのかを確認したい。

（MDCM）エネルギー鉱物資源省の国際局に、このままで問題ないことを確認している。また、Ⅸ．

のプロジェクト期間は、2001年4月1日から2006年3月31日までと明記する必要はないのか。
（調査団）特にその必要はない。

M/M案について
（調査団）短期調査では、OMTC は MDCM への移行中ということであったが、完了したかどうかを確認したい。また、2．のOMTCに関する記述は、このままでいいのか確認したい。
（MDCM）移行は、今年中に完了する予定であるのでこのままでよい。
（調査団）エネルギー鉱物資源省との協議を踏まえ、ここに組織再編の場合の対策を追記したい。
（MDCM）了解した。
（MDCM 所長）6．のオンビリン炭鉱の坑内の略語は、インドネシアでは Pit というのは一般に露天掘を指すのでU/Gを用いていただきたい。
（調査団）了解した。
（MDCM）6．の炭鉱プロジェクト安全評価委員会の設立目的に関して、maxmun を optimum に変更願いたい。
（調査団）最高の安全確保を行うという理解であれば、変更は可能である。
（MDCM）理解はそのとおりであるので、変更願いたい。
（調査団）了解した。
（調査団）6．の模擬坑道建設に関すは、口上書交換が必要になるのでご承知おきいただきたい。
（MDCM）了解した。
（調査団）6．の ANNEX 7 の安全確保対策Ⅱ．1．（1）①のトランスは、乾式かオイルを用いた湿式かどうかを確認したい。
（OMTC 副校長）乾式である。
（調査団）日本の鉱山保安法では、乾式の場合は沿層にも設置可能となっているので、それでは、この項目については、削除することとする。
（MDCM）8．3．のP/Cに関してだが、5年間代えられないということか。
（調査団）そのように依頼したい。
（MDCM 所長）最善の努力はするが、保証はできない。
（調査団）それであれば、最善の努力をするという記述を追加することとしたい。
（MDCM）了解した。
（調査団）8．5．のローカルコストについては、エネルギー鉱物資源省との協議を踏まえて、省庁内再編の場合の予算配置の責任者を追記したい。
（MDCM）予算配置は、インドネシア側が行うという記述からエネルギー鉱物資源省が行うという記述に変更願いたい。
（調査団）了解した。
（MDCM）円滑な予算確保のために、日本側の予算措置についてM/Mに追記することは可能か。
（調査団）不可能である。プロジェクト方式技術協力は、機材、C/P 研修、専門家派遣による技術移転を行うのが目的なので記載不可能である。しかし、予算確保については JICA 事務所を通じてバックアップすることとしたい。
（MDCM）了解した。

プロジェクト開始までの検討・懸案事項について

（調査団）パダン大学鉱山学科は、８月に開設予定であったが予定通りに開設されたのか。

（MDCM）必要な手続きが残っており未開設である。しかし、DGM とパダン大学間では、プロジェクトに協力するという MOU を交換した。

（調査団）2000 年予算の執行状況を確認したい。

（MDCM）追加予算が承認されたのが 10 月であったので予算年度変更まで２ヶ月を残すのみとなり、執行不可能な状況である。これに伴い、ワークショップ、研修生の宿舎の一部、教室等の改修工事が積み残しとなった。しかし、専門家の仮事務所については工事を完了している。

（調査団）民間及び地方監督官の研修費用の負担については、短期調査で確認したが、現在でもその負担基準に変更はないか。

（MDCM）変更はない。

（調査団）オンビリン炭鉱のプロジェクトへの協力と早期改修措置は実行可能か。

（MDCM）R/D 及び M/M に調印後、オンビリン炭鉱と協議したい。

（調査団）それでは遅すぎるので、すぐにオンビリン炭鉱と連絡をとりその確約を得たい。

（MDCM）了解した。

（調査団）地方監督官の要請計画は、作成しているのかどうか確認したい。

（MDCM）地方への権限委譲が 2001 年 5 月以降であり、まだ準備中である。これからプロジェクトと連携をとりながら、進めていきたいと考えている。また、これに伴う MDCM の負担は、講師 60 人、支援要因 30 人合計 90 人の増員が予想されている。ここで、C/P の配置についてその期間を確認したい。

（調査団）常勤職員の５年間の配置である。

（MDCM）これまで、3 ヵ月程度のローテーションを想定していたが、5 年間配置できる C/P に絞込みリストを作成することとする。

（調査団）プロジェクト実施の際に、地方分権化が徐々に進行していく模様であるが、地方自治体の協力は得られるか。

（MDCM）プロジェクトサイトが位置する西スマトラ州及びサワルント市のプロジェクトに対する認知は、既に形成されており、予算面での協力はできないが、治安や宿舎用の土地提供等の便宜供与は可能であることを確認している。また、この他に最新の情報だが、現行の石炭生産時のローヤリティ 13.5%はこれまで建物を中心に使用されてきたが、これからは研究開発と人材育成を中心に変更する予定である。さらに、このローヤリティの執行権限者は、次官から総局長に委譲されるよていであるので、人材育成を目的とする本プロジェクトにとっては朗報である。

10 月 18 日　8:00～13:00　鉱業人材開発センター（MDCM）、プロジェクト内容協議

（面談者）

Mr. Surna T. Djajadiningrat, Director General, Department of General Mines

Mr. A. Thabri Akma, Head of MDCM

Mr. Asmara Karma, Deputy Principle of OMTC

Mr. Zul Ichwan, Staff of MDCM

Mr. Mulyono H.P., Head of Mining Engineering of MDCM

Mr. Wawan Supriatna, Staff of MDCM

Mr. Dedih Budiwan, Staff of MDCM

Mr. Marsudi S., Staff of MDCM

Mr. Tumpal Situmorang, Head of Regular Program

（内容）

調査団は、前日の協議で依頼した C/P リストをの提示を求め、インドネシア側が提示した 15 名のリスト記載者は、5年間の常勤 C/P であることを確認した。また、同時にリスト中に含まれるパダン大学の C/P についても同様に5年間の常勤であることを確認した。さらに、これらの C/P の変更は、極力避けるように申し入れ、了承された。

この後、これらの C/P の履歴書の提出を求めたが、一部は提出されたものの残りの者については、3週間以内に JICA 本部に送信するすることが約された。

また、この他に A1 及び A4 については、R/D 締結時までにドラフトに則って準備し、鉱山総局長の署名を了した後に、アドバンスコピーを日本側に手交することが確約された。

13:00～13:20

（総局長との面談録）

総局長よりこれまでの協議に対する感謝の意が表明され、日本側はインドネシア側の真摯な協力に対する感謝の言葉を述べた。その後、調査団より本案件に係る優秀な5年間常勤 C/P の配置、予算確保、鉱山からの研修生募集に関する積極的な活動およびその経費の確保を依頼し、鉱山総局長は、調査団の依頼事項は非常に重要であり、鉱山分野の発展には人材育成が不可欠であるため、インドネシア側は、この3点を確実に実施していく旨が約された。

10 月 19 日　9:00～10:00　Department of General Mines (DGM)、R/D 及び M/M 締結

（参加者）

Mr. Surna T. Djaja　　, Director General, Department of General Mines

Mr. A. Thabri Akma, Head of MDCM

Mr. Asmara Karma, Deputy Principle of OMTC

Mr. Zul Ichwan, Staff of MDCM

Mr. Mulyono H.P., Head of Mining Engineering of MDCM

Mr. Wawan Supriatna, Staff of MDCM

Mr. Dedih Budiwan, Staff of MDCM

Mr. Marsudi S., Staff of MDCM

Mr. Tumpal Situmorang, Head of Regular Program

Mr. Suamantri, Padang State University

Mr. Murcl Rcgyid, Padang State University

Mr. Marsudi S., Staff of MDCM

Mr. Buyun U.H., DBB

Mr. Snhale, DOC

（内容）

R/D 及び M/M 締結後の鉱山総局長のスピーチでは、プロジェクトへの期待とともに、DGM が締結したパダン大学との MOU を今後は、大臣同士で交換する予定であることが説明された。また、供与機材についても大切に使用していく旨の説明があり、それに伴うメンテナンスについても専門家による

指導が要請された。また、予算確保には最善を尽くす旨の説明が追加された。

10月19日　15:00～15:30　JICAインドネシア事務所報告

（面談者）

米田次長

安藤企画調査員

（内容）

本案件の目的は、オンビリン鉱業専門学校の再興にあり、環境配慮にも力を入れていく予定である旨を説明し、今調査の主な協議内容とその対処方法を報告した。

エネルギー鉱物資源省の組織再編に関しては、現行の責任機関である DGM が他の総局との統合などにより再編がある場合には、主管官庁である同省が、予算確保も含めて責任をとることを M/M に記載することで対処した。また、安全確保対策を M/M に添付し、十分な配慮を行っているので、これに則ってプロジェクトを実施するということであれば、刑事責任は発生しないと考えられる。さらに、研修生の確保対策は、本プロジェクトの根幹をなす問題であるので、M/M にも記載し、鉱山総局長をはじめとするプロジェクト関係者に念を押して依頼した。C/P 及びローカルコストの配置については、その確実なる実施を M/M に記載するとともに、特に C/P についてはこれまでのインドネシア側の誤解を解き、5年間の常勤C/Pであることを確認し、5分野、各3名、合計15名を確定した旨を報告した。

この報告に続き、今年度の現地調達品の手配、インドネシア側の予算確保活動への後方支援、及びE/N提出への協力を事務所に依頼した。

これを受け、インドネシア事務所は、現地調達品の準備を進め、エネルギー鉱物資源省の再編とA1、A4　E/N等の各提出書類をフォローしていく旨の説明があった。

10月19日　16:00～16:30　在インドネシア日本大使館報告

（面談者）

藤原参事官

八山二等書記官

（内容）

調査団は、R/D 及び M/M 締結が滞りなく終了したことを報告した。さらに、今調査では、プロジェクト開始までの懸案事項については M/M に記載するなどして対処したが、エネルギー鉱物資源省などの再編及びオンビリン炭鉱の改修等については事務所がフォローし、必要であればプロジェクト開始前にもう一度調査団を派遣し詳細に確認することを説明した。また、プロジェクトが開始した後も、その立ち上げには困難が予想され、特にカリマンタン島の民間炭鉱からの C/P 確保には相当な努力を要する旨を説明した上で、大使館の協力を要請した。これを受け大使館からは、本案件は、インドネシアのエネルギー政策に寄与する案件なので、大使館としても非常に期待しており、できるだけ協力していく予定である旨の説明があった。また、プロジェクトのカリキュラム運用をフレキシブルに行い、一企業に絞った集中研修コース等により民間炭鉱のインセンティブを高めていくことが肝要である旨が追加された。さらに、組織再編、現地調達機材、専門家の住居、安全対策（オンビリン炭鉱改修）実施状況などをもう一度プロジェクト開始までに確認したほうがよいと判断される旨の説明があり、その調査団が現地に派遣される際には、大使館の同行の希望が出された。

QUESTIONNAIRE TO MINISTRY OF ENERGY AND MINERAL RESOURCES REGARDING TO JICA PROJECT TYPE TECHNICAL COOPERATION ON COAL MINING TECHNOLOGY ENHANCEMENT PROJECT AT OMBILIN MINES TRAINING COLLEGE

We are planning to dispatch the Implementation Study Team from October 15, 2000 to October 20, 2000 in the Republic of Indonesia. In order to conduct our study smoothly, we would like you to prepare followings upon the arrival of the team.

1. Situation

・Please explain present situation and the scope on new Ministry of Energy and Mineral Resources.

2. Policy and basic idea

・Please explain the policy and basic idea of new Ministry of Energy and Mineral Resources in regard to followings:

1) The policy for mining industry;

2) The policy for energy supplies;

3) The policy for coal mining industry;

4) The policy for human resource development in coal mining sector;

5) The correspondence to autonomy

6) The budgetary steps for the captioned project.

3. New National Plan

・Please explain the position and role of coal mining sector in 7th National Developing Plan.

Your answer will be very important to us for implement the Project, so your prompt answer will be highly appreciated.

QUESTIONNAIRE TO MANPOWER DEVELOPMENT CENTRE FOR MINES

REGARDING TO JICA PROJECT TYPE TECHNICAL COOPERATION ON COAL MINING TECHNOLOGY ENHANCEMENT PROJECT AT OMBILIN MINES TRAINING COLLEGE

We are planning to dispatch the Implementation Study Team from October 15, 2000 to October 20, 2000 in the Republic of Indonesia. In order to conduct our study smoothly, we would like you to prepare followings upon the arrival of the team.

1. Circumstance

・Please explain present situation in regard to followings:

1) Geology and Mining Department of Padang University;

2) Privatization of Ombilin Coal Mine;

3) Status of OMTC.

2. Counterpart personnel nomination

・Have you nominated the members of the counterpart personnel for each technology transfer course except mine environment course in the first project year. If you have finished above-mentioned nomination, please prepare the curriculum vitae for them. We would like to interview the prospective chiefs of each course if it is possible. .Please explain your preparation stage.

3. Safety measures for the Project

・Is the safety measures, which is attached the draft of Minutes of Meeting as ANNEX 7, agreeable or not ? If you don't agree above mentioned safety measure, please explain your controversial point.

(Note: Safety measures including the rehabishment of Ombilin Coal Mine)

Your answer will be very important to us for implement the Project, so your prompt answer will be highly appreciated.

Request for Manpower Development Center for Mines (MDCM)
on Coal Mining Technology Enhancement Project
at Ombilin Mines Training College

Requests :

You are requested to prepare following figures which to be attached to the Minutes of Meeting as ANNEX.

ANNEX 1-1	Organization Chart of DGM
ANNEX 1-2	Organization Chart of MDCM (should be included OMTC)
ANNEX 1-3	Organization Chart of OMTC
ANNEX 9	List of Existing Machinery and Equipment at OMTC (should be simplified)
ANNEX 10	List of C/P and Administrative Personnel
ANNEX 12-1	Tentative Budget Plan to be allocated for the Project by the Indonesian Side
ANNEX 12-2	Basis of the Tentative Budget Plan

Please refer to examples attached Minutes of Meeting as ANNEX 9, ANNEX 10, ANNEX 12-1, and ANNEX 12-2.

Thank you for your cooperation.

資料７　実施協議調査質問状に対する回答

Policy and Basic in regard to Autonomy

1. Autonomous Mining sector will be launched by the gradual manner.

2. The transition periode of the readiness of region for autonomous mining sector comprising Contract of Work (KK) and Contract of Coal Mining Concession (PKP2B) is required. And this will be approved by the 2nd of January 2001 while the central government can still administer in issuing the concession untill January 1, 2005.

3. Delegation of authority in mining sector will be started on 1 January 2001.

4. Restructural organization of Department of Mineral Resources and Energy will be completed at the end of the year 2000.

5. Preparation of Ministry Decree for assisting region in accomplishing Autonomous mining sector encompasses all aspects of Mining Policy, Legislation, Mining procedure, and Authority Guidance.

6. The Paper of Contract of Work (KK), Contract of Coal Mining Concession (PKP2B), Mining Concession (KP), District Mining Concession (SIPD), and Sovereign Mining Concession (SIPR) issued by central goverment is still valid untill the end of a periode of issue.

1. MINISTRY OF ENERGY AND MINERAL RESOURCES

Ministry of Energy and Mineral Resources has missions to assist the President in implemeting a part of administative tasks in the sector of energy and mineral resources.

In carrying out such missions, the Ministry of Energy and Mineral Resources has functions, as follows:

a. facilitates the implementatioan of the sector of energy and mineral resources;
b. provides guidance and coordination of the task implementation on adminstrative services of the ministry;
c. facilitates technical implementation and guidance of State Owned Companies in line with their functions;
d. Undertakes applied research and development as well as certain education and training in the framework of supporting policies in the sector of energy and mineral resources.

In conducting its functions as mentioned above, the Ministry of Energy and Mineral Resources has the following authority:

a. determines policies in the concerned sector for supporting macro development;
b. determines criteria in approving and changing the function of area/landuse in the framework of arranging establishment and rehabilitation of such areas;
c. arranges national plan in the concerned sector;
d. determines accreditation requirement for educational institutions and certification for professionals/experts, including concerned position requirement;
e. provides guidance and supervision over the implementation of regional authonomy covering provision of references, guidance, training, direction, and provision as concerned;
f. determines management and protection references over natural resources concerned;
g. manages and implements protection over off-shore natural resources beyond 12 miles as concerned;
h. arranges application of international agreement, approved on behalf of the country as concerned;
i. determines standard of license provision by regional government as concerned;
j. handles geologic hazards at national scale as concerned;
k. determines policy of national information system as concerned;
l. determines qualification requirements on service business as concerned;
m. provides problem solving for conflicts arising between Provinces as concerned;

n. arranges system of state economic institution as concerned;
o. facilitates distribution activities of basic needed materials as concerned;
p. arranges geological and ground water survey at a small scale or at the same as 1 : 250,000, production of thematic geological mapping and mineral resources and energy inventory, and geological hazard mitigation;
q. arranges electric generation, transmission and distribution at national grid and utilization of nuclear electric power, and arrangement of utilization on radio active mining materials;
r. determines policies on intensification, diversification, conservation, energy process as well policy on national/regional transmission network (grid) of electricity and natural gas;
s. determines standard of geological hazard monitoring and investigation;
t. determines standard of geological survey and standard of mineral resources and energy as well ground water management;
u. determines criteria of business area including distribution of electricity and mines;
v. determines provision and basic tariff of national electricity, oil, gas, and natural gas;
w. provides core business license of oil and gas beginning from exploration up to transportation of oil and gas through pipelines over different provices, core business license of electricity covering cross provincial power generation, transmission, and distribution of, and non core business license covering cross provincial depot and transmission line of oil and gas.

NATIONAL LONG RUN ENERGY SUPPLY ANALYSIS

La Ode Muh. Abdul Wahid dan Cecilya L. Malik

Abstract

In economic development, rate of 4.2% per year in 35 years period, total energy demand is expected will grow with the average growth rate of 2.99% per year.

Oil reserve in Indonesia is limited. Even though oil is not clean as natural gas, oil is easier to use and its price is relatively cheap. Therefore, oil becomes a favorite fuel in Indonesia. Natural gas is categorized as a clean fuel. Natural gas is expected to be increase by the average growth rate of 1.53% per year. While, coal has the fastest growth rate among the growth rates of energy demand.

For non fossil fuels, hydropower is the most attractive fuel for power generation in the remote areas. Hydropower demand is expected to be increased until three times in the future.

I INTRODUCTION

The slowing down of the Indonesian economic has affected the purchasing power of the people so that many industries has to reduce their production capacity or even worst shutting down for awhile. The economic slow-down has also affected the other energy consuming sectors such as transport and residential and the process and conversion sectors. Consequently, the total energy demand of the country will be affected and will finally affected the national energy supply system.

To have a general overview of the economic crisis affect to the integrated national energy supply, a research was conducted entitled "Analysis of Energy Supply and its Relationship to the Long Term National Energy Supply Strategy". This research activity was conducted on the basis of least-cost and with the smallest impacts of energy utilization to the environment. The base-year was 1995.

The goals of this research are:

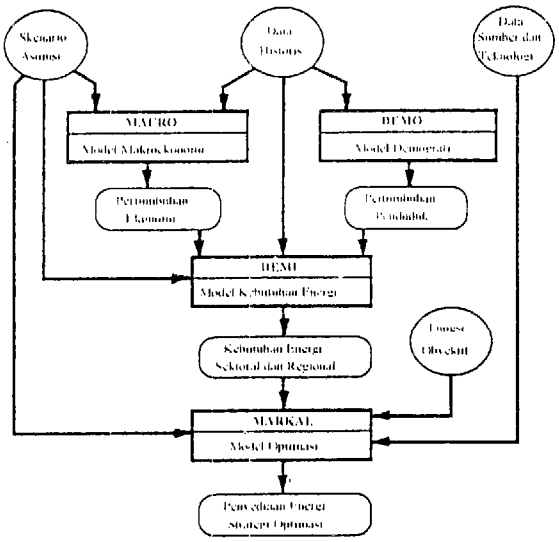
- Widening the integration between energy supply and technology assessment covering economic scenario, energy demand, and the optimization of energy supply using several objective functions as the basis for decision makers to formulate the future national energy policy strategies; and
- Utilizing the computer system that is already available in BPPT.

II RESEARCH METHODOLOGY

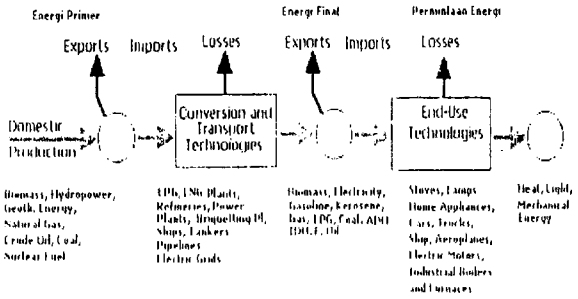
The research on the "Analysis of Energy Supply and its Relationship to the Long Term National Energy Supply" was conducted using the MARKAL (MARket ALlocation) Model software. The outcome of this model will be the optimal long-term energy supply strategies. The MARKAL model flow diagram is shown in Figure 1.

Analysis of the long-term national energy supply requires an objective function of least-cost energy supply and a constraint to reduce emission or pollutants (in term of reducing the environmental impacts). The MARKAL model outcome will be an optimal energy supply taking into consideration economic growth and sectoral energy and taking into account the techno-economic constraints for choosing energy resources, energy process, energy conversion and demand devices. The relationship between energy sources and technologies (process, conversion, demand devices) is shown in Figure 2.

With this approach, the MARKAL Model will provide outputs on the install and utilized capacity of the individual technologies, final energy consumption, primary energy production, the overall energy balance, production cost of the energy sources, additional cost for conversion and utilization of clean technologies and the shadow price of the individual fuels.



GAMBAR 1 Flow Diagram of the MARKAL Model



GAMBAR 2 Flow Diagram of the Energy Sources, Technology and Energy Demand.

In optimizing the national energy supply, the MARKAL model uses the least-cost concept. Energy price has been used only for import and export. Costs and prices are in constant USD95 with a discount rate (i) of 10%.

III RESEARCH OUTCOME

3.1 ENERGY CONSUMPTION

The MARKAL model output indicates that the energy consumption will be increasing at an average rate of 2.8% per year from the first period (1994/1999) until the seventh period (2024/2029). This result is under the efficient technology scenario and with an average economic growth of 4.49% per year. The fastest growth of energy consumption occurs in the transport sector at 3.86% per year. The industrial sector final energy demand growth rate is expected to be 2.89% per year over the same 35-years period. These sectoral energy demand have to be supplied domestically or if not enough, through import.

The final energy demand of the sectors (industry, transport and rescom) as the outcome of the MARKAL model is shown in Table 1. The rescom sector covers residential, commercial and government.

Table 1 indicates that natural gas dominates the final energy consumption of the industrial sector. In the first period (94-99), the natural gas demand of the industries was on average 32.46% per year. The average natural gas demand growth rate slows to 17.27% per year in the seventh period (24-29). The main use of natural gas in industries was as feedstock. The share of feedstock in the total gas consumption of the industries was 40.38% per year in the first period and increased to 46.42% in the seventh (last) period.

In line with government program on energy diversification, coal demand over the 35-years period is expected to increase at an average annual growth rate of 3.99% per year. Refined products demand also shows a tendency to increase over the same period but at a slower rate than coal (1.57% per year). This refined products demand include both feedstock and fuel. Although the total refined products demand increased, the demand as fuel decreases from 199.22 PJ per year in the first period to 163.96 PJ per year in the last period. This decline in the refined product demand as fuel is not only due to the diversification program but also due to the decline of captive power usage that has been substituted by the electricity generated by PLN (State Electricity Company). In addition, the utilization of industrial waste heat through co-generation system using natural gas to produce both electricity and heat as in the paper and sugar industries has become more competitive with the other energy sources. Refined product use as feedstock, on the other hand shows a tendency to increase, from 36.30% per year in the first period to 67.18% per year in the last period.

In the transport sector, the demand of oil products dominates this sector total final energy demand. However, the option of using gas in the transport sector (LPG and CNG) and electricity is also high as indicated by the increase in the share of these fuel demands from 0% per year in the first period to 6.34% per year in the last period for LPG and CNG and from 0.14% per year to 0.16% per year for electricity. The average annual growth rate of gas demand in the transport sector (LPG and CNG) will reach 14.89% per year over only 30-years period while for electricity it will be 3.84

% per year over the 35-year period. Oil products demand of the transport sector will be growing at a slower rate of 3.11% per year.

The use of gas fuelled vehicles in the transport sector (LPG and CNG) is due to the competitiveness of gas to oil products. In addition, the government is also encouraging the use of gas in the transport sector especially for commercial vehicles such as taxi and busses, as stated in the national energy policy. As shown in Table 1, there is already gas consumption in the transport sector in the first period. However it has a very small share in the total energy consumption of the sector. The demand of gas in the transport sector will be increasing sharply in the last two periods. The Government should anticipate this increase in the use of gas through the development of several pumping station (SPBG) and the availability of conversion kits. Similarly, the use of electricity in rail transport is also expected to compete with diesel fuels. Therefore, the provision of mass electrified trains especially in large cities as in Jakarta could be the most economic choices.

As in the case of the industrial and transport sector, the phenomena of energy consumption in the residential, commercial and government sectors is also showing a tendency for the use of a more environmental friendly energy sources. This can be observe from the rapid increase of gas (LPG and city gas) and electricity consumption of the sectors at an average rate of 10,04% and 5,08% per year respectively. The average increase of biomass and oil fuels is only around 0,63% and 0,32% per year respectively. In addition, the use of solar water heater in the second period will reach 0.10 PJ per year and reached 2.08 PJ per year by the end of the period.

TABLE 1 Average Energy Consumption in the Industrial, Transport and Residential-Commercial Sector (including Biomass) (Efficient Technology Scenario)

Sector/ Energy Type	Average Energy Consumption per Year (PJ/Year)							Growth Rate (%/year)
	94-99	99-04	04-09	09-14	14-19	19-24	24-29	
Total Industry	**1232,29**	**1048,06**	**1183,85**	**1381,43**	**1772,26**	**2239,38**	**2895,08**	**2,89**
Coal	172,86	193,39	231,74	270,95	365,08	486,06	680,22	3,99
Coke	3,83	3,98	3,70	4,57	5,34	3,72	5,21	0,88
Biomass	139,71	152,52	175,61	199,60	279,34	352,44	454,18	4,01
Natural Gas	400,05	227,98	257,74	295,95	338,92	398,34	499,84	0,75
Electricity	203,07	216,38	253,12	333,14	440,36	574,36	723,27	4,33
Refinery Product	312,77	253,81	229,18	244,40	310,46	391,70	499,60	1,57
Heat/Coal	0,00	0,00	32,76	32,76	32,76	32,76	32,76	
Total Transportation	**748,62**	**753,37**	**833,56**	**1046,44**	**1358,28**	**1775,30**	**2333,53**	**3,86**
LPG	0	2,05	6,08	14,25	34,26	78,35	117,91	14,46
CNG	0	0,25	1,38	3,09	7,05	15,90	30,08	17,31
Electricity	1,02	1,03	1,15	1,47	1,99	2,78	3,81	4,49
Avtur/Avgas	62,87	64,22	71,71	91,31	121,85	163,42	212,47	4,14
Diesel	368,53	375,42	426,89	537,17	685,69	887,46	1144,59	3,85
Fuel Oil	19,76	23,94	30,80	44,37	66,06	97,72	138,86	6,72
Gasoline	296,44	286,46	295,55	354,78	441,38	529,67	685,81	2,84
Total RESCOM	**1358,98**	**1417,53**	**1503,42**	**1591,81**	**1691,05**	**1797,16**	**1925,57**	**1,17**
Briquette	0,00	0,00	0,00	0,00	0,00	0,00	0,00	
Biomass	962,56	1004,88	1034,90	1071,47	1103,13	1126,40	1161,64	0,63
Gas (LPG, City Gas)	0,62	0,76	2,44	3,18	4,19	10,87	10,93	10,04
Electricity	94,96	121,33	157,45	203,51	271,93	363,12	420,09	5,08
Refinery Product (kero;diesel)	300,83	290,46	308,38	313,12	310,93	295,41	330,83	0,32
Solar Water Heater (Solar Panel)	0,01	0,10	0,25	0,53	0,87	1,36	2,08	19,47
Total Consumption	3339,89	3218,96	3520,83	4019,68	4821,59	5811,84	7154,18	2,80

Source: Computer *Print out* MARKAL Model

In the wake of increasing clean energy utilization, the use of kerosene and diesel oils during that period is relatively constant, while the briquette is not used due to its relatively high price and it is less environmental friendly. The increasing use of biomass is mainly due to the fact that biomass will remain to be used as non-commercial fuel mainly in the rural households in the remote area where there is no other alternative fuel. However, the total share of biomass fuel to the total energy consumption in household sector decreases from 70,83% (period 1) to 60,33% (period 7).

3.2 Primary Energy Supply

The demand for primary energy will be met by energy resources available locally and, in the case the local energy supply is not enough, by imported energy supply. The extent of national energy supply is determined by the availability of energy resources and the economic condition. Based on the availability of energy resources and the national economic growth forecast, the local primary energy supply will increase at a rate of 2,41% per annum in the next 35 years starting from 1994 to 2029, as shown in Table 2. Table 2 shows that coal and hydropower will experience the highest average growth rates of primary energy supply to meet the national energy demand.

Although oil reserve in Indonesia is limited and oil is not as clean as natural gas, oil is still used extensively due to its ease of use and its relatively lower price. Therefore, the local and imported oil remains competitive, even though its share in the total energy supply decreases from 39,13% in the first period to 29,27% in the last period. Even though natural gas is considered as a clean source of energy and its total reserve capacity is considerably large, its supply growth rate is only 1,53% per annum. The of natural Gas is attractive to be used not as a source of energy but also as feedstock in industry. Considering the growth rate of the fertilizer industry that uses natural gas as a feedstock is about 2% per annum, the share of natural gas to the total energy supply will decrease from 22,85% in the first period to 16,87% in the last period.

What stands out of the average domestic energy supply growths is the growth of the coal energy supply. In the first period, the coal energy supply is only 440,03 PJ per annum (+ 17,60 million tons), while in the last period it will increase to more than eight times (± 145,19 million tons), or increases at an average rate of 6,21% per annum.

The use of geothermal for electricity generation will decrease starting from the fourth period. It is even predicted not to be able to compete with other sources of energy, especially with the hydropower which triples its share, by the end of the last period.

TABLE 2 Domestic Primary Energy Supply
(Efficient Technology Scenario)

Energy Type	Average Energy Supply (PJ/Year)							Growth
	94-99	99-04	04-09	09-14	14-19	19-24	24-29	%/Year
Natural Gas	1067,04	1128,29	1341,37	1409,03	1488,12	1587,62	1815,76	1,53
Oil	1827,04	1519,66	1431,31	1690,25	1975,73	2464,35	3150,01	1,57
Coal	440,03	670,87	788,09	1047,20	1760,17	2740,37	3629,66	6,21
Biomass	1118,75	1173,51	1226,45	1287,18	1398,82	1491,16	1628,82	1,08
Geothermal	61,92	65,33	65,62	65,89	65,36	8,42	0,00	
Hydro	154,20	266,25	340,72	480,83	536,91	536,94	536,94	3,63
TOTAL	4668,98	4823,91	5193,56	5980,38	7225,11	8828,86	10761,19	2,41

Source: *Output* Model MARKAL

3.2.1 Crude Oil

In 1990, Indonesian oil production, including condensate, was 533.7 million barrel and increased with the growth rate 1.12% per year to 577.0 million barrel in 1997. Crude oil, beside for export commodity, is also used for refinery throughput for producing oil products such as: gasoline, avgas, avtur, kerosene, ADO, IDO, and HFO. The highest crude oil export was in 1991 at 330.5 million barrel. Indonesia remains a significant importer of crude oil especially from Saudi Arabian and Middle East for refinery throughput.

Crude oil production in the first period was projected to be around 2849.66 PJ per year (488 million barrel) and will be declining until the forth period where it will remain constant at the rate of 958.79 PJ (164 million barrel) per year. The decreased of the crude oil production is expected to be on average 3.35% per year during these period, caused by limitation of crude oil resources (if there is no new reserves being found).

In total, fuel oil consumption will be increasing, especially for transport and industry sectors. In the transport sector, fuel oil consumption will increase around 3 times during the period. The high increased of the oil products in this sector is caused by the fact that oil products can not substitute with the other fuels. In the industrial sector fuel oil consumption was projected to increase 1.5 time during the study period. The projection of oil products consumption for electric generation was decreasing due to the government program for reducing the use of diesel power and to discontinue the development

of oil steam power plants when the lifetime is finished.

The high consumption of fuel oil in one side and the limitation of the crude oil reserves in the another side made the country to import crude oil and its products. According to the MARKAL Model output, import of crude oil, gasoline, ADO, IDO, and HFO during the seventh period will increase at around 3.35% per year in average. The limitation of crude oil production and the increasing of import crude oil (including its products) made the crude oil export (including fuel oil) decreases from 1769.00 PJ (303 million barrel) per year in the first period to 144.89 PJ (25 million barrel) per year in the seventh period (see Table 3).

TABLE 3 INDONESIAN CRUDE OIL AND CONDENSATE PRODUCTION, EXPORT, IMPORT, AND UTILIZATION

Production Export, Import	Production and Utilization of Crude Oil (PJ per year)							%/yr
	94-99	99-04	04-09	09-14	14-19	19-24	24-29	
Production	2849.66	1965,66	1257.66	959,66	959,66	959.66	958,79	-3,06
Import	737.23	722,89	822.64	946,89	1183,48	1649,58	2336,11	3,35
Export	1769.00	1168,89	648,99	216,30	167,41	144,89	144,89	-6,90
Consumption of *Refinery Product*								
Industry	312,77	253,81	229,18	244,40	310,46	391,70	499,60	1,35
Transport	747,60	750,04	824,95	1027,63	1314,98	1678,27	2181,73	3,11
Rescom	300,83	290,46	308,38	313,12	310,93	295,41	330,83	0,27
Power plant	340,49	130,41	106,92	113,49	17,40	24,89	24,89	-7,20

Source: *Output* MARKAL Model

3.2.2 Natural Gas

In the 1990, Indonesia's natural gas production was 1,809,664 MMSCF and increased to 3,166,035 MMSCF in 1997. Natural gas was used for gas plant throughput (LNG, LPG, and CNG), petrochemical feedstock, and as a fuel for power generation, industry, rescom, and transport sectors. The LPG and LNG products is mainly used for export commodity, and LPG for domestic demand are commonly supply from crude oil refinery product. In the household (rescom) sector, natural gas was used as a LPG and city gas, and in the transport sector, it was used as a CNG & LPG car. During 1990 to 1997, the total natural gas consumption increased from 2.088 million MMSCF in 1990 to 2.975 million MMSCF in 1997 at an average growth rate 5.2% per year (see Table 4).

According to MARKAL Model output (efficient technology scenario), natural gas production over the 35-years period will increase 0.39% per year in average. The share of natural gas, LPG and CNG in the total production was projected to increase from 28.76% in average for the first period to 53.25% in the last period. The high consumption of natural gas is the effect of increasing the utilization of efficient technology, such as *gas combined cycle*, boiler, and *heat/cool* for industry sector.

The increasing of domestic natural gas demand will decrease the LNG export in the fifth period. As a total, Indonesian LNG export will decrease from 1248 PJ per year in the first period to 837 PJ per year in the seventh period. But, natural gas export predict to start from third period to the sixth period (*life time* is 30 years). After that, natural gas consumption will mainly be for domestic used. So, the share of LNG and natural gas export as compared to the total natural gas production will be decreasing from 52.66% in the third period to 31.56% in the last period. Based on the above, it is shown that the utilization of gas compare to its production will be less than 100% indicating that there is looses between the production of LNG, LPG, and the distribution of these gases.

TABLE 4 PROJECTION OF PRODUCTION AND UTILIZATION OF NATURAL GAS

Type	Production and Utilization of Natural Gas (PJ per Year)							
	94-99	99-04	04-09	09-14	14-19	19-24	24-29	%/Yr
Production N. Gas	2315.04	2545,29	2833,37	2826,03	2678,12	2610,62	2652,98	0.39
Export LNG	1248.00	1417,00	1444,70	1369,70	1180,31	975,70	837,22	-1,32
Export N.Gas	0.00	0,00	47,30	47,30	47,30	47,30	0,00	
N. Gas (Industry)	400.05	391,81	435,72	512,94	611,48	741,00	932,87	2,45
CNG&LPG (Transport)	0	2,30	7,46	17,34	41,31	94,25	147,99	14,89
LPG/City Gas (Rescom)	0,58	1,80	2,38	3,12	4,12	10,76	10,82	8,72
Power Generation	265,17	269,62	357,58	366,29	319,42	312,02	321,03	0,55

Note : Growth rate CNG&LPG calculated from second period
Source: MARKAL Model *Output*

3.2.3 Coal

In 1990, Indonesia's coal production was 10.460 million tones and had increased to 50.332 million tones in 1996 at an average growth rate of 29.93% per year. Most of the coal are exported, i.e. 45% (1990) and 75% (1996) of the total production. Until mid-1997, the coal production was 26.222 million tones, so there is a possibility that the coal production in 1997 will be more than 1996. Domestically, coal has been used mostly to fulfill the coal demand for power generation, cement industry, and small industries. Lately, coal was also used as feedstock for briquette industry.

According to MARKAL Model output (see Table 5), Indonesian coal production is estimated to grow around 5.83% per year from the first period average of 856.25 PJ (34.3 million tones) to the seventh period average of 6217.62 PJ (248.70 million tones).The coal product are for export commodity and for supplying the demand of the power generation and industrial sector.

Coal export as *bituminous* and *sub-bituminous* coal is projected to increase 6 times during the period, from 425.75 PJ per year (17 million tones) in the first period to 2604.54 PJ per year (± 104 million tones) in the seventh period. Indonesia beside exported coal, also need imported coal especially anthracite type as a reductor in the steel industry.

Domestic coal demand, mostly as a fuel for power generation, is expected to increase at an average of 7.08% per year over the next 35 years or approximately 11 times the current level. This rapid increase of coal demand was the result of the projection made even under the environment constraint consideration. The increase of coal use for power generation is expected to occur drastically from the fifth period This is mainly due to the end of the lifetime of most of the existing oil-power plants and that there will be no new oil-steam power plants to be built in the country in line with the government policy on energy diversification.

Coal use in cement industries is also expected to increase at an average rate of 4.77% per year over the 35-years period. This increase is due to the fact that coal burners in cement industries is cheaper than oil burners. In addition, the increase of coal use in the cement industries is also supported by the government program on energy diversification.

On average, in the first period, about 60.37% of the total coal demand will be that of the power sector. On the seventh period, this share is expected to decrease to 18.86%.

TABLE 5 Production, Export-Import and Utilization of coal

	Production and Utilization (PJ/Year)							
	94-99	99-04	04-09	09-14	14-19	19-24	24-29	%/Yr
Production	856,25	1643,88	2032,28	2633,93	3783,67	5319,42	6217,62	5,83
Import (anthracite+coke)	9,03	6,62	4,95	4,91	5,03	3,03	5,16	-1,59
Export	425,75	979,62	1249,13	1591,64	2028,53	2582,08	2604,54	5,31
Industries	176,69	197,37	235,44	275,52	370,42	489,78	685,43	4,77
Power Generation	269,22	481,87	561,34	780,22	1398,11	2257,16	2948,27	7,08

Source: Output of Model Markal

3.2.4 Renewable Energy

Renewable energy considered in this analysis covers biomass, hydro, geothermal and solar energy.

3.2.4.1 Biomass

Biomass, a non-commercial energy resources that include fire-wood, industrial, agricultural and forestry wastes, are being used for cooking, for industries (boilers and burners) and for power generation. Based on the estimation of the Ministry for Mines and Energy, biomass consumption in 1990 reached 76,69 million tons and increased to 83.82 million tons in 1994. Thus, the biomass consumption increased at an average rate of 2.25% per year over those four years. Considering the lack of an accurate data source of biomass consumption for Indonesia, the data is usually an estimation rather than real data. Consequently there will always a big discrepancy in demand figures from different sources.

The MARKAL Model output indicates that biomass demand over the seven-periods (35-years period) is expected to increase at an average rate of 1.08% per year (Table 6). The largest demand comes from the residential sector even though the average annual growth rate over the seven period is still lower than that of the industrial sector. The high level of biomass

demand in the residential sector is because this energy sources is non-commercial and easily obtained in remote rural areas at a very low investment cost although the stove efficiency is not so high as the other stoves types.

In the industrial sector, biomass is used by those industries that uses biomass in its activities such as wood industry, paper and pulp industries and agricultural based industries. The biomass is used as fuel in boilers or burners.

In power generation, the biomass-fuelled power plants are usually located outside Java and the demand is expected to be decreasing. In the beginning of the study period, the use of biomass for power generation was 16,47 PJ per year or approximately 310 MW.

3.2.4.2 Hydro, Geothermal, and Solar Energy

Hydro, Geothermal and solar energy are used to generate electricity. For hydropower, the generation is differentiated by its capacities. The large hydro plants have capacities more than 15 KVA. Mini-hydro plants have a capacity between 5 KVA and 15 MW while micro-hydro plants are those up to 5 KVA.

The photovoltaic module is being used to generate electricity from solar energy in remote rural areas for household lighting. In addition, solar energy is also used as solar water heater in the residential, commercial and government sectors.

TABLE 6. BIOMASS DEMAND

	Biomass Demand (PJ/Year)							
	94-99	99-04	04-09	09-14	14-19	19-24	24-29	%/Yr
Residential	962,56	1004,88	1034,90	1071,47	1103,13	1126,40	1161,64	0,54
Industry	139,71	152,52	175,61	199,66	279,34	352,44	454,18	3,43
Power Industry	16,47	16,01	15,69	15,52	15,48	10,96	10,92	-1,17
Total Consumption	1118,74	1173,41	1226,20	1286,65	1397,95	1489,80	1626,74	1,08

Source: *Output* Model MARKAL

IV ENERGY RESERVES

4.1 Oil, Natural Gas and Coal

The total oil reserves of Indonesia per 1 January 1999 was million barrels (1.338,41 MTOE). If this reserves level remains constant because of no new additional oil reserves being found and that the production is kept at the 1997 level (74,09 MTOE), then this will mean that the Indonesian reserves will be depleted in the next 18 years (R/P=18 years). Extension of the lifetime of the oil reserves will require very intensive exploration activities.

Natural gas reserves per 1 January 1999 was 165,89 TSCF (3.993,68 MTOE). Using the 1997 production level of 76,22 MTOE, the lifetime of the gas reserves (R/P) will be 52 years. Based on the reserves level, natural gas will have a high possibility to support oil products.

Coal is another energy resources that has a high reserves value. Coal reserves as of 1 January 1999 was 38.008,87 million tonnes (21.279,13 MTOE). Assuming that the yearly production level will be that of 197 (27,98 MTOE), the coal reserves lifetime (R/P) will be 760 years. Table 7 shows the different energy reserves level at the different regions..

TABEL 7 ENERGY RESERVES of INDONESIA
(01-01-1999)

Energy Type	Sumatra	Java	Kaliman Tan	Other Islands	Total	Total MTOE	R/P (Year)
Crude Oil (10^6 bbl)							
- Proven	3.433	738	754	278	5.203		
- Potential	3.597	402	487	134	4.620		
- Total	7.014	1.148	1.246	0.415	9.823	1.338,41	18
Natural Gas (TSCF)							
- Proven	49,205	8,386	31,479	1,100	90,17		
- Potential	45,445	9,830	19,312	1,133	75,72		
- Total	94,278	17,964	51,434	2,214	165,89	3.993,68	52
Coal (Million Tons)							
- Proven	2.491,43	0	2.402,67	0	4.894,09		
- Measured	4.193,61	0,55	5.593,52	23,19	9.810,87		
- Indicated	11 518,56	1,62	11.671,35	112,37	23.303,91		
- Total	18.203,60	2,17	19.667,54	135.57	38.008,87	21.279,13	760

Source: crude oil and natural gas from Pertamina. Coal from Department of Mining and Energy, 30 August 1999
Note: Potential = Possible+Probable
0,1713 x 10^9 Barrel crude oil = 1 PJ; 969,5 MMSCF natural gas = 1 PJ;
0,04169 x 10^6 Ton = 1 PJ; and 1 PJ = 23,34 x 10^3 TOE ; 1 MTOE = 10^6TOE
R/P: (Reserves/Production): assumption that production in year 1999 same as production in year1997

4.2 Hydro, Geothermal and Solar Energy

As of 1 January 1994, the total hydro potential in Indonesia was 75.674 MW and of this, around 3.209,6 MW has been utilized until the end of 1994. For geothermal, the potential as of 1 January 1994 was 19.658 MWe, and the utilization level was 144,5 MWe. The total geothermal potential are differentiated by proven reserves (8,711 MWe) and inferred reserves (10.947 MWe). Both total hydro and geothermal potential is shown in Table 8.

As a tropical country, Indonesia solar potential is very high. However, not all of the sun rays can be absorb because of high humidity. The average solar radiation in Indonesia 4.50 kWh/m^2/day.

TABEL 8 HYDRO AND GEOTHERMAL POTENTIAL

Energy Type	Sumatra	Java	Kalimantan	Other Islands	Total
Hydro (MW)					
- Potential	15.804	4.531	21.661	33.678	75.674
- Total	15.804	4.531	21.661	33.678	75.674
Geothermal (MWe)					
a) Reserves					
- Proven	65	927	-	65	1.057
- Probable	15	470	-	110	595
- Possible	3.065	2.564	-	790	7.059
- Total Reserves	3.145	3.961	-	965	8.711
b) Resources					
- Hypothesis	2.027	1.370	-	550	3.947
- Speculative	4.390	-	-	3.250	7.640
- Total Resources	6.417	1.370	-	3.800	11.587
- Total	9.562	5.331	-	4.765	20.298

Source: KNI-WEC Workshop

V. CONCLUSION

a. In 1994, the industrial sector were the highest energy consumer in the country (38,7% from the total energy demand). This are followed by the transportation sector at 35.3% and the remaining 35.3% will be that of the rescom sector. The total energy demand is expected to continue increasing at an average rate of more than 11% per year. By 1996/1997, the energy demand reached 384,58 million BOE (2.288,25 PJ);
b. The industrial sector, the largest consumer for commercial energy, consumed oil products around 42.05% of its total energy consumption. The remaining total demand of the industrial sector will be that of natural gas, coal, electricity, with shares of 23,40%, 22,40%, 10,83%, and 1,32% respectively.
c. Approximately 99,9% of the total energy consumption are that of oil products (gasoline, solar and diesel). The remaining shares will be that of electricity and gas;
d. Approximately 52,50% of the total rescom sector energy consumption are that of oil products (kerosene). The remaining shares will be electricity (43,25%) LPG (4,20%) and city gas (0,05%);
e. With the assumption that the average GDP growth will around 4.2% per year from 1994 to 2029, the total commercial energy demand of the final sectors (industry, transport, rescom) will be increasing at a rate of 2.99% per year.
f. Total oil reserves of Indonesia per 1 January 1999, was 9.823 million barrels (1.338,41 MTOE). Assuming that the production level remains at the 1997 level of 74,09 MTOE, the reserves lifetime (R/P) will be 18 years. For natural gas, the reserve level as of 1 January 1999 was 165,89 TSCF (3.993,68 MTOE). Assuming 1997 production level (76,22 MTOE) is maintained, the lifetime of gas reserves (R/P) will 52 years. Coal on the other hand still has reserves of 38.008,87 million tons (21.279,13 MTOE) as of 1 January 1999. The lifetime of coal reserves (R/P) will be 760

years based on a production level for 1997 of 27,98 MTOE;

g. Indonesian Oil reserves is limited. Although it is not as clean as natural gas, oil is easy to be used at a very low price. This has made oil product usage increasing rapidly. Consequently, the country imports crude and oil products to balance the domestic production. The share of imports, however, shows a decreasing trend; from 39,13% in first period to 29.27% at the end of the period (seventh period). Natural gas can be categorized as clean fuel, but its growth rate is on average only 1.53% per year;

h. The fastest growth of energy demand domestically will be coal. In the first period, the amount of coal to be supplied reached 440,03 PJ per year (± 17,60 million tons). It increases roughly 8 times over the seven periods (± 145,19 million tons);

i. Geothermal as one of the resources in generating electricity shows a declining trend at the fourth period and by the seventh period, this resource is not able to compete with the other energy source especially hydropower that shows an increase of about 3 times over the seven-period (35-years period).

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OPTIMIZATION OF ENERGY SUPPLY TO FULFILL LONG-TERM ELECTRIC POWER DEMANDS IN INDONESIA

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Abstract

Energy supply optimization aims too meet domestic electricity demands by considering energy reserve and technology options that are efficient and environmental friendly.

Based on output of the MARKAL Model, the priority of efficient technology is more on retrofiting of de-NOx, de-SOx and elective static precipitator on coal utilization. Hydropower and cogeneration have also been chosen for power generation system.

Meanwhile, other clean technologies such as PFBC (Pulverized Fluidized Bed Combustion), IGCC (Integrated Gas Combined Cycle), SHS (Solar Home System), and Fuel Cell are not chosen because their costs make the products non-competitive.

I. INTRODUCTION

Assuming that the national economic growth rate will gradually recover from 2000 and increase to 5.6 in 2029, it is predicted that the domestic energy consumption in the next 35 years will increase by 2.80% per annum. Of the total energy consumed in the period of 1994-1999, around 9% were contributed by electricity and in the period of 2024-2029, this contribution will have increased to 16%.

The largest consumer of electricity in all the periods is the industry sector, followed by residential, and commercial and government sectors. The smallest consumer of electricity is the transportation sector, with only the electric train utilizing electricity. It is expected that electricity will in the future be in higher demands by the community, not only by the industry but also by all the energy user community. This is because electricity may be categorized as clean fuel and does not produce negative impacts on the environment. Besides, it could be easily utilized though the cost of it is still relatively high.

While the utilization of electricity is prospective enough, there are constraints in the generation, as the larger part of the power generation plants in Indonesia use fossil fuel. Accordingly, in order that the power

generation plants will not produce emission that have negative impacts on the environment, and the electricity produced may be utilized continuously, it will be necessary to choose an efficient and environmental-friendly technology by considering the abundant energy reserves and to best possibly utilize renewable energy sources.

The efficient and environmental friendly technology chosen should be that which satisfies the criteria of being reliable, economical, and safe to the environment. It will also be necessary to consider the energy reserves that are still abundant and renewable so that the selection of efficient and environmental friendly technology should give priority of the utilization of coal and hydropower.

To select the best technology and energy in the efforts to fulfill the domestic demands for electric power, a study has been conducted, "Optimization of Energy Supply to Fulfill
Long-Term Electric Power Demands in Indonesia". This study has as its objectives of:

- To identify the types and size of optimum electric power generation capacity in the efforts to fulfill long-term electric power demands in Indonesia;
- To get a picture of future Electric Power Generation in Indonesia;
- To utilize the computer already installed in BPPT.

II. METHODOLOGIES OF THE STUDY

The study of "Optimization of Energy Supply to Fulfill Long-Term Electric Power Demands in Indonesia" requires supporting software, and the choice was the MARKAL Model. The MARKAL was chosen as this model has the ability to analyze the energy system in its entirety including the electricity sector and all the energy system alternatives, including the alternatives of energy sources and energy technology. Accordingly, all the energy variable systems could be transparently observed.

In this study, the optimized choice of electric power generation technology, included the utilization of environmental-clean technology, such as:

- Coal fuel by applying the technologies of CFBC (Circulating Fluidized Bed Combustion), AFBC (Atmospheric Fluidized Bed Combustion), PFBC (Pulverized Fluidized Bed Combustion), IGCC (Integrated Gas Combined Cycle);
- Fuel using Gas Combined Cycle and IGCC technologies;
- Fugitive heat using cogeneration technology;

Solar energy, hydroenergy, and geothermal energy using the technologies of Solar Energy Power Generation, PLTA, Mini/Micro Hydro and PLTP, that are all clean energies for domestic demands.

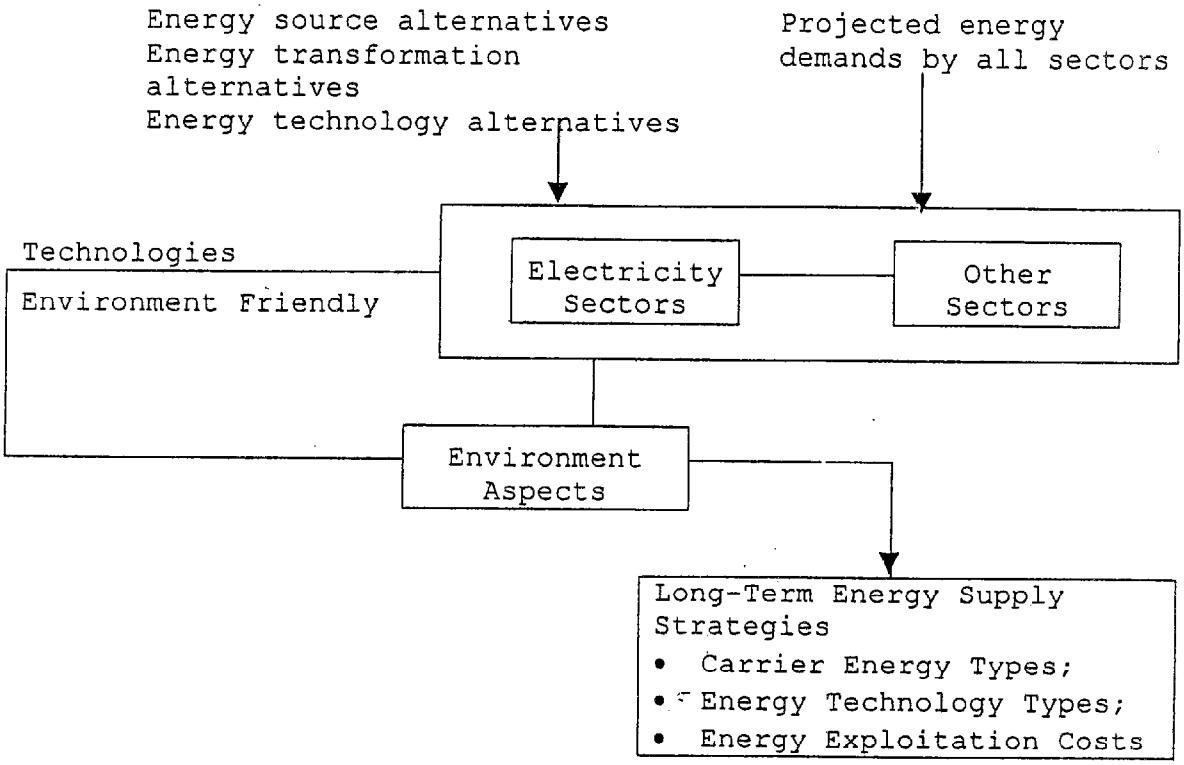

FIGURE 1 OUTLINE OF THE MARKAL MODEL FLOW CHART

By considering low-cost energy provision system, minimum impact of energy use on the environment, and technology options as described above, the MARKAL Model is run. The output of the MARKAL in regard of electricity sector is the generator and the electric generation and capacity that produce positive impacts on the macro economy, ensures long-term energy supply continuity, and promotes the use of non-fossil energy. An outline of the MARKAL Model flowchart is as presented in Figure 1.

III. DATA ANALYSIS OF THE ELECTRIC POWER GENERATION IN INDONESIA

The State Electricity Company (PT PLN), the private sector, industry (captive power) and cooperatives are the organizations that have the authority to produce and distribute electricity to all users in Indonesia. The

installed capacities of the power generating plants in Indonesia are presently as follows:

- In 1995, the total installed capacity of the national electricity generation plants (PLN+private sector, industry and cooperatives) stood at 27,803.83 MW. As many as 53.6% of the total installed capacity of PLN were located in Java.
- In 1996, the total installed capacity of the national electricity generation plants increased to 28,613.44 MW. This total installed capacity already included the captive power of 11,531.009 KVA. Around 47.8% of this total captive power had been connected to PLN network.
- The types and capacity of the national electricity generation in 1996 included oil PLTU (2,504.58 MW), PLTD (10,187.68 MW), oil PLTG (711.95 MW), oil PLTGU (328.95 MW), PLTA (3,366.01 MW), PLTP (307.5 MW), coal PLTU (2,879.56 MW), gas PLTU (1,340.46 MW), gas PLTG (2,591.17), gas PLTGU (4,093.16), and biomass PLTU (302.42 MW).
- In 1997, the total installed capacity of the national electricity generation increased to 39,290.82 MW. This total installed capacity already included the captive power of 20,344.98 KVA. However, in 1998 the captive power experienced a decline to 14,316.83 KVA, while the PLN power generation capacity increased a bit to 20,580.76 MW.

IV. ANALYSIS OF THE STUDY RESULTS

4.1 Predicted Installed Capacity of Power Generation Plants in Indonesia

Based on the output of the MARKAL Model as presented in Table 1, it is expected that the installed capacity of electricity generation plants in Indonesia will increase by on average 2.07% per annum in the period of 1994-2029. The highest increase the installed capacity of electricity generation is identified of the coal PLTU, that increases 10 times in seven periods. With this highest average growth rate, the share of coal PLTU to the total installed capacity increases from 13.15% per annum at the beginning of the period to 68.03% per annum at the end of the period. This high capacity of coal PLTU is attributable to the government's policy of promoting the use of coal that has abundant reserves as fuel for electricity generation. Besides, the power generating cost of coal PLTU can compete that of oil and gas.

TABLE 1. PREDICTED INSTALLED CAPACITIES OF ELECTRIC POWER GENERATORS IN INDONESIA

Energy	Average per Annum (GW)							% growth p.a.
	94-99	99-04	04-09	09-14	14-19	19-24	24-29	
Coal PLTU	4.13	7.39	8.60	12.06	21.41	33.99	43.70	6.97
PLTD	10.46	9.49	8.46	8.27	3.03	3.03	3.02	-3.49
PLTG	2.32	1.93	1.69	1.51	0.75	1.98	1.98	-0.45
PLTGU	3.78	3.78	3.78	3.78	5.73	3.87	3.87	0.07
PLTP	0.83	0.90	0.90	0.90	0.89	0.12	0.00	-
PLTA	3.91	6.29	7.53	9.88	10.84	10.84	10.84	2.96
PLTU Dual Fuel (Olga Steam)	5.67	5.26	4.13	3.58	3.27	0.00	0.00	
Biomass	0.31	0.31	0.30	0.30	0.30	0.21	0.21	-1.11
PFBC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
IGCC Batubara	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Cogeneration	0.00	0.00	0.62	0.62	0.62	0.62	0.62	
PLTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Fuel Cell	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Total	31.41	35.35	36.01	40.90	46.84	54.66	64.24	2.07

Source: MARKAL Model, Output

With the increasing capacity of coal PLTU, the use of oil as fuel for oil/gas PLTD and PLTU will continue to decrease. In the first period, the capacity of oil/gas PLTD/PLTU was on average 51.35% of the total electricity capacity, and in the seventh period this will have decreased to 4.70%. This decrease is in line with the government's plan to connect the Java-Bali interconnection electricity network to become Sumatera-Java-Bali interconnection. Hence, the position of oil/gas PLTD/PLTU will be replaced by large-scale electricity generation plants, such as coal PLTUs. The decline in the oil/gas PLTD and PLTU is also attributable to the limited reserves of our petroleum. The use of oil/gas PLTD and PLTU are only in the areas not covered by interconnection network or in isolated areas.

The capacity of gas-fueled electricity generation is nearly constant in each period. This use of gas is mainly for PLTGU as this generator is of higher efficiency than PLTG.

Renewable electricity generation such as PLTP, PLTA and biomass is expected to increase. The growing role of renewable electricity generation is largely attributable to the increase in the hydropower generation, while the other two renewable electricity generation types decline. The

high increase in the capacity of PLTA is attributable to, in addition to its being of lower cost, its being an electric generation system that does not produce pollutants. The installed capacity of PLTA will increase by 2.96% per annum from the first period trough the seventh period.
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As described in the above methodologies of the study, the identification of electricity generation capacity already takes into account the use of other environmental-friendly technologies such as PFBC, IGCC, cogeneration, SHS and Fuel Cell. However, as the power generation costs of these generators could not compete with conventional generators, except cogeneration, these types of generators are not chosen as future electricity technology.

Cogeneration electricity plants produces, electricity in addition to steam so that it is best used for the industries that still do not utilize their fugitive gas. As the MARKAL outputs show, cogeneration power generators will start competing in the third period with a relatively constant capacity of 0.67 GW through the seventh period.

4.2 Picture of Power Generation Energy Mix in Indonesia in Meeting Long-Term Electricity demands

In 1994-1999 period, the energy sources of coal, fuel oil and geothermal were able to compete in fulfilling energy demands in electricity generation, due to their relatively low utilization costs. However, in the period of 35 years, the use of coal increases most rapidly compared with fuel oil and natural gas, so that by the end of the period, the use of fuel oil and natural gas will have drastically dropped. This is because, in addition to the increasingly limited oil reserves in Indonesia, the use of petroleum is more directed to transportation sector. Meanwhile gas, even with its sufficient reserves will, as with petroleum, also be required as industrial raw material, where it is expected to grow rapidly and effects a high added value.

A close look at the reserves of petroleum, natural gas and coal in Indonesia on January 1, 1999, shows that coal has the largest reserves as an energy source. The reserves of petroleum, natural gas and coal are 1338.41 MTOE, 3993.68 MTOE, and 21,279.13 MTOE respectively.

Besides fossil energy sources (petroleum, natural gas and coal), non-fossil energy sources (geothermal, water, and biomass) are also used as energy sources for electricity generation in Indonesia. Calculation of the three non-fossil energy sources show that the use of water

makes the lowest cost in electricity generation, so that the use of water will keep growing in the periods of the study. Meanwhile, geothermal, while it is clean in use, the exploitation of it requires higher cost than coal equipped with environmental cleaning apparatus, so that geothermal is only used for its lifetime. Biomass is mostly found outside Java and in remote areas so that its the use will decrease by the periods.

The energy consumption for electricity generation by types of energy is as shown in Table 2 and their shares are shown in Table 3 and Graph 1.

TABLE 2. MIX ENERGY CONSUMPTION OF ELECTRIC GENERATION IN INDONESIA

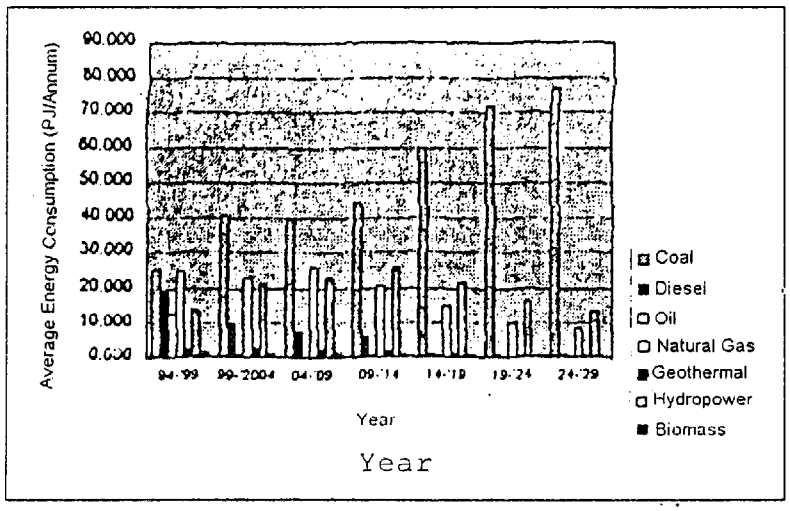
Energy	Average per Annum (PJ/Annum)							% Growth/ Annum
	94-99	99-04	04-09	09-14	14-19	19-24	24-29	
Coal	269.22	481.87	561.34	780.22	1398.11	2257.16	2948.27	7.08
Diesel	204.14	119.22	106.92	103.99	17.40	24.89	24.89	-5.84
Oil	136.35	11.19	0.00	9.50	0.00	0.00	0.00	-
Natural Gas	265.17	269.62	357.58	366.29	349.42	312.02	321.03	0.55
Geothermal	27.14	30.55	30.85	31.11	30.51	8.42	0.00	-
Hydropower	148.56	253.83	323.38	454.22	506.59	506.62	506.62	3.57
Biomass	16.47	16.01	15.69	15.52	15.48	10.96	10.92	-1.17
Total	1067.05	1182.29	1395.76	1760.85	2317.61	3120.07	3811.73	3.61

Source: MARKAL Model, Output

TABLE 3. MIX ENERGY CONSUMPTION SHARE OF ELECTRIC GENERATION IN INDONESIA

Energy	Average per Annum (%/Annum)						
	94-99	99-04	04-09	09-14	14-19	19-24	24-29
Coal	25,230	40,757	40,218	44,309	60,326	72,343	77,347
Diesel	19,131	10,084	7,660	5,906	0,751	0,798	0,653
Oil	12,778	0,946	0,000	0,540	0,000	0,000	0,000
Natural Gas	24,851	22,805	25,619	20,802	15,077	10,000	8,422
Geothermal	2,543	2,584	2,210	1,767	1,321	0,270	0,000
Hydropower	13,922	21,469	23,169	25,795	21,858	16,237	13,291
Biomass	1,544	1,354	1,124	0,881	0,668	0,351	0,286

Source: Markal Model, Output



Graph 1. SHARES OF POWER GENERATORS' MIX ENERGY CONSUMPTION IN INDONESIA

V. CONCLUSIONS

- In 1995, the total installed capacity of the national electricity generation plants (PLN+private sector, industry and cooperatives) including captive power stood at 27,803.53 MW, and in 1996, the total installed capacity of the national electricity generation plants increased to 28,613.44 MW.
- Based on the MARKAL Model outputs, the installed electricity generation capacity in a period of 35 years (1994 to 2029) will grow by 2.07% per annum, with coal PLTU increasing more than 10 times in the seven periods.
- While the utilization of other environmentally-friendly electricity generation technologies such as PFBC (Pulverized Fluidized Bed Combustion), IGCC (Integrated Gas Combined Cycle), SHS (Solar Home System, and Fuel Cell have been considered, these technologies cost high in the utilization for power generation so that they are not taken as options.
- Only PLTA and Cogeneration may be taken as options, as their utilization cost is competitive, PLTA is an electric power generation that does not produce pollutants, while cogeneration can utilize industrial fugitive gas.

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7. COAL POLICY

7.1 Introduction

The coal policy recommendations are developed from:

i. the findings of this study as presented in the first six chapters of this report, and

ii. the March 1997 Draft of the "*General Policy in the Energy Sector (KUBE)*" prepared by the National Energy Coordinating Board (BAKOREN) and described in Part 1 of this report.

Policy recommendations related to institutional matters are presented at the end of Chapter 8.

The policy set out in the draft KUBE follows from Article 33 of the 1945 Constitution which, inter alia, states: "Land and water and natural wealth contained in it is controlled by the State and utilized for the greatest benefit and prosperity of its people". Recognizing Indonesia's strong economic growth, large population and limited energy resources, the vision of the policy set out in the 1997 KUBE has changed from the previous policy as follows:

- from a view of abundance of national energy rescues to one of limited resources
- from oil/gas and coal being sources of foreign exchange and domestic energy to these energy resources being a fuel and raw material for domestic industry which in turn will earn foreign exchange
- from energy prices being below economic value to reflecting economic value

The 1997 KUBE sets out five main policies which are summarized below:

- **Diversification** - a diverse and optimum use of energy resources to the net benefit of the nation, the reduction of the rate of depletion of those resources, and sustained development.
- **Intensification of the search for resources** - the survey and exploration of oil/gas and coal resources to increase reserves on a continuous basis
- **Conservation of energy** - the application of the conservation principle from the exploitation through to final use of energy
- **Energy pricing** - movement towards a price structure which follows the market mechanism
- **Environment** - limitation of damage and degradation to the eco-system as the result of the production, transportation and use of energy

The policy recommendations for coal are made under these five subject headings.

7.2 Diversification

7.2.1 Lignite Generation to Serve the Java Power Market

The Indonesian coal industry, with exception of Bukit Asam serving Suralaya, has developed to serve the export market. The coal-fired power plants being built on Java by PLN and Independent Power Producers (IPP's), which by 2005 will represent over 70% of domestic use, are being designed for the export quality coal that is readily available from Kalimantan.

As noted in Part 5 of this report (i) the reserves of the higher quality coal are not sufficient to serve both an expanding export market and future domestic use and (ii) the substantial, presently untouched, lignite reserves can be used to generate power at essentially the same cost as the higher quality coal. Two lignite options have been identified for serving the Java power market: generation on Java using lignite from Kalimantan or mine mouth lignite generation on Sumatra plus transmission to Java.

Although the costs of power from these two options are similar to the costs of power using higher quality coal, neither of them are included in PLN's plans to 2005, although the Sumatra option is under consideration. Decisions on the lignite options will also be affected by the fact that they:

- require that new mines be opened that will largely be dedicated to serving these power plants; and
- in the case of the Sumatra transmission option, require higher investment (which is offset by lower fuel costs).

Both of these factors increase the financial risk of pursuing these projects relative to the risk of building a power plant and buying the coal from established mines. Given this greater risk, and approximately equal economics with the better quality coal options, these projects are unlikely to proceed without an initiative on the part of government to encourage their implementation.

It is recommended that the Government take the following steps to initiate these two projects:

i. Have prefeasibilty studies prepared of the two lignite options serving Java and compare the resulting costs to the costs of power generation using higher quality coal, i.e. determine whether the findings of this report based on broad brush cost estimates can be confirmed with more detailed assessments;

ii. Examine the options for the ownership, operation and contracting between the mine, plant and transmission line that comprise these two projects, in terms of the role of PLN and private entities;

iii. Based on the findings of i. and ii., determine the incentives that may have to be given to the private entities participating in this in order for them to proceed;

iv. Assuming that the viability of these projects is confirmed, embark on a program through PLN to have additional Java power requirements met with lignite/low quality coal.

This initiative would best be undertaken by a working group made up of representatives of the Director General of Mines drawn from the Directorate of Coal, PLN and the Director General of Electric Power and New Energy with cutside assistance as required particularly in item i. This working group be charged with preparing a report addressing items i, ii and iii and making a recommendation with respect to item iv.

7.2.2 Briquettes

Interest on the part energy planners in briquettes for household, commercial and light industrial use is natural since energy use in these sectors makes up such a large part of Indonesia's total consumption. In 1994, 52% of energy consumption at the level of final demand was by the household and commercial sectors. Of this, 75% was in the form of biomass, mostly firewood, and 20% was in the form of petroleum products, mostly kerosene. In introducing briquettes, the aims are to reduce firewood consumption to ease concerns over deforestation and to reduce kerosene consumption to reduce current consumer subsidies and future oil imports.

Target prices for briquettes are being set at 250 rupiah at the gate of the briquette plant and 350 rupiah at the retail outlet or delivered to the customer. Large new carbonization and briquetting plants like the one recently completed at Tanjung Enim will require subsidies to produce at this price. However, taking account of stove efficiencies, cooking with briquettes that cost 350 rupiah

per kg will be more costly than cooking with unsubsidized kerosene or firewood. Of the three fuels, kerosene can used most efficiently and probably has the lowest cost. It is also the cleanest burning and easiest to use.

The government has a stated objective of increasing briquette consumption, with subsidies if need be. A coherent plan for introducing this fuel is required along with tests of emissions from combustion of the types of briquettes, stoves and furnaces proposed.

Smaller, simpler plants for carbonizing and briquetting may be more economic and warrant further study.

7.2.3 Ownership of the Means of Production

Private Indonesians should have the opportunity (i) to buy ownership in operating mines, as was envisaged in the original first generation contracts (provided that existing owners receive fair prices), and (ii) to invest in new mines. It is noted however that coal mining is a large scale, capital intensive and environmentally intrusive industry requiring a long term commitment by the developer/owner. Given the nature of the industry, achieving Indonesian ownership through the approval of an unlimited number of small and inexperienced mining companies should be avoided.

This opportunity to acquire ownership would be for private Indonesians - government ownership of mining should be limited to its role through PTBA.

7.3 Intensification of Search for Resources

As set out in the previous Part of this report, over 100 Second and Third Generation contractors are entering into the General Survey and Exploration stage of their contracts and will be operating throughout Kalimantan and Sumatra. The challenge to the Government of Indonesia is to collect, utilize and interpret the substantial amount of information that will become available from this activity over the next five years. The necessary organization and staffing to achieve this is described in the next part of this report.

In order to effectively manage and administer the reserve data that will become available, it is recommended that the GOI make independent resource and reserve assessments. To best accomplish this, models should be made of the identified coal basins (starting with the most productive basins) utilizing a standard classification system which recognizes the specific depositional, coal rank, and structural styles of the contained coal deposits. This will bring consistency to the assessment and enable a more accurate assessment of depletion and sustainable production.

7.4 Conservation of Energy

7.4.1 Level of Coal Production

With the reserves of the higher quality coal currently estimated at approximately 6.5 billion tonnes, a long term level of output of 130 Mtpy by 2010 is envisaged in this report starting in 2005. Given the very strong domestic and export markets for this quality coal, and the large number of mining contractors about to be approved as part of the third generation, production could well exceed the 130 Mtpy level, or any other level that the Government may deem to be in the national interest.

The principal means available to the Government of managing total coal production is through the approval of the individual levels of production of each contractor through the CCoW process.

New contractors are required to get approval for production levels as part of the feasibility study approval process and existing contractors must seek approval for changes in their forecast production levels. The agency responsible for coal will need to continually update the reserve estimates, monitor production and make its decisions on individual approvals on the basis of this overall view of the industry.

7.4.2 Coal Mining

Typically when a given reserve is mined operations start at an outcrop and gradually proceed into deeper cover and higher strip ratios. Once mining has ceased at a given site, and the operation has shut down, it is very unlikely to be economic for another mining operation to start up to mine the remaining high cost coal.

It is estimated that 25 to 50% of the 100 plus companies now at the General Survey and Exploration stage will proceed to the Feasibility stage of development. These companies have not been carefully screened and many of them have no mining experience. The challenge to the Government is (i) to insist on detailed feasibility studies that will demonstrate a mine plan to recover all economic reserves and (ii) to monitor the work of each contractor so that all economic reserves are recovered.

Certain coal deposits and seams within deposits will not be economic because of the 13.5% royalty. Lower royalties should be applied in such cases which may include, but not necessarily be limited to, underground mines, isolated properties and low rank coal. A system will have to be put in place to effectively screen applications from coal contractors seeking royalty relief. Generally a system with a lower royalty, rather than lower income taxes, would be more effective in achieving economic recovery of coal since the level of payment to the Government would be a function of the profitability of the operation.

7.4.3 Coal Utilization

The coal fired plants in place and being built in Indonesia are Pulverized Coal units which is the same technology that is used for most coal fired plants throughout the world. In addition to these Pulverized-Coal units, 100 MW Atmospheric Fluidized Bed combustion units are planned for Sumatra. The efficiencies of both the Pulverized Coal and the Atmospheric Fluidized Bed technologies range from 35 to 38%.

The newer technologies of Pressurized Fluidized Bed combustion and Integrated Gasification Combined Cycle have higher efficiencies ranging from 38 to 45% but are not yet fully commercialized. These technologies have higher capital costs and will be most attractive in countries with high coal costs. It is expected that the Pulverized Coal, and to a lesser extent Atmospheric Fluidized Bed because of unit size limitations, will continue to be the most economic means of power generation in Indonesia for several years to come. Thus, no radical changes in technology are expected although the evolution of the newer technologies should be monitored.

7.5 Pricing

Indonesian coal prices are determined by the world markets for steam coal. Indonesian consumers enjoy a transportation advantage relative to export customers and the ability to purchase from numerous domestic sources of supply. It is recommended that this coal pricing framework continue with the only modification being the accommodation of lignite use for power generation as described above.

The use of lignite for power generation will create a separate domestic pricing structure for lignite. This recommendation should only proceed if it is confirmed that lignite fired power

generation is competitive with power that is generated from coal that is internationally traded and priced. As such the lignite price will also be a function of world coal prices.

7.6 Environment

7.6.1 Mining

More clearly defined and enforceable environmental standards should be developed for coal mining operations by:

- establishing more specific and uniform requirements in coal mine environmental monitoring and management plans flowing from the AMDAL process
- developing industry wide mine drainage quality standards

The enforcement function should be improved by making available a wider range of enforcement actions to environment inspectors and the Directorate of Mining Technology.

7.6.2 Coal Utilization

The new source emission standards for coal fired generating plants are comparable to those in developed countries. The new NOx and particulate standards can be met without significant incremental cost but the SO2 standard will require the application of SO2 removal technology when utilizing most Indonesian coals. The generally low sulphur content of Indonesian coal will allow technologies to be used that are considerably less expensive than conventional wet scrubbing. These SO2 removal technologies will add in the order of 5% to the overall levelized cost of power generation.

The new SO2 standard should not be applied retroactively to existing plants if ambient standards are met. In addition, the new standard should be applied as an overall plant average rather than at each stack at a multiple stack facility to comply.

4. POLICY FOR HUMAN RESOURCES DEVELOPMENT IN COAL MINE SECTOR

The government of the Republic of Indonesia already has a program for advancing training system in coal mining technology through both existing training institutions and new training center to be established in the future.

Based on the rapid growth of Indonesian coal industry in a very short time such as within 10 years of production from around 3 million tons to over 50 million tons and even to be expected to double in the next few years, as a consequence the coal industry is generating many social economic benefits for Indonesia, as follows:

- employment for thousands of Indonesian mostly in less developed areas of the country such as Kalimantan and Sumatra which will support the government's program for poverty alleviation;
- transfer of new technologies and skills which are providing Indonesians with a range of direct and indirect benefits and new options for business ventures.

Indonesia's 1945 Constitution emphasises that its natural resources must be used for the maximum benefit of its people. One objective of this policy is to ensure these significant benefits, which are being secured, are more widely publicised than in the past throughout Indonesia. Where possible these should be quantified to make clear that the future growth and development of the coal industry is very much in the interest of the Indonesian people.

In formulating the coal policy for Indonesia, the government has set principal objectives which some of them are closely related to human resources, comprisingly:

- to harness opportunity created by the development of the coal industry to provide economic and social development, and to generate employment in more remote areas of Indonesia;
- to ensure there is an adequate supply of skilled manpower to staff the future expansion of the coal industry;
- to ensure the growth of the coal industry is consistent with the concept of sustainable development and to protect the environment and the safety and health of the industry labour force and its consumers.

Targetary Step

The policy and ideas to the Coal Mining Technology Enhancement Project are as follows:

- Increasing the adequate supply of skilled to staff in the future expansion of coal industry in the far remote areas.
- Increasing employement opportunities and reducing thousands of people living in proverty.
- Introducing the underground Coal Mining Technology with the concept of sustainable Development, Environment Protection, and the Safety and Healty of the labour force.
- Boosting the Implementation of the underground Coal Industry in Indonesia.
- Developing Employements, social and economics benefit for Indonesians.
- Concerning the environment issue arising from the open mine activities.
- Formulating a master plan for the training of the manpower in underground Coal mines.
- Implementing the underground coal technology especially in the development of new coal mines.
- Recruiting the quantity and quality of the manpower for Development of new Coal mines.