GEF

Global Environment Facility

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April 2, 2008

Dear Council Member:

The World Bank as the Implementing Agency for the project entitled ***Indonesia: Geothermal Power Generation Development Program*** has submitted the attached proposed project document for CEO endorsement prior to final Agency approval of the project document in accordance with the World Bank procedures.

The Secretariat has reviewed the project document. It is consistent with the project concept approved by the Council in November 2007 and the proposed project remains consistent with the Instrument and GEF policies and procedures. The attached explanation prepared by the World Bank satisfactorily details how Council's comments and those of the STAP have been addressed.

If by April 30, 2008, I have not received requests from at least four Council Members to have the proposed project reviewed at a Council meeting because in the Member's view the project is not consistent with the Instrument or GEF policies and procedures, I will complete the Secretariat's assessment with a view to endorsing the proposed project document.

We have today posted the proposed project document on the GEF website at www.TheGEF.org. If you do not have access to the Web, you may request the local field office of UNDP or the World Bank to download the document for you. Alternatively, you may request a copy of the document from the Secretariat. If you make such a request, please confirm for us your current mailing address.

Sincerely,

Monique Barbut
Chief Executive Officer and Chairperson

Attachment: Project Document

cc: Alternates, GEF Agencies, STAP, Trustee

REQUEST FOR CEO ENDORSEMENT/APPROVAL

PROJECT TYPE: Full-sized Project
THE GEF TRUST FUND

Submission Date: February 29, 2008
Re-submission Date:

PART I: PROJECT INFORMATION

GEFSEC PROJECT ID: 3296
GEF AGENCY PROJECT ID: P099757
COUNTRY(IES): Republic of Indonesia
PROJECT TITLE: Geothermal Power Generation Development
GEF AGENCY(IES): World Bank
OTHER EXECUTING PARTNER(S): Ministry of Energy and Mineral Resources
GEF FOCAL AREA(S): Climate Change
GEF-4 STRATEGIC PROGRAM(S): CC-SP3-RE
NAME OF PARENT PROGRAM/UMBRELLA PROJECT: NA

Expected Calendar	
Milestones	**Dates**
Work Program (for FSP)	November 2007
GEF Agency Approval	March 2008
Implementation Start	May 2008
Mid-term Review (if planned)	December 2009
Implementation Completion	June 2011

A. PROJECT FRAMEWORK

Project Objective: To assist the Government in removing key barriers to the development of geothermal resources so that Indonesia can scale-up on-grid renewable power generation that will lead to the reduction of emissions of greenhouse gases.

Project Components	Indicate whether Investment, TA, or STA**	Expected Outcomes	Expected Outputs	Indicative GEF Financing*		Indicative Co-financing*		Total ($)
				($)	%	($)	%	
1. Policy Framework for Scaling up Development	TA	Improved investment climate for developing geothermal power projects	• Policy to address incremental costs adopted • Upstream resource risk mitigation mechanism in place • Implementation regulations of the Geothermal Law issued	1,100,000	30	2,500,000	70	3,600,000
2. Transactions Management for Mobilizing Investments	TA + (leveraged investment)	Increased market uptake of geothermal power	• Model procedures and standardized documentation for competitive bidding of geothermal power transactions adopted • Financial closure for about 300 MW additional geothermal power in fields that are controlled by existing operators • Financial closure for one power project (= 50MW) in a new geothermal field competitively tendered based on the Geothermal Law	2,350,000	70	1,000,000 (expected to leverage investments of $700,000,000)	30	3,350,000

3. Technical Capacity Building for Sustained Sector Growth	TA	Enhanced national capacity to support sustained sector development	• Relevant agencies for undertaking geothermal transactions trained through on-the-job programs as well as 5-10 workshops and seminars • Awareness raising and information dissemination activities about sector policies and business opportunities conducted through promotional campaigns including 5-10 stakeholder dialogue seminars • Strategy for domestic geothermal technology development formulated	350,000	22	1,300,000	78	1,650,000
4. Project management				200,000	50	200,000	50	400,000
Total project costs				4,000,000	45	5,000,000	55	9,000,000

* The percentage is the share of GEF and Co-financing respectively to the total amount for the component.
** TA = Technical Assistance; STA = Scientific & technical analysis.

B. FINANCING PLAN SUMMARY FOR THE PROJECT ($)

	*Project Preparation**	*Project*	*Agency Fee*	*Total at CEO Endorsement*	*For the record: Total at PIF*
GEF		4,000,000	400,000	4,400,000	4,400,000
Co-financing	170,500	5,000,000		5,170,500	5,170,500
Total	170,500	9,000,000	400,000	9,570,500	9,570,500

***** Please include the previously approved PDFs and PPG, if any. Indicate the amount already approved as footnote here and if the GEF funding is from GEF-3. Provide the status of implementation and use of fund for the project preparation grant in Annex D.

C. SOURCES OF CONFIRMED CO-FINANCING, including co-financing for project preparation for both the PDFs and PPG. (expand the table line items as necessary)

Name of co-financier (source)	*Classification*	*Type*	*Amount ($)*	*%**
Government of Indonesia	National Government	Budget	5,000,000	96.7
World Bank	Implementation Agency	Grant	170,500	3.3
Total Co-financing			5,170,500	100

* Percentage of each co-financier's contribution at CEO endorsement to total co-financing

D. GEF RESOURCES REQUESTED BY FOCAL AREA(S), AGENCY(IES) OR COUNTRY(IES)

This is a single focal area, single country, and single GEF agency project.

E. PROJECT MANAGEMENT BUDGET/COST

Cost Items	*Total Estimated person weeks*	*GEF ($)*	*Other sources ($)*	*Project total ($)*
*Local consultants**	220	200,000		200,000
*International consultants**				
*Office facilities, equipment, vehicles and communications***			200,000	200,000
*Travel***				
Total		200,000		200,000

* Provide detailed information regarding the consultants in Annex C.

** Provide detailed information and justification for these line items.

F. CONSULTANTS WORKING FOR TECHNICAL ASSISTANCE COMPONENTS:

Component	*Estimated person weeks*	*GEF($)*	*Other sources ($)*	*Project total ($)*
*Local consultants**	510	765,000		765,000
*International consultants**	393	2,425,000		2,425,000
Total	903	3,190,000		3,190,000

* Provide detailed information regarding the consultants in Annex C.

G. DESCRIBE THE BUDGETED M&E PLAN:

The monitoring and evaluation (M&E) will be guided by the results-based framework, which includes specific and measurable performance indicators for the proposed project (Annex A). DGESGWM will develop an M&E Plan as part of its Project Implementation Plan and will be responsible for collection of qualitative and quantitative data for the baseline, as well as for assessment of the relevance, effectiveness and efficiency of the proposed interventions on an annual basis. These M&E activities will be supported by project management budget co-financed by GEF. The M&E will be strengthened by the Bank's bi-annual supervision missions during which the progress toward delivery of outputs and achievement of results will be reviewed, key implementation issues will be identified, and actions to solve them will be initiated. The mid-term review of the project is scheduled in about 18 months from the project effectiveness date.

PART II: PROJECT JUSTIFICATION

A. DESCRIBE THE PROJECT RATIONALE AND THE EXPECTED MEASURABLE GLOBAL ENVIRONMENTAL BENEFITS:

Indonesia has the world's largest geothermal power development potential, estimated to be about 27 GW. So far, around 60 geothermal fields have been identified, and 36 of which are ready for detailed exploration or exploitation. However, only about 807 MW have been developed, accounting for less than 3 percent of the identified potential.

The Government of Indonesia (GoI) has recently stepped up its efforts to expand geothermal power development. In 2003, the Geothermal Law was promulgated to open up new opportunities for private and public investments in the sector. A road map for geothermal power was also developed, establishing a progressive target of 6,000 MW of installed geothermal power capacity by 2020. However, three years after the passage of the Law, Indonesia is still facing major hurdles in attracting investors as well as financing for developing its geothermal resources. Recent estimates suggest that Indonesia's geothermal power capacity would only increase by about an additional 300 MW by 2008, falling 75 percent short of the incremental GoI target of 1,200 MW established for this period. Given this pace of development, the installed geothermal power capacity over the long-term is likely to reach only about 2,800 MW by 2020, falling 3,200 MW short of GoI's goal of 6,000 MW. With a projected doubling of electricity demand in the next 10 years, mostly to be met through the expanded use of fossil fuels, any shortfall in the expansion of geothermal power generation capacity would be met through coal-fired power plants. This would result in significantly greater green house gas emissions that would adversely impact the global environment.

The key barriers that have hindered GoI's effort to scale-up geothermal development include: (i) lack of a policy framework that provides sufficient economic incentives, proper risk mitigation, sector coordination, and regulatory certainty for investing in geothermal power; (ii) lack of government management, planning, and implementing capacity to effectively engage investors through efficiently conducted geothermal power development transactions; and (iii) insufficient domestic technical capacity – in areas of planning and managing geothermal resources as well as resource assessment, equipment manufacturing, and construction – to support sustained growth in the sector. Without removing these barriers, it is unlikely that Indonesia will be able to exploit its vast geothermal power potential, locking away sizable economic benefits to the country as well as significant global environmental benefit.

The proposed project will assist the GoI in its efforts to remove these key barriers to geothermal development by: (i) developing and implementing economic incentives and upstream risk mitigation policies, which will provide a level playing field for geothermal power vis-à-vis coal-based power; (ii) assisting with the formulation and delineation of detailed implementation regulations of the Geothermal Law; (iii) creating a coordinated sector approach to manage geothermal power procurement using best-practice processes and documentation; (iv) developing deals and assisting transactions management of geothermal power projects to reach financial closures for a group of projects where partially developed fields will be expanded, as well as for an undeveloped "green-field" project, where the integration of upstream exploration and downstream power generation activities is needed; and (v) training of staff of the recently-created geothermal department in the Ministry of Energy and Mineral Resources, as well as other concerned national and local government agencies and staff, on transacting geothermal power projects and formulating a sector strategy on domestic technology development.

The proposed project is expected to have a sizable immediate impact as well as sustained long-term benefits. It is designed to directly leverage significant private and/or public investments by the time of project completion. These initial projects are expected to total about 350 MW of power generation capacity (about 300 MW from expanding existing fields and upwards of 50 MW from a new Greenfield site) that could leverage financing upwards of US$700 million by the completion of the proposed GEF assistance. The expected global environmental benefits of this immediate expansion is estimated to be 60 million tons of avoided CO_2 emissions (over the lifecycle of the geothermal power plants) resulting directly from the incremental installed geothermal power capacity (replacing fossil fuel-based technologies). The impact of the project will also extend over the longer-term, with the reforms enabling the GoI to achieve their geothermal expansion target with an estimated incremental geothermal power capacity of 3,200 MW helping GoI reach its 2020 target of 6,000 MW. The commensurate long-term global environmental benefits will be much larger, and are estimated to be in the order of 500 million tons of avoided CO_2 emissions over the life-cycles of the incremental geothermal power capacity

B. DESCRIBE THE CONSISTENCY OF THE PROJECT WITH NATIONAL PRIORITIES/PLANS:

The GoI is aiming to diversify its power generation mix to enhance energy security and support economic growth in a sustainable manner. Given that most of the proposed capacity expansion will be from fossil fuel-based sources, this places environmental sustainability at risk unless renewable resources such as geothermal are developed rapidly. Scaling-up the use of geothermal power generation capacity, therefore, is essential to back-up GoI's explicitly stated actions to be taken towards limiting greenhouse gas emissions in the energy sector in Indonesia's Initial National Communication to the UNFCCC. These include two specific actions relevant to the proposed project: (i) phasing out fuel and electricity subsidies; and (ii) promoting the use of renewable energy, especially from geothermal resources. Consequently, the GoI has intensified its efforts to scale up geothermal power development in the past few years. In addition to issuing the Geothermal Law and a subsequent "Blueprint for Geothermal Development in Indonesia," establishing development targets, GoI have also established a Directorate for Geothermal under the Ministry of Energy and Mineral Resources (MEMR) in 2005 to spearhead geothermal power development and strengthen sector management. In 2006, MEMR also initiated a study supported by the Japan International Cooperation Agency (JICA) to revise and update the geothermal development blueprint. Despite this renewed commitment to developing the sector, there has been little investment in geothermal development since the Asian Financial Crisis in the late 1990s, due to significant barriers that still remain. Therefore, the proposed project aims to build upon recent reforms to address the remaining major impediments to sector development so that GoI can achieve the goals established in their geothermal power development program.

The World Bank is already supporting the GoI with its infrastructure and energy sector reform efforts, and has been requested by the MEMR to assist geothermal power development. The proposed project would be an expansion of work already underway in the geothermal sector, where the World Bank has been advising the MEMR on its reform agenda. A recently-commissioned study by the World Bank on identifying barriers that prevent greater levels of investments in

geothermal is serving as input into designing the reform program. Furthermore, the World Bank is facilitating a carbon finance transaction of the Lahendong geothermal project, which will provide lessons for further refining the Government's program for geothermal policy reform.

The World Bank also has a significant engagement in helping the Government expand investments in the infrastructure sector through public-private partnerships, which would also benefit geothermal power development. As a result, present work through the Infrastructure Development Policy Loan, Private Participation in Infrastructure Technical Assistance Project, the Guarantee Fund, and the Infrastructure Facility, could be well placed to support the expansion of geothermal power. In fact, the transactions that are expected to be tendered through the proposed project would be consistent with the national agenda for developing international caliber model projects that could serve as examples to be replicated in subsequent competitive tenders.

C. DESCRIBE THE CONSISTENCY OF THE PROJECT WITH GEF STRATEGIES AND STRATEGIC PROGRAMS:

The proposed project is fully consistent with the GEF-4 Climate Change Focal Area Strategic Objective 4 to promote on-grid renewable energy by scaling up base-load geothermal power generation. The proposed barrier removal activities promote market approaches (economic incentives and transparent commercial transactions) for the economic supply of geothermal power in grid-based systems and fit well with the GEF-4 Climate Change Focal Area Strategic Program 3.

D. OUTLINE THE COORDINATION WITH OTHER RELATED INITIATIVES:

The Japan International Corporation Agency (JICA) is currently undertaking a detailed technical assessment of geothermal resources across the country that will be used to update the sector Road Map and formulate a Master Plan for Geothermal Power Development in Indonesia. The proposed GEF project will utilize these results in developing the detailed design of each component. The two efforts are being effectively coordinated by the Ministry of Energy and Mineral Resources, which is the counterpart of both projects. In fact, the interim report of the JICA study has already provided a wealth of data and information for the economic analysis of the proposed project. The project will also work closely with the World Bank's Carbon Finance Group to explore the opportunities for supporting geothermal projects by augmenting finances with proceeds from carbon off-set trading utilizing the Clean Development Mechanism (CDM), or any post-Kyoto Protocol carbon credit schemes which may emerge in the next few years.

E. DESCRIBE THE INCREMENTAL REASONING OF THE PROJECT:

Despite the various reform efforts made by the GoI recently, there has been very little investment in geothermal, even in fields that are already partially developed. Therefore, the Baseline Scenario assumes a gradual ramping up of the geothermal power generation in the partially developed fields with no development in unexplored "green" fields. This would amount to about 2,000 MW of total additional power capacity by 2020 for a total of around 2,800 MW installed capacity, less than half of the 6,000 MW target set by the Government. The shortfall in expected geothermal power would translate into the need for development of around 3,200 MW of additional base-load power capacity utilizing coal, which would be the least-cost expansion option without considering global environmental implications. In the absence of the GEF barrier-removal activities, the GoI will be challenged to mobilize investments to expand the generation capacity in its geothermal fields. There would be neither firm economic incentives for developers nor concrete measures to mitigate the upstream resource development risks faced by investors. Presently, the GoI also does not have a credible process for transacting undeveloped geothermal fields in a well-structured and transparent manner, which, as a result, undermines investor confidence. Furthermore, developers will find difficulty in implementing projects due to a lack of coordination among the various government agencies. As a result, the investment environment will remain risky, costly, and time consuming. Based on the present level of reforms given the barriers facing the sector, a business environment conducive to public and private participation in developing geothermal power generation capacity is unlikely to develop quickly. Therefore, the GoI would not be able to scale-up sector development in line with the Geothermal Blueprint targets.

Compared with the Baseline Scenario, the proposed project will provide GoI with the necessary support to implement an integrated set of actions to comprehensively address the major constraints on investing in geothermal power and lead to the accelerated development of geothermal resources in Indonesia. With an enabling policy framework in place, successfully demonstrated transaction procedures, and strengthened government capacity to support sector growth, it is expected that Indonesia will be able to quickly take advantage of its sizable proven geothermal power potential in the fields already partially developed or with confirmed reserves (up to 2,000 MW), and effectively tap into its larger pool of economically viable undeveloped geothermal fields. Over the long-term, the proposed project will help geothermal power

become more competitive among alternative energy sources through its capacity building measures that will enhance sector management and domestic participation. Therefore, the GEF alternative scenario assumes a fast scaling-up of installed geothermal power capacity and that GoI's goal of developing 6,000 MW geothermal power by 2020 is attainable. Consequently, Indonesia would have 3,200 MW of additional geothermal power generation capacity than under the baseline scenario, replacing an equivalent amount of coal-fired generation capacity. Additionally, the measures instituted through the GEF project would be available to facilitate the development of the remaining resources beyond 2020.

F. INDICATE RISKS, INCLUDING CLIMATE CHANGE RISKS, THAT MIGHT PREVENT THE PROJECT OBJECTIVE(S) FROM BEING ACHIEVED AND OUTLINE RISK MANAGEMENT MEASURES:

Unfavorable overall investment climate in Indonesia would impact all sectors including geothermal power. The Indonesian economy has been recovering robustly from the financial crisis and grew at nearly 6 percent during each of the past three years. Stronger economic growth and an improving overall investment climate are expected in the coming years. This positive outlook has been strengthened particularly after the investment rating for Indonesia was recently upgraded.

Lack of inter-governmental coordination and support that may lead to a fragmented approach which would undermine the implementation of the reform program. This could particularly be the case where multiple agencies are concerned. The project, through the MEMR, adopts a continuous consultation approach to engage other concerned government agencies, especially the Ministries of Planning and Finance as well as local governments who, under the 2003 Geothermal Law, have an increased role in the sector, throughout the preparation of the project, and there are indications of broad support for the proposed policy measures. Effective coordination of their support would be further required in obtaining development permits, conducting transactions, and garnering possible funding that may be required to support an incentive mechanism or risk mitigation instrument.

Lack of interest among investors due to concerns of insufficient regulatory certainties and inadequate financial returns. Reports and numerous stakeholder meetings indicate that investor interest in the geothermal sector is high, but implementing the GoI reform program with concrete results is vital to gaining investor confidence that would support significant investments in the sector. The main activities of the proposed project are geared toward achieving investment results by building the confidence of major stakeholders in developing supportive policies and implementing them in actual transactions.

Inadequate coordination between geothermal and power sectors, especially the lack of buy-in from PLN, the state-owned national power monopoly. The Ministry of Energy and Mineral Resources is well placed to coordinate policy between the geothermal and the power sector since both policy making groups are based within the ministry. Ways to better integrate the two sectors have already been identified during project preparation and will be facilitated during project implementation. Moreover, the Ministry of Energy is responsible for regulating PLN, and has maintained a close engagement with them during the preparation of the project. This engagement is expected to continue during project implementation as well.

G. EXPLAIN HOW COST-EFFECTIVENESS IS REFLECTED IN THE PROJECT DESIGN:

The proposed project is designed to achieve a high level of immediate as well as long-term leverage of investments in geothermal power generation that will have a long term impact. This is achieved through an integrated set of activities that include support to the Government's ongoing policy reforms, especially a geothermal pricing mechanism, and helping concerned agencies develop their capacity to conclude investment transactions including the actual undertaking of an internationally competitive tender of a geothermal project. As a result of these interrelated undertakings, it is expected that some US$700 million in investments will be leveraged that will result in an additional capacity of 350 MW of power generation capacity by the completion of the project (3 years). Substantially more investments will result over the longer term (next 12 years or so), as the project undertakings will extend to help the Government realize its geothermal development target of 6,000 MW total installed geothermal power capacity by 2020, compared with 970 MW of capacity available as of 2006.

The cost effectiveness of mitigated CO_2 emissions (over lifecycle of power plants) is evaluated based on incremental geothermal power capacity (financial closure) achieved at the completion of the proposed project (350 MW), compared with coal-fired power with local environmental controls (particulates and sulfur dioxide). The overall cost-effectiveness

of mitigated CO_2 emissions is estimated at about US$12/ton-$CO_2$ abated. The cost-effectiveness of GEF financing (undiscounted) is about US$0.07/ton-$CO_2$ abated.

PART III: INSTITUTIONAL COORDINATION AND SUPPORT

A. PROJECT IMPLEMENTATION ARRANGEMENT:

The proposed project will be implemented by the Ministry of Energy and Mineral Resources through its Directorate General of Mineral, Coal and Geothermal (DGMCG). The MEMR is uniquely positioned to implement the proposed project for it is the sole national agency responsible for policy formulation and regulation of both the power sector and the geothermal sector. The Directorate of Geothermal Enterprise Supervision and Ground Water Management (DGESGWM) under the DGMCG will be the executive implementation unit.

A Stakeholder Advisory Group will be established by DGESGWM to review and comment on key project outputs, including intermediate results, and help enhance the focus and effectiveness of the policy recommendations. The advisory group will consist of senior officials/experts from the Ministries of Finance, Planning, Forestry, and Environment, as well as MEMR, PLN, and major investors/operators of geothermal power projects in Indonesia. The advisory group will meet twice a year or depending on work progress.

DGESGWM will hire a full-time Project Manager to assist project implementation. The project manager will report directly to the director of DGESGWM and will be responsible for work planning, day-to-day coordination of project implementation activities, project progress monitoring and reporting. Additional consultant support may be hired on a short term basis to provide project implementation assistance as needed.

PART IV: EXPLAIN THE ALIGNMENT OF PROJECT DESIGN WITH THE ORIGINAL PIF:

The project design remains fully aligned with the original PIF. The project components, outcome and output are consistent with the original PIF. Financing plan and confirmed co-financing are consistent with the indicative figures in the original PIF.

PART V: AGENCY(IES) CERTIFICATION

<table>
<tr><td colspan="2">This request has been prepared in accordance with GEF policies and procedures and meets the GEF criteria for CEO Endorsement.</td></tr>
<tr><td> 

Steve Gorman
GEF Executive Coordinator</td><td>Project Contact Person</td></tr>
<tr><td>Date: March 04, 2008</td><td>Tel. and Email:</td></tr>
<tr><td>

Name & Signature
GEF Agency Coordinator</td><td>

Project Contact Person</td></tr>
<tr><td>Date: (Month, Day, Year)</td><td>Tel. and Email:</td></tr>
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ANNEX A: PROJECT RESULTS FRAMEWORK

PDO	Project Outcome Indicators	Use of Project Outcome Information
Promote the development of economic and environmentally-sound geothermal power generation. Reduce CO_2 emissions by increasing electricity supply from geothermal power plants.	• Installed geothermal power capacity resulted from the investment transactions assisted by the project • Avoided CO_2 emissions by substituting geothermal power for coal-fired power	Y1-Y3: It is expected that the project outcome will be achieved toward the end of project implementation, building on continuous progress of the project components during the implementation period. It is especially critical to closely monitor the progress in policy development and adoption. Mid-term review to determine necessary actions and adjustments.
Intermediate Outcomes	**Intermediate Outcome Indicators**	**Use of Intermediate Outcome Monitoring**
Component 1 Improved investment environment for geothermal power projects	• Policy to address incremental costs adopted by GoI • Upstream resource risk mitigation mechanism in place • Implementation regulations of the Geothermal Law issued by GoI	Y1-Y2: Lack of GoI commitment to implement selected pricing mechanism would indicate weak political support to accelerating geothermal power development, especially in partially developed fields. Y1-Y2: Indecision on risk mitigation mechanisms would signal uncertain GoI commitment to developing greenfield geothermal resources. Y1-Y2: Delayed promulgation of the Implementation Regulations of the Geothermal Law may imply increased legal complexity for developing greenfield geothermal resources in the wake of government decentralization.
Component 2 Increased market uptake of geothermal power	• Model procedures and standardized documentation for competitive bidding of geothermal power transactions adopted by MEMR • Financial closure for about 300 MW additional geothermal power in fields that are controlled by existing operators • Financial closure for one power project (= 50MW) in a new geothermal field competitively tendered based on the Geothermal Law	Y1-Y3: Delays may indicate difficulties encountered in policy development and adoption (Component 1) and/or inefficient project implementation management. Need to pay special attentions to sequences of and the cross links between policy work and transactions assistance.
Component 3 Enhanced government capacity to support sustained sector development	• Relevant agencies for undertaking geothermal transactions trained through on-the-job programs as well as 5-10 workshops and seminars • Awareness raising and information dissemination activities about sector policies and business opportunities conducted through promotional campaigns including 5-10 stakeholder dialogue seminars • Strategy for domestic geothermal technology development formulated	Y1-Y3: Determine effectiveness of training and awareness programs and adjust as needed.

Arrangements for Results Monitoring

		Target Values			Data Collection and Reporting		
Project Outcome Indicators	**Baseline**	**YR1**	**YR2**	**YR3**	**Frequency and Reports**	**Data Collection Instruments**	**Responsibility for Data Collection**
Installed geothermal power capacity resulted from the investment transactions assisted by the project	0	0	0	350 MW	Annual	Surveys and Government Statistics	Directorate of Geothermal Enterprise Supervision and Ground Water Management (DGESGWM)
Avoided CO_2 emissions by substituting geothermal power for coal-fired power	0	0	0	2,000,000 tonnes/year			
Intermediate Outcome Indicators							
Component 1	Not Applicable				Annual	Project reports	DGESGWM
• Policy to address incremental costs adopted		Option selected	Funding secured	Applied in transactions			
• Upstream resource risk mitigation mechanism in place		Option selected	Funding mechanism confirmed	Implementation arrangement for mechanism developed			
• Implementation regulations of the Geothermal Law issued		Draft	Final draft	Promulgated			
Component 2	Not Applicable				Annual	Project reports	DGESGWM
• Model procedures and standardized documentation for competitive bidding of geothermal power transactions adopted		NA	Final drafts	Applied			
• Financial closure for about 300 MW additional geothermal power in fields that are controlled by existing operators		NA	NA	Target achieved			
• Financial closure for one power project (= 50MW) in a new geothermal field competitively tendered based on the Geothermal Law		NA	NA	Target achieved			
Component 3	Not Applicable				Annual	Project reports	DGESGWM
• Relevant agencies for undertaking geothermal transactions trained through on-the-job programs as well as 5-10 workshops and seminars		2 Workshops	3 Workshops	2 Workshops			
• Awareness raising and information dissemination activities about sector policies and business opportunities conducted through promotional campaigns including 5-10 stakeholder dialogue seminars		2 Workshops	2 Workshops	3 Workshops			
• Strategy for domestic geothermal technology development formulated		NA	Final draft	NA			

ANNEX B: RESPONSES TO PROJECT REVIEWS

1. STAP Roster Reviewer Comments and Executive Agency Responses

World Bank Indonesia Geothermal Power Generation Development Project:
Review and Comments

by

Jayant Sathaye

Senior Staff Scientist, Lawrence Berkeley National Laboratory, USA

25 November 2007

Summary and Conclusion

The goal of this project is to promote geothermal energy development in Indonesia as an alternative to the development of coal power plants. This will help reduce emissions of particulates and sulfur and nitrogen oxides, and carbon dioxide, which is a major contributor to climate change. Indonesia possesses significant geothermal resources but its exploitation is hampered because of the lack of capacity in project development and also lack of ready access to investment in this resource. The project aims to address both issues.

The technical problems identified by the World Bank are familiar and widespread in many electricity generation companies in developing countries. Lack of knowledge about the design and implementation of new generation technologies particularly renewable ones is not uncommon. The project thus provides a viable platform for improving Indonesia's capability in this sector. It is technically feasible and manageable and reflects priorities that will have both local and global benefits. It will also enhance the credibility of geothermal energy as a developable resource in Indonesia and other countries.

In summary, this project is well suited to provide tangible sustainable development benefits in the power generation sector in Indonesia. .

General and specific comments by paragraph are noted in the sections below.

General Comments

The project is aimed at improving the exploitation of brownfield and greenfield geothermal energy resources. The proposed project will build capacity for project design and implementation, and increase access to investment in this sector. The project goals are not tied to an IBRD loan since that might delay the development of geothermal resources in the country. While this is acceptable, it is important that the project activities be closely tied to some ongoing investment program in geothermal energy. This would enable the project to demonstrate tangible benefits of capacity building that otherwise might be difficult to track and verify.

***Response*: The proposed project is indeed closely tied to actual investments in geothermal power development by investors and project developers. This is supported by Component 2 of the proposed project which will assist GoI undertake actual investment transactions and leverage in excess of 350 MW of geothermal power generation capacity (at least 300 MW brownfields and at least 50 MW greenfields). More importantly, the policies and model transaction procedures developed and implemented in the proposed project will continue to progressively catalyze up to 3,200 MW incremental geothermal power capacity by 2020. Paragraph 19 in the revised PAD better reflects these linkages.**

The project appraisal document (PAD) does not provide a description of Indonesia's geothermal resource and the technologies that will be used in brownfield and greenfield projects to exploit the resources. A description of the steam

or hot water temperature, field depth, level of impurities, types of turbines used to extract energy, etc. will help the reader to relate the costs with resource size and efficiency estimates.

***Response**: The Japan International Corporation Agency (JICA) has sponsored a comprehensive geothermal resources assessment of Indonesia for the preparation of GoI's Master Plan for Geothermal Power Development. The interim JICA report, which contained detailed data and information of 51 geothermal fields with a total estimated capacity of 13, 824 MW, provided the basis for the cost and technical evaluation of geothermal power investments during the preparation of the proposed project. The JICA report and the cost analysis report are in the project file (Annex 12 of PAD)*

Geothermal electricity generation typically releases some greenhouse gases, particularly carbon dioxide. Admittedly, these are relatively small compared to those from the major alternative, coal power plants, but need to be accounted for in the document. For instance, a survey of geothermal facilities in several countries concluded that the carbon dioxide coefficient was 122 g/kWh.[1]

***Response**: The relatively smaller emissions from geothermal plants is already reflected in the estimation of avoided CO2 emissions.*

Specific Comments

I would like to suggest the following specific considerations to improve various sections of the main text, and appendices.

Section A. Strategy Context and Rationale

- Para (P).3 What were the lower tariff levels? Can you provide a range?

***Response**: The original tariffs ranged from 7-9 US cents and they were renegotiated to around 5 US cents.*

- P. 5 It would be useful to provide information on the range of geothermal and coal power plant costs in Indonesia.

***Response**: Both geothermal and coal capital cost estimates are indicated in the economic and financial analysis section (Annex 4). Further underlying assumptions are on project file in the study by Japan International Corporation Agency (JICA).*

Section B: Project Description

- P.6-C1.1 Please list the types of preliminary alternative policy and technology options that MEMR could choose from. Will R&D be one of the options?

***Response**:* **Alternative policy options that were considered during project preparation are described in Section 5 of the PAD. In terms of technology choice, it is optimally determined by the developers who will be making the investment rather than being predetermined by the Government. Therefore, the MEMR, b design, would not want to pre-specify a technical solution, and instead provide developers with the latitude to evaluate each field and determined the most suitable and least cost technological option.**

- P.6-C1.2 Please list the countries with geothermal resources that you are referring to here and also list the types of options that they have or are taking into consideration.

***Response**: this is summarized in Paragraph 29 as well as Annex 4 of the PAD.*

Annex 1. Country and Sector Background:

- P.20 – I am somewhat surprised that Indonesia has extensive geothermal resources but the resource is not cost-effective enough to generate electricity when compared with coal powered generation. In California, geothermal

[1] http://www.pi.energy.gov/enhancingGHGregistry/comments/documents/davis.pdf

has traditionally out-competed other baseload resources. Here it would be good to add more background on technologies, quality of resource base, and the cost of generating electricity relative to other locations worldwide.

***Response**: the costs are higher in Indonesia in large part due to the fact that most geothermal power components have to be imported from industrialized countries and have limited related human resources, while new coal-fired plants using Chinese technologies are significantly cheaper than similar plants relying on technologies from industrialized countries, such as Japan.*

Annex 4. Results of Project Analysis

- P.28 – The three basic approaches for estimating local pollution damage costs are appropriate. However, the SO_2 and NOx costs in the US were to a large extent driven down by the increased availability of low sulfur coal and not as much due to technological improvement. A similar situation could arise in Indonesia if low sulfur coal is utilized as an alternative source of coal. This should be noted either in the text or as a footnote so that the reader is aware of the source of the costs and also its implications for the Indonesia situation.

***Response**: Footnote added in Annex 4.*

- P.29 – Please make a note in the text that scrubber and precipitator costs are included. How much do they add to the power plant investment cost? Is the coal only 60% carbon because of large ash content? Is the coal washed?

***Response**: The assumptions table for coal fired thermal power plants in Annex 4 already indicates the environmental control considerations and reflects its associated costs. The cost of ESP adds 2-3% to the power plant investment and the cost of FGD adds another 3-4%. In general Indonesian coal has very lower sulfur (less than 0.5%) and FGD is normally not needed and is not included in the investment for power plant in the project analysis. The 60% carbon content is based on coal chemistry analysis data from PLN, the national power company. The ash content of Indonesia coal is low, too, and coal washing is not necessary.*

- P. 35 – Apparently there is no electricity shortage in Indonesia today. Might there be one in the future? Would this help in making a stronger case for geothermal?

***Response**: the Java-Bali power grid, accounting for 75% of installed power generation capacity in all of Indonesia, is already under pressure with deteriorating reserve margin in recent years, forcing PLN to undertake a crash program of building 10 GW new coal-fired plants by 2009. This indeed makes a stronger case for accelerating geothermal power development and is reflected in the main text as well as the annexes.*

Annex 7. Implementation Arrangement

- P.57-60 – Project implementation needs to be tied to actual projects that are being or will be implemented shortly. This will allow a closer link to be established between proposed project activities and the expected results from the project.

***Response**: the proposed project will involve actual transactions of investment in at least 350 MW of geothermal power capacity.*

Appendix 10: Safeguard Policy Issues:

- Page 73, Operation paragraph – Need to report pollutant emissions from Indonesian geothermal plants, and if none are available, this project needs to provide indicative measurements of the values or use IPCC default factors for these.

***Response**: the suggestion will be considered as part of the Component 2 activities to develop environmental and social guidance document to assist geothermal power investors and agencies in complying with Indonesian requirements.*

Appendix 11: Incremental cost analysis:

- Page 90 – Are the capacity factors and pollutant emissions factors based on experience to date? If the current values are different, is there a reason to believe that the assumed values will actually materialize?

***Response**: Yes, they are based on actual experiences in Indonesia. The capacity factors and the emissions factors applied in the analysis are relatively conservative to avoid overestimating.*

2. French Council Comments and Executing Agency Responses

Comment: Indonesia is one of the greatest potential for geothermic in the world. With 807 MW already in place, it is only 3% of the potential which has been so far developed. The GoI has planned to develop new capacities, 6 000 MW, before 2020. However, and in spite of WB support to energy reforms in Indonesia, the investments in the geothermal sector is expected to be very low in the coming years (around 350 MW). The institutional framework is not yet performing well and in practice, the tariff of energy purchase is actually too low to deliver attractive return on capital investment. The objective of the new project is to give new impetus and confidence in this sector. The work recently done by JICA on the technical geothermal assessment, will contribute to strengthen this confidence. The project is based globally on technical assistance.

Opinion: favorable, but with the following questions and remarks to be taken into account:

Comment: One of the major problems which hamper the development of the geothermal sector in Indonesia is the heavily subsidized energy prices for the consumers and the non conducive tariff of local energy purchase. It is not clear how the proposed project will overcome this tariff issue.

Response: It is true that subsidies have distorted the market for investment in the sector, but this has largely been due to the heavy subsidization of fuel oils that affected the primary energy choices made in the power sector in Indonesia. The result was an energy mix that heavily relied on the highly subsidized diesel for a significant part of its generation needs. The Government of Indonesia has begun to gradually reduce the fuel oil subsidy over the past years. Today, the fuel oil subsidy for PLN has been eliminated and they do not receive any direct subsidies from GoI that favor one form of primary energy over another Any subsidies that are provided at the level of consumers will impact overall electricity demand, but does not specifically impact the development of geothermal vis-à-vis other energy resources. Instead, a key reason for the slow exploitation of geothermal resources in Indonesia is because of its incremental costs. The financial cost of developing geothermal power in most cases in Indonesia will exceed similar costs for a comparable base-load substitute power generation source as such coal. However, given the environmental benefits of utilizing a cleaner source of energy, there is a compelling economic rationale for developing greater levels of geothermal power. But, in the absence of some intervention that would incorporate the environmental benefits of geothermal (or the environmental cost of coal) in the decision making process, business-as-usual will continue and many geothermal investments are likely to be passed over in favor of fossil-based options. Therefore, a key component of the project is to develop a pricing mechanism that would address the issue of incremental costs and create appropriate economic incentives so that geothermal power will be evenly considered with other generation choices by decision makers. In doing so, the Government of Indonesia will internalize the environmental "externality" that will lead towards a more economically optimal outcome than the status quo.

Comment: It is deemed that CDM carbon credits might be a piece of the solution. How are carbon credits used in the context?

Response: Carbon finance is a key source of funds that could contribute towards addressing the incremental costs associated with developing geothermal power in Indonesia. Therefore, carbon financing that utilize the Clean Development Mechanism (or any other post-Kyoto Protocol carbon credit schemes which may emerge) will be a consideration for incorporating into the pricing mechanism that the Ministry of Energy and Mineral Resources has proposed to develop as a part of Component 1 of the project. The project will work closely with the Bank's Carbon Finance Group to identify the opportunities and efficient means for supporting geothermal development and would benefit greatly from a parallel ongoing effort by the Bank to introduce a programmatic mechanism to streamline access to carbon financing to catalyze investments in geothermal power development.

Comment: The PIF mentioned a contribution in cash of the GoI (4, 0 M$). How this contribution will be used?

Response: Directorate of Geothermal Enterprise Supervision and Ground Water Management (DGESGWM) within the Ministry of Energy and Mineral Resources (MEMR) is responsible overseeing the development of the geothermal sector in Indonesia. A key part of their responsibilities in this regard is to develop policies that promote geothermal development and undertake transactions for competitively offering development opportunities for investors. These activities form the GoI's geothermal reform program. In order for the continued implement of this reform

program, the DGESGWM is provided with a government budget allocation to finance its activities. The indicated co-financing contribution is based on funding in the present DGESGWM budget that is allocated to tasks that are directly related to the activities that is being supported by the proposed GEF project. The GoI has confirmed at least the same amount of budget allocation for DGESGWM during the implementation period of the project, and this will be reflected in the annual plan for project implementation and in the annual project progress report.

ANNEX C: CONSULTANTS TO BE HIRED FOR THE PROJECT

Position Titles	*$/ person week*	*Estimated person weeks*	*Tasks to be performed*
For Project Management			
Local			
Project Manager	1000	140	Reports directly to the director of DGESGWM, day-to-day coordination of project implementation activities, project progress monitoring and reporting.
FM Specialist	750	60	Provides technical assistance on financial management, including budget document preparation, disbursement mechanism, accounting and reporting.
Operations Consultants	750	20	Support project implementation as needed, for example, procurement assistance.
For Technical Assistance			
Local			
Energy Specialist	1,500	60	Power sector analysis and policy advice
Geothermal Specialist	1,500	71	Technical analysis and advice
Energy Economist	1,500	52	Pricing and economic analysis and policy advice
Transaction Specialist	1,500	50	Transactions advice
Financial Specialist	1,500	124	Financial analysis and advice
Legal Specialist	1,500	153	Legal review and advice
International			
Energy Specialist	5,000	46	Same as above
Geothermal Specialist	5,000	41	Same as above
Energy Economist	5,000	27	Same as above
Transaction Specialist	5,000	71	Same as above
Financial Specialist	7,500	68	Same as above
Legal Specialist	7,500	116	Same as above
Other Specialists	5,000	24	Including institutional specialist, and tax and accounting specialists

ANNEX D: STATUS OF IMPLEMENTATION OF PROJECT PREPARATION ACTIVITIES AND THE USE OF FUNDS

Not applicable.

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The World Bank

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Report No: 41420-ID

PROJECT APPRAISAL DOCUMENT

ON A

PROPOSED GEF GRANT

IN THE AMOUNT OF US$4 MILLION

TO THE

REPUBLIC OF INDONESIA

FOR A

GEOTHERMAL POWER GENERATION DEVELOPMENT PROJECT

{February 14, 2008}

Transport, Energy and Mining Sector Unit
Sustainable Development Department
East Asia and Pacific Region

CURRENCY EQUIVALENTS
(Average of December, 2007)

Currency Unit = Indonesian Rupiah
IDR 9,350 = US$1

FISCAL YEAR

January 1 – December 31

ABBREVIATIONS AND ACRONYMS

ADB	Asian Development Bank	JICA	Japan International Cooperation Agency
AMDAL	Analysis of Impacts on the Living Environment	JOC	Joint Operation Contract
BPKP	Badan Pemeriksa Keuangan Pemerintah (Government Audit Agency)	JBIC	Japan Bank for International Cooperation
CDM	Clean Development Mechanism	KPK	Komite Pemberantasan Korupsi (Anti Corruption Commission)
DOE	Department of Energy (USA)	KPPN	Kantor Pembayaran Pengeluaran Negara (State Expenditure Payment Office)
DGMCG	Directorate General for Mineral, Coal and Geothermal	MEMR	Ministry of Energy and Mineral Resources
DGESGWM	Directorate for Geothermal Enterprise Supervision and Ground Water Management	MOF	Ministry of Finance
DGEEU	Directorate General for Electricity and Energy Utilization	MIGA	Multilateral Investment Guarantee Agency
DG	Directorate General	MOE	Ministry of Environment
DA	Designated (Special) Account	NGO	Non Government Organization
DOE	Department of Energy (USA)	ODA	Official Development Assistance
EIA	Environment Impact Assessment	PID	Project Information Document
FGD	Flue Gas Desulfurization	PMM	Project Management Manual
FM	Financial Management	PIP	Project Implementation Plan
GOI	Government of Indonesia	PMU	Project Management Unit
GEF	Global Environment Facility	PPA	Power Purchase Agreement
GHG	Greenhouse Gas	PDO	Project Development Objective
IFC	International Finance Corporation	PNOC	Philippines National Oil Corporation
ISDS	Integrated Safeguard Data Sheet	PLN	Perusahaan Listrik Negara (State Electricity Company)
IA	Implementing Agency	PD 45	Presidential Decree no.45/1991
IG	Inspector General	RPS	Renewable Portfolio Standard
IPP	Independent Power Producer	UNFCCC	United Nations Framework for Combating Climate Change
IBRD	International Bank for Reconstruction and Development		

Vice President:	James Adams
Country Director:	Joachim von Amsberg
Sector Manager:	Junhui Wu
Task Team Leader:	Migara Jayawardena

EAST ASIA AND PACIFIC REGION

REPUBLIC OF INDONESIA

GEOTHERMAL POWER GENERATION DEVELOPMENT PROJECT

CONTENTS

Page

Annexes:

PROJECT APPRAISAL DOCUMENT

EAST ASIA AND PACIFIC
EASTE

Date: February 14, 2008 Country Director: Joachim von Amsberg Sector Manager: Junhui Wu Project ID: P099757 Lending instrument: Grant	Team Leader: Migara Jayawardena Sectors: Renewable Energy and Power Themes: Infrastructure Environmental screening category: C Safeguard screening category: S3
Sector Manager: Junhui Wu Global Supplement ID: 3296 Lending instrument: Grant GEF Focal Area: Climate Change Supplement Fully Blended? Stand-alone	Team Leader: Migara Jayawardena Sectors: Renewable Energy Themes: Climate Change

Project Financing Data:

[ ] Loan [ ] Credit [X] Grant [ ] Guarantee [ ] Other:

Total GEF grant financing (US$m): US$4.0

Financing Plan (US$m.)

Source	Local	Foreign	Total
Recipient	5.0		5.0
GEF		4.0	4.0
Total	5.0	4.0	9.0

Recipient: Republic of Indonesia
Responsible agency: Ministry of Energy and Mineral Resources

Estimated disbursements of GEF Grant (Bank FY/US$m)

FY	**2008**	**2009**	**2010**	**2011**	
Annual	0.10	1.75	1.60	0.55	
Cumulative	0.10	1.85	3.45	4.00	

Project implementation period: Start April 2008 End: June 2011
Expected effectiveness date: May 31, 2008
Expected closing date: June 30, 2011

Does the project depart from the CAS in content or other significant respects? ***Ref. PAD A.3***	? Yes [X] No
Does the project require any exceptions from Bank policies? ***Ref. PAD D.7*** Have these been approved by Bank management? Is approval for any policy exception sought from the Board?	? Yes [X] No ? Yes ? No ? Yes ? No
Does the project include any critical risks rated "substantial" or "high"? ***Ref. PAD C.5***	? Yes [X] No
Does the project meet the Regional criteria for readiness for implementation? ***Ref. PAD D.7***	[X] Yes No

Project development objective ***Ref. PAD B.2, Technical Annex 3*** Promote the development of economic and environmentally-sound geothermal power generation. Reduce CO_2 emissions by increasing electricity supply from geothermal power plants.
Project description *[one-sentence summary of each component]* ***Ref. PAD B.3.a, Technical Annex 5*** Component 1: Policy Framework for Scaling-up the Development of Geothermal Power Component 2: Transactions Management for Mobilizing Investments in Geothermal Power Generation Component 3: Geothermal Sector Technical Capacity Building Component 4: Project Management Assistance
Which safeguard policies are triggered, if any? ***Ref. PAD D.6, Technical Annex 10*** Environmental Assessment (clarification of roles and responsibilities for developers undertaking project-facilitated transactions)
Significant, non-standard conditions, **if any**, for: ***Ref. PAD C.6*** Board presentation: None Loan/Credit effectiveness: The Recipient shall have adopted the Project Manual acceptable to the World Bank and shall have appointed the Project Manager on terms of reference acceptable to the World Bank. Covenants applicable to project implementation: None

A. STRATEGIC CONTEXT AND RATIONALE

1. Country and Sector Issues

1. Indonesia has made a strong economic recovery from the 1997 financial crisis. Its gross domestic product (GDP) grew at an average of 4.8 percent per year from 2000 to 2006, and registered 5.6 and 5.5 percent growth rates in 2005 and 2006, respectively. The economy is projected to grow at 6 to 7 percent per year in the next few years. Primary energy consumption increased by 5.2 percent per year from 2000 to 2006, and electricity consumption grew by about 6 percent per year during the same period. The demand for electricity is expected to grow at 7 to 9 percent per year between 2007 and 2020.[1]

2. Faced with rapidly growing electricity demand and the high cost of oil the Government of Indonesia (GoI) is pursuing a power generation expansion strategy that will boost the use of coal and natural gas while also scale up the utilization of the country's large geothermal power potential. In fact, PLN, the state-owned national electricity utility, is carrying out a crash program of building 10,000 MW of coal-fired power plants by 2009. The increasing reliance on coal-fired power, currently seen as a low-cost alternative to quickly expand capacity, presents a challenge of dealing with the associated local and global environmental impacts. Geothermal power, on the other hand, can serve as a suitable base-load substitute for coal-fired capacity in many areas with much lower emissions of air pollutants and greenhouse gases. The GoI plans to achieve 6,000 MW of installed geothermal power capacity by 2020, up from about 970 MW in 2007. This ambitious plan will require strong government support to materialize. Any shortfall in the expansion of geothermal power generation capacity is most likely to be met by additional coal-fired power plants, resulting in additional local air pollution and greenhouse gas emissions.

3. Indonesia has the world's largest geothermal power development potential, estimated to be about 27,000 MW. So far, around 253 geothermal fields have been identified, and 53 of them are ready for detailed exploration or exploitation. The 970 MW of installed capacity accounts for less than 4 percent of the identified potential. Most of the currently installed geothermal power capacity was the result of a GoI initiative in 1991 to develop about 4,500 MW of geothermal power under a Presidential Decree (PD45/1991). But the development stalled in the aftermath of the Asian Financial Crisis. Geothermal contracts along with other power purchase agreements with private producers were suspended during the economic turmoil. They were subsequently either renegotiated or cancelled. Many of the existing investors who were already producing power eventually renegotiated their power purchase agreements at substantially reduced tariff levels. Many others who had rights but were yet to develop their respective fields opted to transfer these assets back to public control, either as a result of arbitration proceedings or the cancellation of their contracts. Presently, there is nearly 1,000 MW of unexploited geothermal power potential under private control and over 3,000 MW with state-owned enterprises. About half of these resources are in geothermal fields which are currently producing electricity (brownfields) or with confirmed reserves (quasi-brownfields) and are well placed for further expansion.

[1] Economic and energy data in this section were drawn mainly from: World Bank country brief (www.worldbank.org/id), APEC Energy Overview 2006 (http://www.ieej.or.jp/aperc/energy_overview.html), and Indonesia and Climate Change: Current Status and Policies, PEACE, 2007 (www.worldbank.org/id).

4. The GoI has intensified its efforts to revive and scale up geothermal power development in the past few years. In 2003, the Geothermal Law (Law 27/2003) was promulgated, making geothermal the only renewable energy governed by its own law. The Law, among other things, mandated that future geothermal fields (fields which were not included under the PD45/1991, with a total potential of about 22,000 MW) must be transparently and competitively tendered for development. It also permitted operators of the fields previously allocated under the PD45/1991 to retain control. In 2004, the Ministry of Energy and Mineral Resources (MEMR) issued the "Blueprint for Geothermal Development in Indonesia," which was intended as a roadmap to develop a total of 6,000 MW of geothermal power capacity by 2020. In 2005, the Directorate of Geothermal Enterprise Supervision and Groundwater Management were established by MEMR to strengthen sector management and support. In 2006, MEMR initiated the Master Plan Study for Geothermal Power Development in Indonesia funded by Japan International Cooperation Agency (JICA), further solidifying the knowledge and understanding about developing Indonesia's geothermal resources. Despite these recent efforts, Indonesia still faces significant hurdles in attracting commercial financing and private investors to develop geothermal power. A number of issues have also constrained the state-owned enterprises to expand geothermal power capacity in fields under their control. The main barriers that deter investments in geothermal power expansion include the following:

5. *Lack of an adequate policy framework that incorporates the environmental benefits of geothermal energy and provides sufficient economic incentives for investing in the sector.* Despite a flurry of government initiatives in the last 4 years two critical issues remain unaddressed: (i) the environmental benefits and the initially higher cost of developing geothermal power, compared with building coal-fired power plants, meaning that economic incentives for harnessing the benefits and bridging the cost gap are needed to promote investments in geothermal power; and (ii) the exploration risks associated with developing upstream geothermal resources, which, without proper mitigation mechanisms or compensation, often deter investments in the sector. The introduction of appropriate economic incentives is particularly important in the next five years or so for developing the brownfields that are already explored with confirmed geothermal resources, and remain under the control of either private operators or state-owned enterprises. In the longer term, the introduction of an effective risk mitigation mechanism will be important to address the uncertainty and the resulting costs associated with exploration of geothermal fields whose resources have not been confirmed (greenfields). These policy issues need to be addressed to effect future geothermal power project transactions.

6. *Lack of government planning and management capabilities to efficiently conduct transactions of geothermal power projects.* Presently, the Government has relatively weak administrative and technical capabilities to conduct geothermal power transactions. The MEMR has limited capability to plan and identify suitable geothermal opportunities for development. This is partly evident in the inconsistency between the GoI geothermal blueprint and the power expansion plan by the state-owned power utility, PLN. Furthermore, there is very little experience within the MEMR in preparing and designing (structuring) investment transactions so that they can be made attractive (bankable) to potential investors. Therefore in order to move forward, MEMR will need to develop a credible process for transacting future greenfield geothermal sites in compliance with the Geothermal Law.

7. *Lack of domestic technical capabilities to support long-term growth in the sector*. The domestic capability is weak in almost all the major areas of geothermal development from resource identification to operation of geothermal power generation facilities. The level of domestic participation in all parts of the value chain of geothermal resource development is low, and project costs remain high as a result. There is no coordinated effort to develop the skills of domestic professionals in the sector, or efforts to reduce costs through technology transfer. Given Indonesia's large share of world geothermal resources, the GoI is keen to support increased involvement of concerned domestic industries in the sector.

8. If Indonesia is to accelerate the development of geothermal resources and to achieve the goals set forth by the Blueprint, it will be necessary for the GoI to address these key interrelated barriers. It is estimated that some 10,000 MW of geothermal power capacity is economically viable when local and global environmental benefits are considered (Annex 4). The economically viable geothermal resources are likely to grow as the resource assessment and exploration deepens. Yet a business-as-usual scenario suggests that Indonesia's installed geothermal power capacity would only reach about 2,800 MW by 2020, compared with the GoI target of 6,000 MW. An integrated set of actions are needed to address the key barriers and improve the investment climate for greater and sustained development of geothermal resources.

9. A two-pronged strategy to move forward will be necessary, with an immediate aim to mobilize expansion in already partially developed brownfields, while simultaneously undertaking appropriate reforms to sustain long-term development of the sector. Most existing developers will be looking for the GoI to address financial shortfalls involving past commitments (under the PD45/1991) and to help ensure cost recovery from new expansions. The development of the large number of unallocated greenfields would need sufficient economic incentives to be offered through a credible transaction process. Investors will also seek opportunities to reduce their upstream technical risks associated with developing unexplored geothermal fields. By undertaking a reform strategy to address these issues, the GoI hopes to accelerate the development of geothermal power generation and provide a viable alternative for replacing base-load power generation from fossil fuels.

10. Greater utilization of geothermal resources for power generation will benefit Indonesia in a number of ways that include: (i) improved local and global environment, (ii) enhanced energy security by utilizing a non-tradable indigenous resource, and (iii) improved power generation mix as geothermal energy can serve as a hedge against the volatility of fossil-based commodity prices.

2. Rationale for Bank Involvement

11. The Bank is supporting the GoI with its infrastructure and energy sector reform efforts, and has been requested by the Ministry of Energy and Mineral Resources to assist with the proposed project. The proposed project would be an expansion of work already underway in the geothermal sector where the Bank has been advising the MEMR on its reform agenda. A recently commissioned study by the World Bank on identifying barriers that prevent greater levels of investments in geothermal is serving as input into designing the reform program. A subsequent study is also assisting MEMR enhance their understanding of pricing and transaction issues. Furthermore, the Bank is facilitating a carbon finance transaction of the Lahendong

geothermal project in North Sulawesi, which will provide greater insights into addressing the challenges facing geothermal developers.

12. The Bank has a significant engagement in assisting the Government to expand investments in the infrastructure sector through public-private partnerships, which would benefit geothermal power development. As a result, present work through the Private Participation in Infrastructure Technical Assistance Project, the Guarantee Framework, and the Infrastructure Facility, could be well placed to support the expansion of geothermal power. In fact, the transaction that is expected to be tendered through the proposed project would be consistent with the national agenda for developing model projects to serve as an example to be replicated in subsequent competitive tenders.

13. The Bank can also bring considerable international experience that would correspond with all aspects of the proposed project. In the Philippines, the world's second largest geothermal producer, the Bank has financed geothermal investment projects which provide insights into the development challenges and technical risks specifically associated with the sector. Several investment funds being supported by the Bank and the GEF in Africa and Eastern Europe could provide lessons and experiences in investment risk management. Experiences in applying pricing and incentive policies to spur the development of renewable energy supplies in other countries could be useful for Indonesia to consider as they attempt to resolve their own pricing issues related to the development of geothermal power.

3. Higher Level Objectives to which the Project Contributes

14. The proposed project is consistent with the strategic objectives set forth in the Bank's Country Assistance Strategy (CAS) for Indonesia, as well as GEF's climate change focal area. More specifically, it will support the CAS strategy of (i) helping improve the climate for high quality investments, and (ii) helping improve service delivery by the utilization of a more efficient energy resource.

15. The proposed project is fully consistent with the GEF-4 Climate Change Focal Area Strategic Objective 4 to promote on-grid renewable energy by scaling up geothermal power generation. The proposed barrier removal activities promote market approaches (economic incentives and transparent commercial transactions) for the economic supply of geothermal power in grid-based systems and fit well with the GEF-4 Climate Change Focal Area Strategic Program 3. Scaling-up the use of geothermal power generation capacity is essential to backing-up GoI's explicitly stated actions to be taken towards limiting greenhouse gas emissions in the energy sector in Indonesia's Initial National Communication to the UNFCCC, including the promotion of the use of renewable energy, especially from geothermal resources.

B. PROJECT DESCRIPTION

1. Financing Instrument

16. The proposed project is a standalone GEF grant-financed operation which will directly leverage and facilitate investments in new geothermal power generation capacity.

2. Project Development Objective and Key Indicators

17. The development objective of the proposed project is to promote the expansion of economic and environmentally friendly geothermal power generation in Indonesia. The project will assist the GoI to prepare and implement its geothermal sector reform program designed to remove the key policy and institutional barriers which presently prevent greater development of geothermal resources, and will assist in the transaction of geothermal power investments. The principal outcomes will be an improved investment environment for geothermal power projects and enhanced government capacity to support sector growth, leading to increased market uptake of geothermal electricity. The key development indicator is the geothermal power generation capacity with secured financing resulting from the reforms and the transactions implemented through the project.

18. The global environment objective of the project is to promote on-grid electricity from geothermal sources, reducing the need for coal-based generation capacity and avoiding associated greenhouse gas emissions. The outcome will be increased geothermal energy in electricity grids. The key global environment indicator is the amount of carbon dioxide emissions that will be avoided due to the utilization of geothermal power from investments that result from the reforms and transactions of the proposed project.

19. The proposed project is expected to have a sizable immediate impact as well as sustained long-term benefits. It is designed to directly leverage significant private and/or public investments by the time of project completion. These initial projects are expected to total about 350 MW of power generation capacity (about 300 MW from expanding existing fields and upwards of 50 MW from a new greenfield site), which would be more than a 35% increase in Indonesia's present geothermal power generation capacity. This could leverage financing upwards of US$700 million by the completion of the proposed GEF assistance. The impact of the project will also extend over the longer-term, resulting in an estimated incremental geothermal power capacity of 3,200 MW and enabling the GoI to achieve their geothermal expansion target of 6,000 MW by 2020.

20. The expected global environmental benefits of the immediate expansion is estimated to be 60 million tons of avoided CO_2 emissions over the lifecycle of the incremental installed geothermal power capacity of 350 MW. The commensurate long-term global environmental benefits will be much larger, and are estimated to be in the order of 500 million tons of avoided CO_2 emissions over the lifecycles of the incremental geothermal power capacity of 3,200 MW.

3. Project Components

21. To develop Indonesia's vast potential for geothermal power, the present barriers will need to be addressed through several key government interventions: (i) development and implementation of a policy framework for the promotion of geothermal power, including mechanisms for mitigating upstream risks and offering economic incentives; (ii) introduction and demonstration of credible and efficient project transaction procedures and practices; and (iii) strengthening government support capabilities for geothermal development and introducing initiatives to develop domestic technical capacities towards cost reduction. These actions form the integrated design of the proposed project as described below.

22. **Component 1: Policy Framework for Scaling-up the Development of Geothermal Power (proposed GEF funding: US$1,100,000, GoI funding US$2,500,000).** This component will assist the GoI in developing and implementing an integrated set of policies that will provide sufficient regulatory certainty, risk mitigation, and economic incentives for increased public and private investments toward developing geothermal power in Indonesia. Three key areas of assistance are proposed:

***C1.1**: Development and implementation of policy to address incremental costs.* This subcomponent is designed to develop a pricing mechanism to provide adequate economic incentives for developing geothermal resources. It will also address any incremental costs that may be associated with some geothermal developments as a result of the market failure to incorporate the environmental externalities into investment decisions, which remains a key barrier to geothermal development (see Annex 4 Sections1 & 2 for more details). The project will study international experiences in formulating pricing and economic incentive mechanisms, evaluate the extent of the market failure and assess the incremental costs, confirm the funding requirements and sources, and develop the operational procedures required to implement the selected option.

***C1.2**: Development and introduction of upstream risk mitigation measures*. This sub-component is designed to create a mechanism for mitigating upstream resource development risks faced by geothermal developers in Indonesia (See Annex 4, Section 3 for more details). It is intended to limit investor's exposure to uncertainty stemming from the potential power capacity in geothermal fields and the relatively high upfront investment costs – both of which can be prohibitive for commercial financing of geothermal projects. International experience will be evaluated before selecting a risk mitigation mechanism applicable to Indonesia, after which, the project will develop procedures and arrange necessary funding for implementing the selected mechanism. The development of risk mitigation measures will be carefully coordinated with other aspects of the Geothermal Policy Framework (Component 1) and with the management of transactions (Component 2 below) to ensure its integration.

***C1.3**: Support the implementation of the Geothermal Law*. This sub-component will review the Geothermal Law and the draft Implementation Rules and Regulations of the Geothermal Law, identify gaps within the documents and potential hindrances to future geothermal power project investments, and recommend necessary amendments and supplementary policies and regulations, in view of the coherence of the overall policy framework for geothermal power development in Indonesia.

23. The main outputs of this component will include (i) formulation of a pricing mechanism to provide adequate economic incentives for developing geothermal power; (ii) introduction of a risk mitigation mechanism to address upstream technical risks; and (iii) enhancement of the implementation rules and regulations of the Geothermal Law. The outcome will be an improved investment environment for geothermal power projects.

24. **Component 2: Transactions Management for Mobilizing Investments in Geothermal Power Generation (proposed GEF funding: US$2,350,000, GoI funding: US$1,000,000).** This component will assist the GoI, especially the MEMR, to develop the capacity for planning and transacting geothermal power developments in an efficient and transparent manner. The present lack of a credible mechanism for offering geothermal

development opportunities is a key barrier to attracting investors (Annex 4 Section 4). The transactions would be the conduit through which the pricing and economic incentives in the new policy framework would be integrated as a "bankable" project to be offered to investors. It will aim to mobilize two distinct groups of investors: (i) existing developers who were given control of geothermal fields under PD45/1991, and (ii) new investment opportunities to exploit geothermal resources in greenfield sites. At a strategic level, the activities in this component will help operationalize policies and procedures necessary for eventually realizing the government's goal of 6,000 MW installed geothermal power capacity by 2020. Through this component, the GoI will be able to directly leverage investments in the geothermal sector, and also establish procedures and processes that can be replicated beyond the duration of the project.

***C2.1**: Expanding power generation in geothermal fields already allocated to investors*. This sub-component is designed to catalyze investments by existing developers to expand geothermal power generation in fields under their control. It will review the legacy issues of the geothermal fields which were allocated to investors under PD45/1991, identify and recommend appropriate solutions, develop and implement transaction agreements/arrangements consistent with the economic incentives provided in the new policy framework developed in Component 1, and achieve financial closures for installation of at least 300 MW of new generation capacity in these geothermal fields.

***C2.2**: Facilitating transactions of new geothermal fields for power development*. This sub-component will develop the procedures through which MEMR will offer new geothermal development opportunities to potential investors. This will include the development of criteria for project selection, the transaction procedures, and model bidding documents, which would be consistent with the Geothermal Law and the new policy framework for economic incentives and risk mitigation as well as meet international standards of good practice. This sub-component will also financially engineer a selected project (50 MW installed capacity or greater in scale) to ensure that it is "bankable" and offer it to investors through the transaction process towards achieving financial closure of the investment. This model can be subsequently customized for offering further investment opportunities in greenfield geothermal sites.

25. The main outputs at implementation completion will include: (i) firm transaction arrangements for resolving PD45/1991 legacy issues consistent with the new policy framework; (ii) model procedures and standardized bidding documents for competitive tendering of geothermal power projects under the Geothermal Law; (iii) financial closure on a batch of expansion geothermal power projects among the brownfields for at least 300 MW incremental installed capacity; and (iv) financial closure of one select greenfield geothermal power project for 50 MW or more installed capacity. The outcome will be increased market uptake of electricity generated from geothermal resources, progressively leading to a total of 3,200 MW incremental geothermal power capacity and help GoI achieve its target of 6,000 MW by 2020.

26. **Component 3: Geothermal Sector Technical Capacity Building (proposed GEF funding: US$350,000, GoI funding: US$1,300,000).** This component will address the limited domestic technical capacity for handling most geothermal related activities, and support the long-term development prospects of the sector.

***C3.1:** Training of government officials and technical staff in planning and transaction management*. This sub-component will train relevant staff in the central and local governments

in preparing transactions, engaging investors, evaluating bids, and negotiating financial closings. The specific training needs will be identified and addressed as part of the transactions assistance work in Component 2. The proposed activities will mainly involve training workshops and seminars for concerned officials and technical staff, in addition to the on-the-job training which they will receive through their work in facilitating actual transactions.

C3.2: *Building awareness among stakeholders.* This sub-component is designed to enhance the familiarity of various stakeholders, including civil society, with the implementation aspects of the Geothermal Law as well as the GoI geothermal power development targets and sector reform program. It will also specifically focus on sharing information regarding the transaction regime developed and demonstrated by the proposed project. It will support a series of seminars and stakeholder discussions to promote the sector as well as obtain feedback that can be incorporated into the ongoing reform program.

C3.3: *Options for long-term cost reduction.* As a preparation for implementing a cost reduction program in geothermal related industries in Indonesia for enhanced domestic participation and competitiveness, the project will support an industrial analysis that will be conducted to identify key areas where local industries maintain a comparative advantage, and develop a sector strategy to strengthen their roles and participation in the geothermal power development industry.

27. The outputs of this component will include (i) improved transaction management skills and knowledge of concerned government agencies and officials; (ii) improved stakeholder understanding of the policies/regulations and business opportunities concerning geothermal power development; and (iii) a national strategy on increasing domestic participation and technology development. The overall outcome will be enhanced government capacity to support the long term growth of the sector.

28. **Component 4: Project Management Assistance (proposed GEF funding: US$200,000, GoI funding: US$200,000).** This component will provide the necessary technical consultant support to the Directorate of Geothermal Enterprise Supervision and Ground Water Management, the executive implementation unit, for the management and supervision of the project.

4. Lessons Learned and Reflected in the Project Design

29. A universal lesson for developing renewable energy resources is that they need strong government policy support to gain a foothold in the fossil fuel dominated energy markets, and that aspiring government goals for renewable energy development need concrete and clear regulatory provisions and/or economic incentives to materialize. Broadly speaking the key lessons for developing on-grid renewable energy are:[2]

- Mandatory market uptake requirements are effective policies to support scaling up of on-grid renewable energy supplies. These regulations may be in the forms of mandatory purchase of renewable-energy-based power at a fixed price, such as the electricity feed-in law in Germany, or renewable energy portfolio standards (RPS) introduced in the US.

[2] Grid-based Renewable Energy in Developing Countries: Policies, Strategies, and Lessons from the GEF, Eric Martinot, 2002, http://www.gefweb.org/Martinot_WCRE_June2002.pdf.

- Two key forms of support go hand-in-hand in helping develop a market for on-grid renewable energy supplies: creating a favorable investment climate for private power projects, and establishing a transparent and stable regulatory framework for independent power production. In many countries, utility regulatory frameworks that allow fair competition for electricity generation by independent power producers, including power purchase agreement and a transparent and stable tariff setting regime, are an essential first step towards creating private markets for renewable energy. In addition, rules and institutions for bidding and transacting power purchases are also essential elements of a power market.
- In view of encouraging economically viable development of renewable energy sources (capturing their environment benefits), policy frameworks must address the question of how the additional cost of renewable-energy-based power (relative to conventional sources) can be covered – and especially the questions of who will pay this additional cost and what policy/institutional mechanism allow the additional cost to be collected.
- Market development takes time and that a large and growing domestic industry is required to work out regulatory, contractual, technical, and operational challenges of on-grid renewable energy. This means that *GEF assistance must focus explicitly on the medium and short-term outcomes which ensure that sustainable regulatory mechanisms, policies, financing, and adequate skills and manpower are developed*. One of the key focuses of GEF assistance would be the development of frameworks for independent power producers, formulation of model power-purchase agreements, feed-in tariff schemes, and simplified procedures for access to the grid.

30. Geothermal power development involves substantial risks and up front investments to confirm the reliability of the energy source and the capacity for power generation. Mitigation of the financial risk associated with the upstream steam field development is a major hurdle for geothermal investors. Various mitigation measures have been used internationally to share the risk of upstream geothermal exploration, and the main methods have included: (i) *Exploratory drilling cost-sharing*. During 1979 and 1980 the United States Department of Energy (DOE) used federal funds to share the risk of exploratory drilling (with industry) in 15 prospect areas of Utah and Nevada. A similar approach is now used by the US DOE through the Geothermal Resource Exploration and Definition Program. (ii) *Government-sponsored exploration*. The Philippines National Oil Company (PNOC) undertook upstream exploration through a service contract with the national government. Similar government-sponsored exploration programs also exist in Iceland and New Zealand. (iii) *Partial risk guarantee fund*. In countries in the African Rift Valley, a guarantee is provided to cover the exploratory risk and appraisal drilling at the early stages of resource exploration as well as during the advanced stage of production drilling. A combination of subsidies and insurance is provided to cover exploration risks while the prospect of a fully unsuccessful well is covered through insurance. These and other international experience will be drawn upon towards developing a risk mitigation mechanism that is applicable in Indonesia.

5. Alternatives Considered and Reasons for Rejection

31. At the project identification and concept stage, the focus of proposed activities was primarily on assisting the development of new greenfield geothermal power projects and on broad sector capacity building. Two main areas of GEF support were considered: (i) finance some of the exploratory drilling to enhance the quality and certainty of geothermal resources in

the fields which GoI would tender; and (ii) sector capacity building through international exchange programs of advisory and technology transfer services and establishment of a geothermal research and education center in an already existing high-level technical education institution. While some elements of these ideas are retained in the current design of the project the thrusts and means of support have been changed significantly for the following reasons: (i) it is realized during the preparation that there is a sizable amount of confirmed geothermal resources (up to 2,000 MW) which can be immediately brought to market if proper economic incentives are offered to investors and key legacy issues related to these fields are resolved; (ii) the required funding for subsidizing exploratory drilling is too large and cannot be supported by the grant available; and (iii) while supporting technology transfers and research and educational programs is important in the long-term, it would divert the limited funds from more urgent activities that would vital for scaling-up geothermal development.

32. The proposed project focuses on the key policy measures that address the major barriers to investments, and are preconditions for successfully implementing transactions to leverage direct investments from public and private sources. Therefore, the present project design will not only lead to immediate financing for expanding the generation capacity in the brownfields but also build the foundation for successfully attracting investments into geothermal power generation over the longer term.

C. IMPLEMENTATION

1. Partnership Arrangements

33. The Japan International Corporation Agency (JICA) is currently undertaking a detailed technical assessment of geothermal resources across the country that will be used to update the sector Road Map and formulate a Master Plan for Geothermal Power Development in Indonesia. The proposed GEF project will utilize these results in developing detailed design of each component. The two efforts are being effectively coordinated by the Ministry of Energy and Mineral Resources, which is the counterpart of both projects. In fact, the interim report of the JICA study has already served as one of the basis for the analyses conducted to appraise the proposed project.

34. The project will work closely with the Bank's Carbon Finance Group to identify the opportunities and efficient means for supporting geothermal projects by augmenting finances with proceeds from carbon off-set trading utilizing the Clean Development Mechanism (CDM), or any post-Kyoto Protocol carbon credit schemes which may emerge in the next few years. The project in particular and Indonesia's geothermal power development in general would benefit greatly from a parallel effort by the MEMR to introduce a programmatic mechanism to streamline access to carbon financing to catalyze investments in geothermal power development, which is being supported by the World Bank. It could serve as a key source of support for the pricing mechanism for providing adequate economic incentives that is to be developed under sub-component C1.1.

2. Institutional and Implementation Arrangements

35. The proposed project will be implemented by the Ministry of Energy and Mineral Resources through its Directorate General of Mineral, Coal and Geothermal (DGMCG). The

MEMR is uniquely positioned to implement the proposed project for it is the sole national agency responsible for policy formulation and regulation of both the power sector and the geothermal sector. The Directorate of Geothermal Enterprise Supervision and Ground Water Management (DGESGWM) under the DGMCG will be the executive implementation unit.

36. A Stakeholder Advisory Group will be established by DGESGWM to review and comment on key project outputs, including intermediate results, and help enhance the focus and effectiveness of the policy recommendations. The advisory group will consist of senior officials/experts from the Ministries of Finance, Planning, Forestry, and Environment, as well as MEMR, PLN, and major investors/operators of geothermal power projects in Indonesia. The advisory group will meet twice a year or depending on work progress. Further consultation as well as dissemination of information will be undertaken as a part of the sub-component designed to raise awareness about the project and the GoI reform geothermal program.

37. DGESGWM will hire a full-time Project Manager to assist project implementation. The project manager will report directly to the director of DGESGWM and will be responsible for work planning, day-to-day coordination of project implementation activities, project progress monitoring and reporting. Additional consultant support may be hired on a short term basis to provide project implementation assistance as needed.

3. Monitoring and Evaluation of Outcomes/Results

38. The monitoring and evaluation (M&E) will be guided by the results-based framework, which includes specific and measurable performance indicators for the proposed project (Annex 3). DGESGWM will develop an M&E Plan as part of its Project Implementation Plan and will be responsible for collection of qualitative and quantitative data for the baseline, as well as for assessment of the relevance, effectiveness and efficiency of the proposed interventions on an annual basis. The M&E will be strengthened by Bank supervision missions during which the progress toward delivery of outputs and achievement of results will be reviewed, key implementation issues will be identified, and actions to solve them will be initiated. The mid-term review of the project is scheduled in about 18 months from the project effectiveness date.

4. Sustainability and Replicability

39. ***Sustainability***: The GoI has intensified its support to geothermal power development in recent years by (i) shoring up the legal basis through the Geothermal Law, (ii) increasing institutional capacity through the establishment of a dedicated government branch, and (iii) consolidating knowledge and information on sector potential through an extensive and in-depth assessment of geothermal resources. The GoI is moving toward the next and critical step of mobilizing investments and has requested the Bank's assistance to enhance the policy framework with specific issues to address, including development and introduction of economic incentive and risk mitigation instruments with associated financing mechanisms and regulatory assurances, as well as implementation of investment transactions for immediate expansion of generation in partially developed fields and for competitive tendering of unexplored fields. These results-driven activities are expected to significantly increase geothermal power generation in the near term while also establishing the essential building blocks for sustained growth in the sector.

40. ***Replicability***: The proposed project will help develop a framework, process and procedures for engaging both public and private investors in geothermal resource development. These processes, such as the pricing mechanism, competitive tender process, and model bidding documents, as well as the risk mitigation measure(s) will be applicable for subsequent geothermal investments. It is also likely that these outputs of the proposed project can be replicated to enhance the development of other renewable energy resources. Certain project outputs, such as the model transaction for competitive tendering is also relevant to the development of other infrastructure projects in the power sector, given the fact that there have been very few projects in Indonesia that have been successfully tendered to private investors.

5. Critical Risks and Possible Controversial Aspects

41. The country and sector-level risks such as a relatively unfavorable overall investment climate in Indonesia would impact all sectors including geothermal power. However, the Indonesian economy has been recovering robustly from the financial crisis and growth of nearly 6% has been achieved in the last three years. Therefore, stronger economic growth and an improving investment climate are expected in the coming years. This positive outlook is strengthened by the recent upgrade of the country investment rating for Indonesia. The following are some key operational risks which may undermine the proposed project from achieving its development and global environmental objectives if adequate mitigation measures are not implemented:

RISKS	RISK MITIGATION MEASURES	RISK RATING WITH MITIGATION
To Project Development and Global Environment Objective		
Lack of inter-governmental coordination and support that may undermine the implementation of the reform program, especially with regard to achieving firm financing arrangements to fund the necessary economic incentive and risk mitigation mechanisms.	The project, through the MEMR, adopts a continuous consultation approach to engage other concerned government ministries, especially the Ministries of Planning and Finance, through out the project preparation and implementation to ensure a broad support of the proposed policy measures. The funding risk for supporting an incentive mechanism in the short-to-mid term also is reduced by the fact that about 2,000 MW (confirmed reserves) of geothermal power in Indonesia can be developed with relatively low incremental cost, compared to coal-fired plants, as well as a strong possibility of accessing carbon finance opportunities.	Moderate
To Component Results		
Lack of interest among investors due to concerns of insufficient regulatory certainties and inadequate returns.	Reports and numerous stakeholder meetings indicate that investor interest in the geothermal sector is high, but implementing the GoI reform program with concrete results is vital to gaining investor confidence to make significant investments in the sector. The main activities of the proposed project are geared toward achieving investment results by engaging major stakeholders in developing supportive policies and implementing them in actual transactions.	Moderate
Inadequate coordination between geothermal and power sectors, especially the lack of buy-in from PLN, the state-owned national power monopoly.	The MEMR is well placed to coordinate policy between the geothermal and the power sector since both policy making groups are based within the ministry. Ways to better integrate the two sectors is being looked at during project preparation. More specifically, the project has maintained a close engagement of PLN during preparation and will continue to consult PLN during implementation.	Moderate
Overall Risk Rating		**Moderate**

6. Grant Implementation Conditions

42. Prior to undertaking the offering of a pilot transaction with respect to a new geothermal field for power development to investors under Component 2 of the Project, the GoI shall ensure that:

(i) MEMR has endorsed the policies and funding mechanism, acceptable to the World Bank, to address incremental costs associated with geothermal power under Component 1 of the Project, including a clearly defined mechanism to identify the off-take price of geothermal electricity, the related funding mechanism, the process for awarding the new off-take pricing to specific projects, and the implementation schedule; and
(ii) MEMR has reached agreement with PLN on the form of a model power purchase agreement, acceptable to the World Bank, including conditions for connecting a geothermal power plant to the PLN grid and other remaining terms within a given period.

D. APPRAISAL SUMMARY

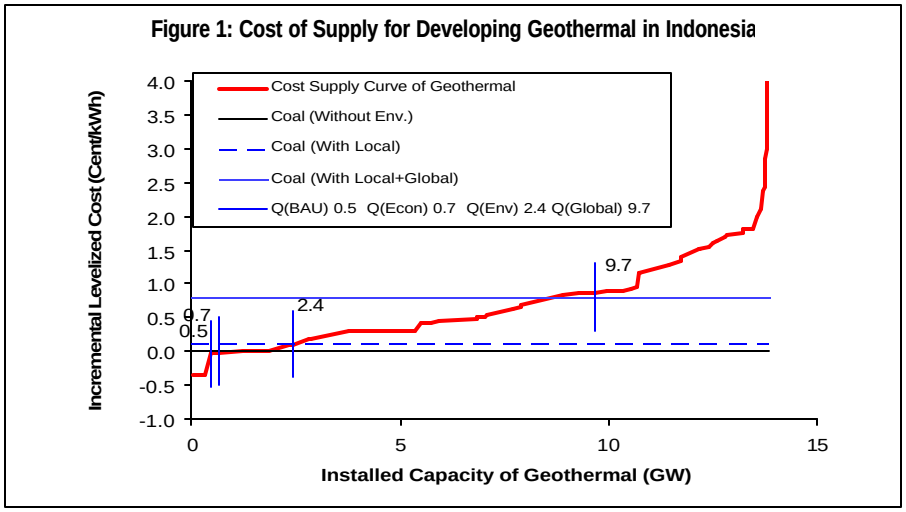
1. Economic Rationale for Developing Geothermal

43. An analysis was carried out to assess the comparative economic competitiveness of geothermal power generation in Indonesia. A supply curve was developed from available data for 51 geothermal fields[3] (with a total estimated capacity of 13,824 MW) to determine the economically optimal quantity of geothermal energy in Indonesia comparing it to coal-based power generation, which is confirmed to be the least-cost option for base-load generation expansion[4]. It also incorporates conservatively estimated environmental externalities that should be considered in determining the economically optimal level of geothermal development. The results show that (i) 662 MW of geothermal capacity are economically justified if environmental benefits are not included. (i.e. business-as-usual); (ii) 2,442 MW of geothermal power is economically justified if local environmental benefits (reduced TSP, SO2 and NOx emissions) are considered; and (iii) 9,669 MW are justified if both local and global environmental benefits are incorporated. A more detailed description of the assumptions, methodology and results are provided in Annex 4.

44. A sensitivity analysis was carried out to reflect potential fluctuations in the price of coal, which would affect the relative competitiveness of geothermal. The results indicate that if coal prices were to increase by 10%, then more than 2,800 MW of total geothermal capacity could become economically viable even without accounting for its environmental benefits. If the environmental externalities associated with mitigating local and global pollution are considered, then a 10% rise in coal prices would increase the economically justified quantity of geothermal development to over 10,500 MW. Conversely, if coal prices were lower by 10%, then the economically viable level of geothermal development exclusive of environmental externalities would be reduced to 300 MW while less than 8,000 MW would be justified even with consideration for its environmental benefits. Since coal prices tend to fluctuate and this will impact the relative competitiveness of geothermal power, it is important to address this facet when developing the pricing/incentive mechanism in sub-component C1.1.

[3] Master Plan Study for Geothermal Power Development in the Republic of Indonesia, JICA, 2007.
[4] PLN carried out a cost-effectiveness and a least cost study using WASP (Wien Automatic System Planning). Based on the assumptions used, it showed that coal is the least cost option for base-load generation expansion.

45. The cost effectiveness of mitigated CO_2 emissions (over lifecycle of power plants) is evaluated based on incremental geothermal power capacity (financial closure) achieved at the completion of the proposed project (350 MW), compared with coal-fired power with local environmental controls (particulates and sulfur dioxide). The overall cost-effectiveness of mitigated CO_2 emissions is estimated at about US$12/ton-$CO_2$ abated. The cost-effectiveness of GEF financing (undiscounted) is about US$0.07/ton-$CO_2$ abated.



2. Economic and Financial Analysis

46. The project will assist GoI to reform policies and enhance institutional capacities, and will not directly finance any investments. Therefore, an economic and financial analysis of the project is not applicable. The overall economic and financial aspects related to geothermal development in Indonesia in the context of the GoI proposal are further detailed in Annex 4.

3. Technical

47. Geothermal power development involves technologies in exploration similar to those used in the oil and gas industry, as well as equipment in power generation with both specialized and standard components. As a major oil and gas producing country and with the world's fourth largest installed geothermal capacity and over 20 years of development experience, Indonesia is capable of applying the prevailing technologies to expand its geothermal power generation. The proposed project does not invest directly in geothermal power projects. The geothermal power projects transacted through the proposed project will employ proven commercial technologies.

4. Fudiciary

48. The **financial management assessment** found that DGESGWM staff do not have experience with Bank financed projects and the financial management staff capacity need further strengthening. Risks may also arise from weaknesses in internal control over training and seminar expenditures, which in other similar projects in Indonesia, have been found to be vulnerable to lapses in control. These risks will be mitigated by i) providing appropriate technical assistance to the DGESGWM to fulfil its required financial management responsibilities; ii) putting in place additional financial control procedures on training/workshops expenditures, such as supporting documentation that all activities are supported by reports, attendance lists for workshops and training and third party invoices. Overall, the project

financial management risk is assessed as being moderate. Based on this assessment, the risks will be substantially mitigated if the proposed actions are successfully implemented, making the proposed financial management arrangements sufficient to satisfy the Bank's requirements under OP/BP10.02. It will be adequate to provide, with reasonable assurance, accurate and timely information on the status of the grant as required by the Bank.

49. The **procurement management capacity assessment** of DGESGWM's procurement capacity for the project concluded that the overall project risk for procurement is "average." Procurement under the proposed project involves only consultant selections and almost all the contracts will be subject to prior review. The Bank has provided procurement training during the preparation phase of the project to mitigate the risk associated with the low capacity in handling Bank financed procurement. Furthermore, the DGESGWM shall secure sufficient consultant services with experience in Bank procurement to support project implementation. The publicly held procurement activities will also include civil society participation to ensure greater transparency. Additional risks and mitigation measures are identified in Annex 9.

5. Social

50. The proposed project does not finance investments in geothermal power development and is not directly linked to activities which may have social impacts. As part of the technical assistance activities developing the policy framework and transaction management, due diligence procedures will be reviewed and incorporated.

6. Environment

51. The proposed project will not have a direct environmental impact as it will not finance geothermal investments. As part of the reforms the proposed project seeks to achieve, it will develop guidelines for prospective investors in geothermal power to assist them in complying with the applicable social and environmental laws, regulations and guidelines of Indonesia, and suggest measures consistent with international good practice that may help make the investments more "bankable", and therefore, attractive to international financiers. Safeguard policies

Safeguard Policies Triggered by the Project	Yes	No
Environmental Assessment (OP/BP 4.01)	[X]	[ ]
Natural Habitats (OP/BP 4.04)	[ ]	[X]
Pest Management (OP 4.09)	[ ]	[X]
Physical Cultural Resources (OP/BP 4.11)	[ ]	[X]
Involuntary Resettlement (OP/BP 4.12)	[ ]	[X]
Indigenous Peoples (OP/BP 4.10)	[ ]	[X]
Forests (OP/BP 4.36)	[ ]	[X]
Safety of Dams (OP/BP 4.37)	[ ]	[X]
Projects in Disputed Areas (OP/BP 7.60)*	[ ]	[X]
Projects on International Waterways (OP/BP 7.50)	[ ]	[X]

7. Policy Exceptions and Readiness

52. This project complies with all applicable Bank policies. This project will be ready for implementation upon Board approval.

* *By supporting the proposed project, the Bank does not intend to prejudice the final determination of the parties' claims on the disputed areas*

Annex 1: Country and Sector Background

INDONESIA: GEOTHERMAL POWER GENERATION DEVELOPMENT PROJECT

1. Key Development Issues

Indonesia could face a looming power sector crisis with the demand rising from a growing economy outpacing the countries' ability to develop adequate generation capacity. The situation is further exacerbated by a heavy reliance on diesel which, given today's high prices, is eroding the state-owned utilities' financial position hindering their ability to expand. In response, PLN, the state-owned electricity utility, is embarking on a large undertaking of constructing 10,000 MW of coal-based power generation, which they see as one of few immediate options available to them to quickly expand their generation capacity at the lowest financial cost. A critical risk with this strategy, however, is that the prices of these fossil fuels could also increase over time, as recent trends indicate, again pushing up the cost of supply that will undermine PLN's financial position. Furthermore, the utilization of fossil based fuels, whether diesel or coal, presents Indonesia with another challenge of dealing with the environmental impacts due to the resulting local[5] as well as global pollutants, particularly the incremental greenhouse gas (GHG) emissions.

Geothermal power development provides a clean and efficient alternative that can complement Indonesia's largely fossil-based energy generation mix. This is particularly the case given that Indonesia has an estimated 27,000 MW of geothermal power potential - nearly 40% of the world's geothermal potential. Exploiting this large endowment of resources can have a number of benefits: 1) its indigenous nature and local utilization provides enhanced energy security; 2) its non-tradable nature makes geothermal power a natural hedge against the volatility of fossil-based commodity prices; and, 3) significant environmental benefits since geothermal is a clean and renewable energy source. The GoI recognized the opportunity for greater utilization of geothermal resources and began a major effort to scale-up development in the 1990s utilizing both public and private channels.

The aim of GoI was to develop about 4,500 MW of geothermal power (see illustration in Figure A1.1). The GoI issued a Presidential Decree in 1991[6], through which they granted 11 Joint Operating Contracts[7] (JOC) to private geothermal developers to eventually exploit upwards of 3,000 MW. The remaining fields, with an estimated potential of nearly 1,500 MW were under the development plan of two state-owned enterprises - Pertamina, the state-owned oil company, and PLN. Subsequently, geothermal power capacity in Indonesia rapidly expanded to 807 MW, but development stalled in the aftermath of the Asian Financial Crisis. Very little geothermal capacity has been added since, and by 2007 the total stands at 969 MW.

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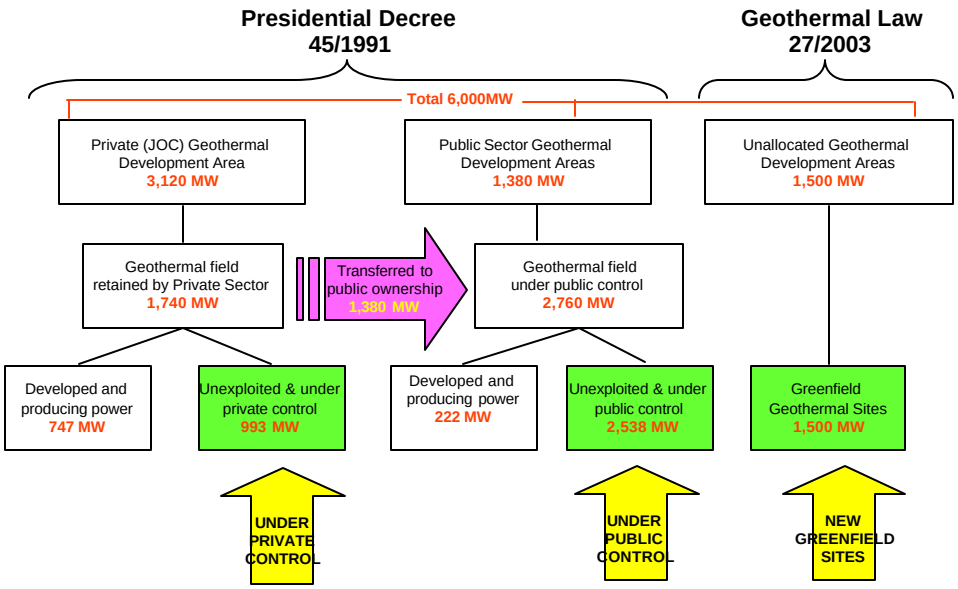
5 Total Suspended Particulates (TSP), Sulfur Dioxide (SO2), Nitrogen Oxide (NOX).

6 Presidential Decree 45/1991.

7 Pertamina was entrusted at the time with regulatory responsibilities for geothermal development, and therefore, private operators were given only the rights to develop the fields jointly with the state-owned oil company. Functionally, they were developed and operated by private developers, but there is cooperation with Pertamina on a number of aspects, including import duty and tax refunds.

Figure A1.1 : Status of Geothermal Power Development in Indonesia



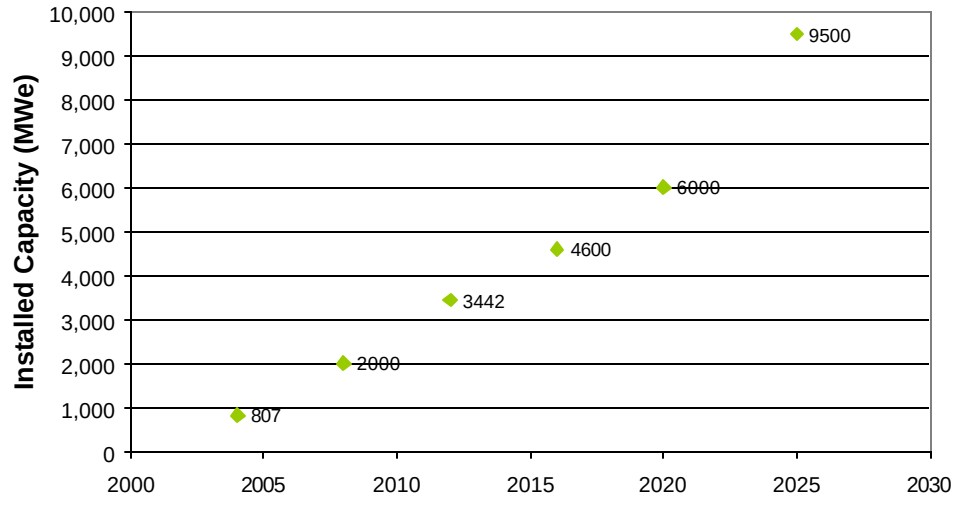
Geothermal contracts for private power producers, like many other power sector agreements, were suspended during the economic turmoil, and later they were either renegotiated or cancelled. Many of the existing investors who were already producing power eventually renegotiated their power purchase agreements at substantially lower tariff levels. Many others who had rights but were yet to fully develop their respective fields opted to transfer these assets back to public control, either as a result of arbitration proceedings or the cancellation of their contract. These geothermal fields, with an estimated total potential of nearly 1,400 MW, eventually reverted to public ownership with state-owned enterprises. Presently, there is nearly 1,000 MW of unexploited power potential under private control and over 3,000 MW with state-owned enterprises, about half of which are in geothermal sites that are partially developed[8].

Indonesia has added very little new geothermal capacity since the Asian Financial Crisis, but in 2003, the GoI made another effort to revive the sector. A new geothermal law (Law 27/2003) was issued in 2003, making geothermal the only renewable energy governed by its own law. The Law, among other things, shifted regulatory authority of the sector back to the GoI (Ministry of Energy and Mineral Resources), mandated that future geothermal fields (fields that were not allocated under PD45/1991) must be transparently and competitively tendered for development, and enhanced the role of local governments to be consistent with the more decentralized governance structure practiced in Indonesia today. The Law also "grandfathered" the fields previously allocated under PD 45 where existing operators could retain control. In addition, the

[8] Including geothermal fields with confirmed reserves (ready for power development).

GoI also developed a Geothermal Blueprint, which was to serve as a revised roadmap to develop a total of 6,000 MW of geothermal capacity by 2020[9].

Figure A1.2 : Geothermal Development Plan – Blueprint and Beyond



Despite these reform efforts, Indonesia still faces significant hurdles in attracting commercial financing and private investors to develop its geothermal resources. A number of barriers have also constrained the state-owned enterprises' ability to expand geothermal fields under their control. In general, the investment climate for infrastructure is not favorably viewed by many largely due to fragmented policies, bureaucratic red-tape, and poorly "structured" projects. Despite being regarded as a near commercial renewable energy technology, geothermal power development face a number of significant issues specific to the sector that deter investment in its expansion. These barriers include: (a) insufficient policies and regulations to support the implementation of the Geothermal Law, (b) inadequate incentives and a pricing mechanisms that would enable investors to recover costs to expand capacity to a level that is economically optimal, (c) Limited institutional capability to properly plan geothermal development and sufficiently engage suitable developers; (d) weak domestic capacity in the areas of resource assessment, equipment manufacturing, construction, operation and maintenance of geothermal energy facilities; (e) technical risks associated with the upstream steam resources that creates substantial uncertainty when developing unexplored (Greenfield) sites. Consequently, the development of new projects has been slow. Estimates suggest that Indonesia's geothermal power capacity would reach at most 1,100 MW by 2008, nearly 75% short of the incremental target set by Government.

[9] Later expanded to include an indicative longer-term target of 9,500 MW by 2025.

2. Regional Aspects of Geothermal Resources in Indonesia

Most of Indonesia's geothermal potential is found in the islands of Java-Bali and Sumatra, which accounts for about 37 and 51 percent of the national total, respectively (Table). This is favorable since Java-Bali is the predominant load center, accounting for 75 percent of the installed capacity in all of Indonesia, while Sumatra has the fastest growth in electricity demand (albeit from a small base of about 3 GW) in the nation. The potential for regional interconnection also puts Sumatra's geothermal potential in a valuable position.

Table A1.1: Geothermal Resources in Indonesia by Region and Resource Category
(MW As of 2005 and Installed Capacity as of 2007)

Location	Resources		Reserves			Installed Capacity
	Speculative	Hypothetic	Possible	Probable	Proven	
Sumatra	5,705	2,433	5,419	15	499	2
Java-Bali	2,300	1,611	3,088	603	1,727	947
Nusa Tenggara	150	438	631	-	14	-
Sulawesi	1,000	125	632	110	65	20
Maluku/Irian	325	117	142	-	-	-
Kalimantan	50	-	-	-	-	-
Total of 251 Locations	9,530	4,714	9,912	728	2,305	969
	14,244		12,945			
	27,189					

Source: Progress Report, Master Plan Study for Geothermal Power Development in the Republic of Indonesia, West Japan Engineering Consultants, Inc., February 2007.

Annex 2: Major Related Projects Financed by the Bank and/or other Agencies

INDONESIA: GEOTHERMAL POWER GENERATION DEVELOPMENT PROJECT

Project	Type of Assistance	Agency	Status	FY	Sector Issues being Addressed	Rating (for WB project)
Java Bali Power Sector Restructuring and Strengthening Project	IBRD	World Bank	Ongoing	2004	Energy Supply	MS
ID-PCF-Indocement-Cement	Carbon Offset	World Bank	Ongoing	2004	Environment	S
Solar Home Systems	Global Environment Project	World Bank	Closed	1997	Energy Supply	H
Domestic Gas Market Development Project	IBRD	World Bank	Ongoing	2005	Energy Supply	S
Master Plan Study for Geothermal Power Development in the Republic of Indonesia	Technical Assistance	JICA	Ongoing	2005	Technical Capability	
Study on Optimal Electric Power Development in Sulawesi	Technical Assistance	JICA	Ongoing	2006	Technical Capability	
Study on the Improvement of Utilization of Electric Power Facilities in Java Bali Region	Technical Assistance	JICA	Closed	2005	Technical Capability	
Study on Pollution Risk Mitigation Programs for Sustainable Coal Mine Development in the Mahakam River Basin In Indonesia	Technical Assistance	JICA	Closed	2005	Environment	
Lahendong Geothermal Power Plant Project	ODA Loan	JBIC	Ongoing	2004	Energy Supply/ Environment	
Muara Karang Gas Power Plant Project	ODA Loan	JBIC	Ongoing	2003	Energy Supply	
Muara Karang Gas Fired Power Plant Extension Project	ODA Loan	JBIC	Ongoing	2003	Energy Supply	
Semarang Power Plant Rehabilitation and Gasification Project	ODA Loan	JBIC	Ongoing	2004	Energy Supply	
South Sumatra-West Java Gas Pipeline Project	ODA Loan	JBIC	Ongoing	2003	Energy Supply	
Tanjung Priok Gas Fired Power Plant Extension Project	ODA Loan	JBIC	Ongoing	2004	Energy Supply	
Renewable Energy Development	Loan	ADB	Ongoing	2004	Energy Supply/ Environment	
Power Transmission Improvement Sector	Loan	ADB	Ongoing	2004	Energy Supply	
Infrastructure Project Development Facility	Loan	ADB	Ongoing	2006	Investment Climate	
INO: Tangguh LNG Project	Private Sector	ADB	Ongoing	2005	Energy Supply	
South Sumatra to West Java Phase II Gas Pipeline Project	Private Sector	ADB	Ongoing	2006	Energy Supply	
Institutionalizing the Clean Development Mechanism	Technical Assistance	ADB	Closed	2004	Environment	

Annex 3: Results Framework and Monitoring

INDONESIA: GEOTHERMAL POWER GENERATION DEVELOPMENT PROJECT

PDO	Project Outcome Indicators	Use of Project Outcome Information
Promote the development of economic and environmentally-sound geothermal power generation. Reduce CO_2 emissions by increasing electricity supply from geothermal power plants.	Installed geothermal power capacity resulted from the investment transactions assisted by the project Avoided CO_2 emissions by substituting geothermal power for coal-fired power	Y1-Y3: It is expected that the project outcome will be achieved toward the end of project implementation, building on continuous progress of the project components during the implementation period. It is especially critical to closely monitor the progress in policy development and adoption. Mid-term review to determine necessary actions and adjustments.
Intermediate Outcomes	**Intermediate Outcome Indicators**	**Use of Intermediate Outcome Monitoring**
Component 1 Improved investment environment for geothermal power projects	• Policy to address incremental costs adopted by GoI • Upstream resource risk mitigation mechanism in place • Implementation regulations of the Geothermal Law issued by GoI	Y1-Y2: Lack of GoI commitment to implement selected pricing mechanism would indicate weak political support to accelerating geothermal power development, especially in partially developed fields. Y1-Y2: Indecision on risk mitigation mechanisms would signal uncertain GoI commitment to developing greenfield geothermal resources. Y1-Y2: Delayed promulgation of the Implementation Regulations of the Geothermal Law may imply increased legal complexity for developing greenfield geothermal resources in the wake of government decentralization.
Component 2 Increased market uptake of geothermal power	• Model procedures and standardized documentation for competitive bidding of geothermal power transactions adopted by MEMR • Financial closure for about 300 MW additional geothermal power in fields that are controlled by existing operators • Financial closure for one power project (= 50MW) in a new geothermal field competitively tendered based on the Geothermal Law	Y1-Y3: Delays may indicate difficulties encountered in policy development and adoption (Component 1) and/or inefficient project implementation management. Need to pay special attentions to sequences of and the cross links between policy work and transactions assistance.
Component 3 Enhanced government capacity to support sustained sector development	• Relevant agencies for undertaking geothermal transactions trained through on-the-job programs as well as 5-10 workshops and seminars • Awareness raising and information dissemination activities about sector policies and business opportunities conducted through promotional campaigns including 5-10 stakeholder dialogue seminars • Strategy for domestic geothermal technology development formulated	Y1-Y3: Determine effectiveness of training and awareness programs and adjust as needed.

Arrangements for Results Monitoring

		Target Values			Data Collection and Reporting		
Project Outcome Indicators	**Baseline**	**YR1**	**YR2**	**YR3**	**Frequency and Reports**	**Data Collection Instruments**	**Responsibility for Data Collection**
Installed geothermal power capacity resulted from the investment transactions assisted by the project	0	0	0	350 MW	Annual	Surveys and Government Statistics	Directorate of Geothermal Enterprise Supervision and Ground Water Management (DGESGWM)
Avoided CO_2 emissions by substituting geothermal power for coal-fired power	0	0	0	2,000,000 tonnes/year			
Intermediate Outcome Indicators							
Component 1 • Policy to address incremental costs adopted • Upstream resource risk mitigation mechanism in place • Implementation regulations of the Geothermal Law issued	Not Applicable	Option selected Option selected Draft	Funding secured Funding mechanism confirmed Final draft	Applied in transactions Implementation arrangement for mechanism developed Promulgated	Annual	Project reports	DGESGWM
Component 2 • Model procedures and standardized documentation for competitive bidding of geothermal power transactions adopted • Financial closure for about 300 MW additional geothermal power in fields that are controlled by existing operators • Financial closure for one power project (= 50MW) in a new geothermal field competitively tendered based on the Geothermal Law	Not Applicable	NA NA NA	Final drafts NA NA	Applied Target achieved Target achieved	Annual	Project reports	DGESGWM
Component 3 • Relevant agencies for undertaking geothermal transactions trained through on-the-job programs as well as 5-10 workshops and seminars • Awareness raising and information dissemination activities about sector policies and business opportunities conducted through promotional campaigns including 5-10 stakeholder dialogue seminars • Strategy for domestic geothermal technology development formulated	Not Applicable	2 Workshops 2 Workshops NA	3 Workshops 2 Workshops Final draft	2 Workshops 3 Workshops NA	Annual	Project reports	DGESGWM

Annex 4: Results of Project Analysis

INDONESIA: GEOTHERMAL POWER GENERATION DEVELOPMENT PROJECT

This annex provides information on the analytical assessment that underpins the project and its key components. It includes descriptions of:

1. The economic rationale for developing geothermal power in Indonesia, and its economic competitiveness with coal-based power;
2. The incremental financial costs of developing geothermal power;
3. The major risks associated with geothermal resource exploitation; and
4. The challenges facing geothermal transactions in Indonesia

4.1 Economic Rationale for Developing Geothermal Power

An analysis was carried out to assess the comparative economic competitiveness of geothermal power generation in Indonesia. A supply curve was developed from available data for 51 geothermal fields[10] (with a total estimated capacity of 13,824 MW) to determine the economically optimal quantity of geothermal energy in Indonesia comparing it to coal-based power generation, which is confirmed to be the least-cost option for base-load generation expansion[11]. It also incorporates conservatively estimated environmental externalities that should be considered in determining the economically optimal level of geothermal development.

Methodology

The methodology consists of the following steps:

1) Estimate the production cost of coal-fired thermal power;
2) Estimate the production costs of each geothermal power project, and sort these in ascending order of cost to represent the supply curve of geothermal energy;
3) Estimate the quantity of geothermal energy whose production costs are lower than the production cost of coal-fired thermal power, an amount defined as Q_{ECON};
4) Estimate the local environmental damage costs of coal-fired thermal power;
5) Estimate the quantity of geothermal energy whose production costs are lower than the social cost of coal-fired thermal power (i.e. sum of the production cost and their corresponding local environmental externalities), an amount defined as Q_{ENV}; and
6) Estimate the quantity of geothermal energy that would be additionally justified by the avoidance of CO_2 emissions, an amount defined as Q_{GLOBAL}.

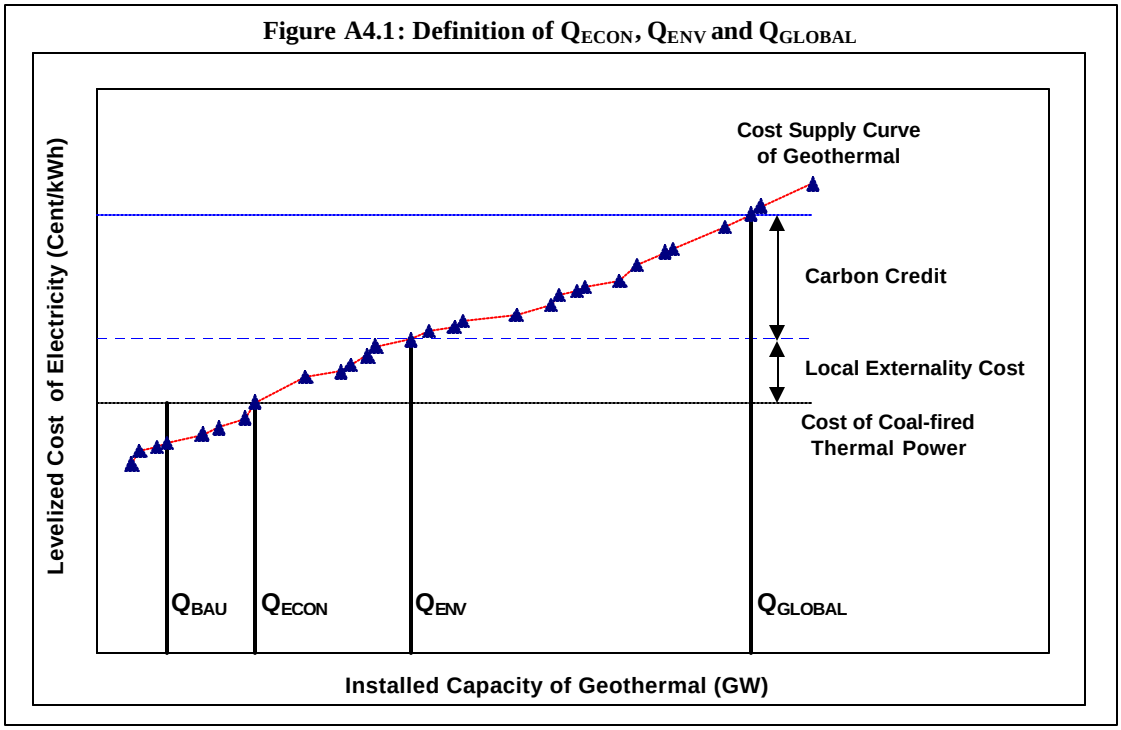
All costs are assumed to be economic costs, i.e. exclusive of taxes and duties. The coal price is based on international prices.

[10] Master Plan Study for Geothermal Power Development in the Republic of Indonesia, JICA, 2007.

[11] PLN carried out a cost effectiveness and a least cost study using WASP (Wien Automatic System Planning). Based on the assumptions used, it showed that coal is the least cost option for base-load generation expansion.

Figure A4.1 illustrates the definition of each optimal quantity before and after the environmental externalities is incorporated. Also shown in this figure is the quantity Q_{BAU}, which represents the quantity of geothermal energy that would be built, and is economic, even in the absence of policies to encourage geothermal energy development in Indonesia.

Figure A4.1: Definition of Q_{ECON}, Q_{ENV} and Q_{GLOBAL}



The geothermal energy database that was used is based on a recent JICA study[12] in which 73 geothermal fields have been surveyed and the data for 51 fields was deemed sufficient for inclusion in this analysis.

Valuation of Environmental Externality

Since emissions from geothermal power is far less than from an equivalent amount of coal-based power generation, these environmental impacts are quantified using conservative assumptions and included in analyzing the economically justified amount of geothermal development in Indonesia..

There are several methods that are commonly used to estimate the environmental externality cost associated with coal-fired power generation:

- One such method that is commonly used is to estimate directly the cost of damages caused by air pollution, including, for example, the health cost due to pollution, agriculture losses due to acid rain, etc;

[12] Master Plan Study for Geothermal Power Development in the Republic of Indonesia, JICA, 2007.

- Another frequently used method focuses on estimating the investment and operational costs that would be required to avoid the pollution that result from coal-based power; and
- A third option would be to attempt to quantify the willingness-to-pay by those affected by pollution in order to avoid such impacts.

Each of these methods require extensive data, which is often not available, especially in developing countries. Therefore, the costs associated with pollution in developing countries are often estimated using the benefit transfer method. This method calls for utilizing estimates from one country and adjusting them to be applicable in another. The ratio of GDP or PPP per capita between the two countries is commonly used to adjust the environmental impact estimate from one country to another. Since there has been very limited pollution damage cost estimates that have been done in Indonesia during the past few years, the benefit transfer method was used to quantify the encironmental externalities in the economic evaluation of developing goethernmal power.

The externality valuations are conducted for three major air pollutants that result from a typical coal-fired thermal power plant: TSP, SO_2, and NOx. The value of carbon credits that would result from trading CO_2 emissions reductions are monetized to estimate the global environmental impact of developing geothermal power in Indonesia.

The results from various studies can vary significantly, and even within studies most estimates are expressed in ranges to reflect their uncertainty as well as the different valuation approaches. In this analysis, assumptions and estimates are conservatively applied, adopting different reference studies for TSP, SO2, and NOx . The referenced studies and the estimates selected are as follows:

- TSP: A report *China – Environmental Cost from Pollution* was prepared jointly by Chinese government and an international team including the World Bank to assess the costs of environmental degradation in China. The damage cost of TSP was estimated based on its impacts on human health. The study shows that the total health costs in 2003 amounted to 157 billion Yuan or 1.2% of national GDP, when valued using the "adjusted human capital" approach which quantifies forgone earnings to value the loss of life. This is equivalent to an externality cost of 1,087 US$/ton of TSP (2006 price) in China.
- SO2 and NOx: The allowance spot prices of SO2 and NOx under the US Acid Rain and NOx Budget Trading Programs, which is operated by U.S. Environmental Protection Agency (EPA), are taken as the reference to calculate the externality cost of these two types of pollutants. The historical changes of spot price since 2005 shows that they fluctuate significantly over years. The 2006 average prices, about 1000 $/ton for SO2 and 1800 $/ton for NOx, are selected as the reference prices for this analysis.[13]

Using the PPP per capita in Indonesia in 2006, compared with that of China and US for the same year, the externality cost of TSP, SO2 and NOx for Indonesia is estimated using the benefit transfer method as indicated in Table A4.1.

[13] The SO2 and NOx costs in the US were driven down in large part due to the increased availability of low sulfur coal, which is abundant in Indonesia.

Table A4.1: Externality Cost Estimation in Indonesia (2006 price)

Country	PPP Per Capita in 2006 ($)	**Pollutants**	Reference Price ($/ton)	Externality Cost ($/ton)
Indonesia	3,950	**TSP**	1,087 (China)	555.6
US	44,260	**SO2**	1,000 (US)	89.2
China	7,730	**NOx**	1,800 (US)	160.6

The global environmental benefit of developing geothermal is estimated using the value of carbon credits traded under the Kyoto Protocol using the Clean Development Mechanism (CDM). In 2006, developing countries supplied nearly 450 MtCO2e of primary CDM credits for a total market value of US$5 billion[14]. This amounts to an average price of US$10.90 for Certified Emission Reductions (CERs) with a vast number of transactions in the range of US$8-14). Therefore, the present analysis conservatively applies a value of US$10/ton of CO2e to value the global environmental impact.

Major Assumptions for Estimating the Cost of Supply

Based on the discussion with PLN staff and input from international experts, the following basic assumptions are used to develop the cost of supply curve:

For coal-fired thermal power plant:

	Java-Bali	**Sumatra etc.**
- Capital cost ($/kW) *	900	1000
- O&M cost ($/kW-year)	45	45
- Plant efficiency (net, %)	36%	36%
- Economic life (year)	25	25
- Capacity factor (%)	75%	75%
- Coal price ($/ton)	40	30
- Coal quality **		
LHV (kcal/kg)	4,800	4,800
Sulfur content (%)	0.23%	0.23%
Ash content (%)	3.3%	3.3%
Carbon content (%)	60%	60%
- Emission removal efficiency		
TSP/Particulate (%)	95%	95%
SO2 (%)	0%	0%
- Economic life (years)	25	25
- Capacity factor (%)	75%	75%

Note: * FGD is not installed.
** The ash and sulfur content are much lower than that in China.

For geothermal plants:

- Transmission cost: These plants will normally be located remotely from the transmission grid compared with coal-fired thermal. Therefore, an average distance of 50 km for Java-

[14] *State and Trends of the Carbon Market 2007*, World Bank, May 2007

Bali Island and 30 km for other small islands are assumed; the transmission cost (normally over 150kV transmission line) is included in the capital cost of each geothermal plant.

- O&M cost: The station and steam field operations and maintenance costs are assumed as:

	Fixed O&M (US$/kW)	**Variable O&M (US$/MWh)**
Developments = 30MW	65	1.3
Developments > 30MW	52	1.1

In addition to these costs, the well replacement cost is assumed at 5 percent of the cost of the wells per year. Considering the relative cost of wells and fluid collection/disposal system which should be largely left intact, an additional 5 percent has been added to the annual well replacement cost to cover connection.

- Capacity factor: 80%
- Economic life: 30 years

Results

As summarized in Table A4.2, the results show that (i) 662 MW of geothermal capacity are economically justified if environmental benefits are not included. (i.e. business-as-usual); (ii) 2,442 MW of geothermal power is economically justified if local environmental benefits (reduced TSP, SO2 and NOx emissions) are considered; and (iii) 9,669 MW are justified if both local and global environmental benefits are incorporated.

Table A4.2: Optimal quantity of geothermal energy development (MW)

	Q(Bau)	Q(Econ)	Q(Env)	Q(Global)
National	450	662	2442	9669
Java-Bali	450	662	1842	3644
Sumatra etc.	0	0	600	6025

Note: Total installed capacity of all 51 fields is 13,824 MW, including 4,719 MW in Java-Bali grid and 9,105 MW in other grids.

Figures A4.2-A4.4 presents the cost supply curves for all of Indonesia, Java-Bali grid, Sumatra etc. grid and the national cost supply curve based on the information of these 51 geothermal fields

Figure A4.2: Cost of Supply Curve for Geothermal Power Development in Indonesia

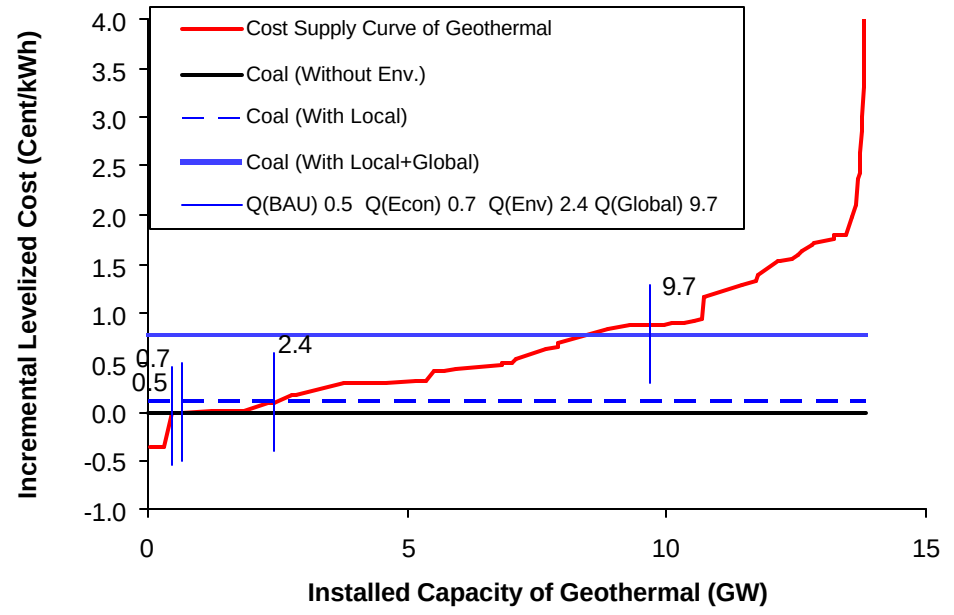


Figure A4.3: Cost of Supply Curve for Geothermal Power Development in Java-Bali

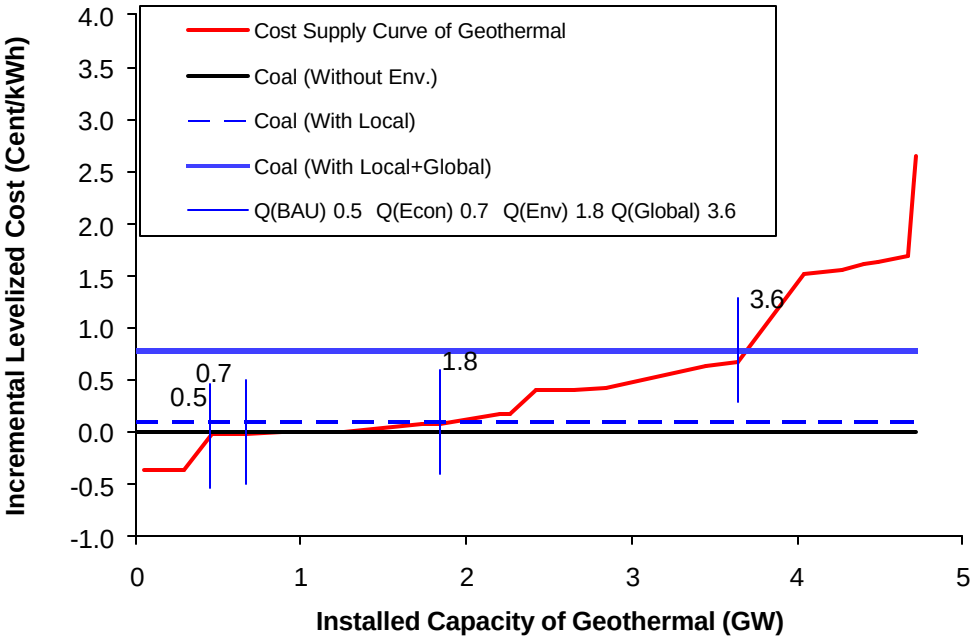
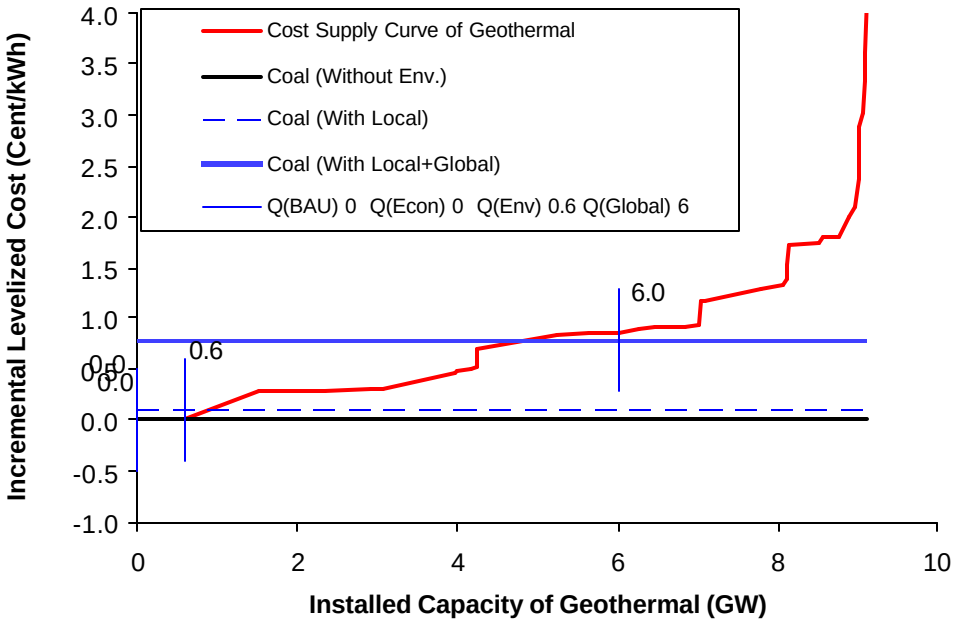


Figure A4.4: Cost of Supply Curve for Geothermal Power Development in Sumatra



A sensitivity analysis was carried out to reflect potential fluctuations in the price of coal, which would affect the relative competitiveness of geothermal. The results indicate that if coal prices were to increase by 10%, then more than 2,800 MW of total geothermal capacity could become economically viable even without accounting for its environmental benefits. If the environmental externalities associated with mitigating local and global pollution are considered, then a 10% rise in coal prices would increase the economically justified quantity of geothermal development to over 10,500 MW. Conversely, if coal prices were lower by 10%, then the economically viable level of geothermal development exclusive of environmental externalities would be reduced to 300 MW while less than 8,000 MW would be justified even with consideration for its environmental benefits

4.2 Incremental Financial Cost of Developing Geothermal Power

It is unlikely that Indonesia will be able to exploit its vast geothermal resources despite its substantial environmental benefits. The most significant reason is that financially geothermal power is often more expensive to develop than comparative base-load alternatives such as coal-based power. Therefore, PLN has little incentive to opt for increasing their geothermal power off-take and further deteriorate their already precarious financial condition. Instead, PLN, in coordination with GoI, is planning to undertake a major expansion of coal-fired power generation capacity, including an expansion of 10,000 MW in the coming years (Crash Program) to relieve capacity shortfalls. On the other hand, geothermal investors are also not eager to accept a power purchase price that is below cost recovery. Therefore, it is important that GoI identify ways in which incremental financial costs can be addressed in order to resolve the

impasse between PLN and developers so they both have sufficient incentive to undertake development consistent with the geothermal power development targets. .

The following section presents the main assumptions and results from a preliminary analysis to estimate the financial cost of developing different geothermal fields in Indonesia. These costs are then compared with generating power from coal-fired power plants, which by most indications remains the primary choice for upcoming power capacity expansion. Finally, there is an estimate of the total incremental financial costs of developing geothermal power up to the GoI target.

The analysis is based on technical data gathered for 51 geothermal fields Indonesia from a study undertaken by JICA[15] for the MEMR. The data for estimating the cost of coal are based on information obtained from PLN's Systems Planning group and other sources. The analysis was conducted separately for each island with geothermal resources since Indonesia's power grid is not interconnected between them (except for Java and Bali). It also focuses predominantly on the Java-Bali and Sumatra grids, since these islands are the largest load centers with about 90% of the installed capacity, and also have the largest concentration of geothermal resources with nearly 85% of the total in the country. Given the significant and rapidly growing power demand in these islands, there exists the possibility of substantial expansion of both geothermal as well as coal based generation capacity. Several other islands such as Sulawesi, Maluku and Nusa Tengara also have geothermal resources, but given their relatively small load many generation options they face are mutually exclusive. A financial cost comparison between available generation options for each of these islands is also included.

Key Assumptions

The following are the key assumptions made in estimating the financial costs:

Capital Costs

Coal-Fired Power Plants: PLN's System's Planning Report (RUPTL) indicates that they plan to construct coal-fired power plants of varying sizes throughout the country. Large units are planned for the Java-Bali grid in multiples of 300 MW units. Based on comparative information these plants are estimated to cost US$1040/kW including an allowance for flue gas desulphurisation plant (FGD) and some particulate control equipment. This investment cost has been scaled to reflect the capital costs of the smaller coal-fired power plants planned in the outer islands, which in Sumatra is 100 MW on average and range from 65MW to 7 MW in other islands.

Geothermal Power Development: The cost of developing geothermal fields were assessed using technical parameters from a study undertaken by JICA for the MEMR, where 51 of the 73 sites that were evaluated had sufficient information to be considered. The capital costs associated with developing the power plant is relatively consistent and is estimated to be $1,200/kW in line with experience in Indonesia and internationally. However, the cost of developing the upstream

[15] Master Plan Study for Geothermal Power Development in the Republic of Indonesia, JICA, 2007.

steam fields is site specific and can vary significantly. The discrepancies are mostly driven by the costs associated with drilling and Fluid Collection and Disposal System (FCDS).

The cost of drilling is a function of the number of wells as well as their required depth. Drilling costs have been recently increasing internationally because of rising steel prices and increasing competition for drilling rigs from the oil and gas sector. Therefore, it is estimated that the cost of drilling each well is US$1.4 million/km. The number of wells that are required to realize the potential of a given field is also a substantial driver of costs and also reflects the uncertainty associated with developing geothermal fields. Prior to drilling, it is difficult to predict the number of wells that may be successful in producing steam and their respective capacities. Such risks would be less prevalent in geothermal fields that are already partially developed where the conditions of the site are more certain. The estimated cost of developing greenfield geothermal sites can vary significantly, however, since more wells would need to be estimated drilled in order to account for the associated risks.

FCDS costs are also site specific as it would not apply to dry steam fields that will not require the disposal of waste water. For those that will require FCDS, the following estimates have been made and incorporated into the cost of developing the steam fields:

- Preliminary and civil costs not associated with waste water = $0.14 million/MW
- Preliminary and civil costs associated with waste water (costs will not apply to dry steam fields) = $0.07 million/MW
- Two phase pipe, separators, steam pipe, blow down costs = $0.14 million/MW
- Waste water line = $3.0 million/1000t/h of water
- Electrical and Control & Instrumentation = $0.014 million/MW

Transmission Costs: While coal-based power plants are assumed to be located in relative proximity to the existing power grid, geothermal plants may be located remotely from major centres and from the transmission grid. Since exact distances from the grid are not available, specific contingency funds have been allowed as follows. It is assumed that on major islands (i.e. Java and Sumatra) the transmission grid will be located between 50 and 100 km of the transmission line, and an allowance has been made for 75 km of transmission line at US$200,000/km. For small islands where the distance from the grid would be less, an allowance of 30 km of transmission line at US$100,000/km. The allowance for transmission was omitted only for fields where there are known transmission lines either through existing developments or through planned transmission routes.

Operational Costs

Fuel Costs: The cost of fuel is a key operational factor, particularly for coal fired power plants. Geothermal power plants essentially incur their fuel costs upfront when developing the upstream steam fields, and face lower costs that are steady over time by drilling make-up wells to maintain the capacity of the site. Alternatively, the coal-based power plants will need to acquire the fuel over time and the costs will vary according to fluctuations in the market.

PLN had indicated that they will gain access to a relatively low calorie coal sourced from Kalimantan that is intended for domestic use. However, there are indications that some of this coal with a calorific value between 4,300-4,800 kcal/kg is being marketed internationally possibly as a blender. Therefore, in the analysis it is assumed that the coal-fired power plants will need to access tradable coal at an average internationally comparative price of US$30/ton or US$1.7/GJ including local fuel transport.

As previously mentioned, geothermal fields will also incur ongoing costs associated with well replacement or workovers. Typical wells may have operational lives of 20 years so replacement is assumed at 5 percent of the cost of the wells per year. In addition, there will be costs associated with the connection of these wells to a slightly modified system. Considering the relative costs of wells and FCDS that would remain intact, an additional 5 percent has been added to the annual well replacement cost to cover connection.

Operations and Maintenance: The operational and maintenance costs for coal generation are based on a comparative average both internationally and in Indonesia. The fixed O&M costs are estimated at US$33.3/kW and the variable O&M costs are US$3.6/MWh.

The O&M costs associated with geothermal operations are also based on an international comparative estimate, and they vary based on the scale of the project. The fixed O&M costs for developments over 30MW will be US$52/kW while the variable costs will be US$1.1/MWh. For smaller operations under 30MW, the fixed O&M is estimated to be US$65/kW with the variable O&M cost at US$1.3/MWh.

The Cost of Capital

The cost of developing both coal-based and geothermal power are calculated using a cost of capital for each. A weighted average cost of capital (WACC) that would be faced in Indonesia by an Independent Power Producer (IPP) is estimated for this purpose assuming a debt/equity arrangement of 70/30 percent. The analysis indicates that a typical IPP requires a return on equity of 14.68% calculated using the widely utilized capital asset pricing model (CAPM)[16]. With a typical cost of financing construction projects in Indonesia at about 10%, the WACC for a standard IPP is estimated to be 12%. Discussions with several coal-based IPPs have further confirmed this estimate. Geothermal developers, on the other hand, will face additional non-diversifiable risks that would increase their cost of capital. One factor is the uncertainty regarding the upstream development cost associated with drilling wells, but this is already accounted for in the upfront investment estimate. The other would be the premium that would be placed given the greater up-front investment cost requirements of a geothermal development that would make investors more susceptible to contractual disputes and payment risks. Various reports and discussions with investors indicate that the cost of capital for geothermal IPPs is reaching 14-16 percent. Based on this information, a 16% WACC is used for all geothermal developments. This constitutes a conservative approach, given that slightly lower WACC may be realistic at brownfield sites given their relatively lower financing risks.

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[16] $CAPM = r_{free} + b_{asset} MRP$ ® **8.5%+0.95*6.5%=14.675%.**

Comparison of Geothermal and Coal Costs

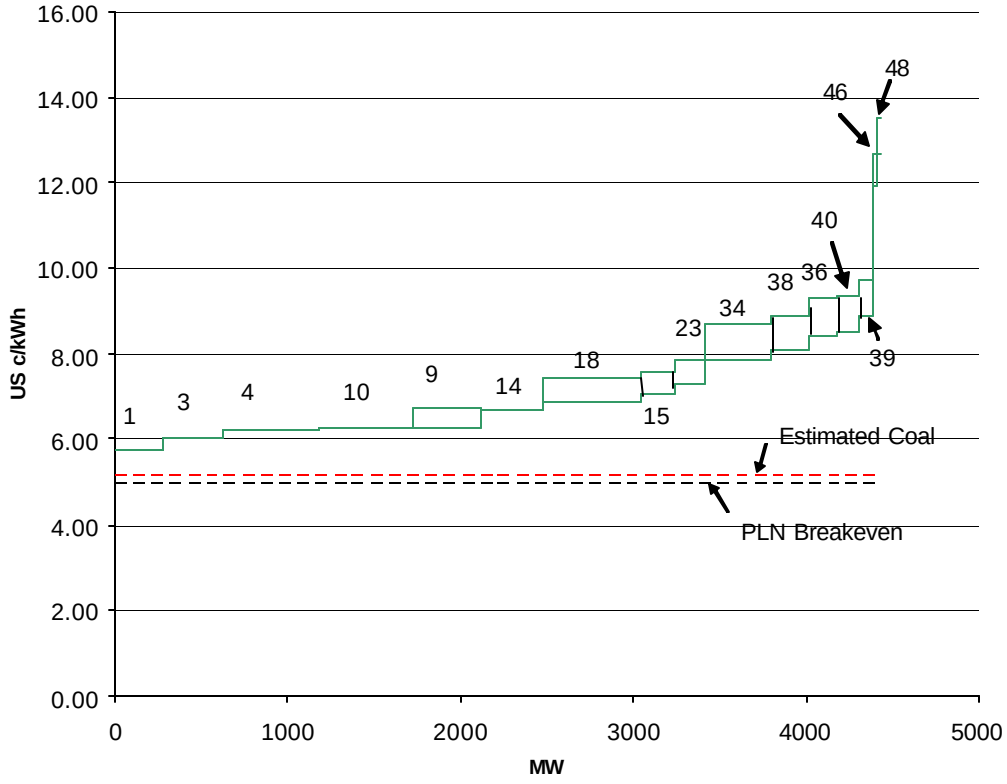
The costs of the 51 geothermal fields were calculated based on the field information from the JICA study along with the assumptions and analysis mentioned previously. The key parameters and results for each geothermal field are listed in Attachment 1 at the end of this section. These results were compared with the estimated cost of coal-based power in each grid in Indonesia. Furthermore, the cost at which PLN can purchase power and financially break-even across its system is also indicated. A power purchase cost beyond US cents 4.95 /kWh would lead to financial losses by PLN regardless of power source given the current retail electricity tariff levels.

The Java-Bali Grid

The graph illustrates each geothermal field in Java-Bali and their estimated total potential power generation capacity. The cost of developing each field is also indicated by estimated kWh costs. These costs are based on the estimated potential power generation capacity of each field and the expected total financial costs of developing them. Each field is numbered and correspondents to a list of geothermal fields displayed in the Addendum to this section. Each geothermal brownfield (1,3,4,10,14) that is already partially developed has a specific kWh price since they are proven fields where resources are confirmed whereby the cost of developing thee sites can be predicted with greater certainty. The cost of developing greenfield sites (9,18,15,23,34,36,40,38,39,46,48) are indicated as a range with upper and lower bounds, since there is greater variability around their costs until the sites undergo further exploration.

The geothermal costs are compared with two possible alternate prices. The first, referred to as the PLN benchmark price, is the level at which PLN can purchase power without incurring additional financial losses given the current electricity tariff levels. This breakeven price for PLN is 4.95 US cents/kWh across their system. The second is an estimated cost of coal-based power calculated based on parameters previously discussed and is specific to each grid. In Java-Bali, this price of coal-based power is calculated to be 5.17 US cents/kWh.

Figure A4.5: Financial Cost of Developing Geothermal for the Java-Bali Grid



Legend

Field Identifier	Name of Field	Field Identifier	Name of Field
1	Kamojang	23	G. Telagabodas
3	Darajat	34	Cisolok-Cisukarame
4	G Salak	36	Ungaran
9	Dieng	38	Ijen
10	G. Patuha	40	ArjunoWeilinangl
14	G. Wayang Windu	39	Telomoyo
15	G. Karaha	46	Citaman - G. Karang
18	Bedugul	48	Tankubanperahu

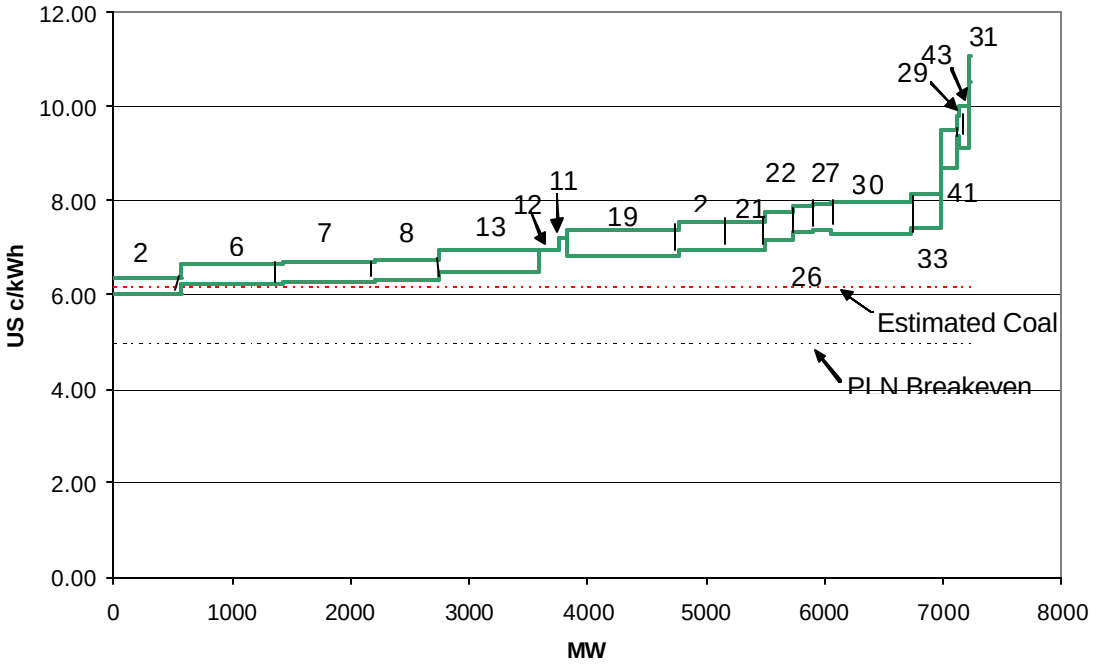
The cost associated with developing geothermal power is clearly different between brownfield developments and greenfield sites. The lower costs associated with fields that are already partially developed where there is greater certainty regarding geothermal prospects is reflected in the fact that all brownfield cost estimates fall below 6.68 US cents/kWh in the Java-Bali grid. The geothermal field that would be cheapest to expand is Kamojang (1) at 5.75 US cents/kWh. Wayang Windu (14) is estimated to be the costliest field among brownfield developments at a cost of 6.68 US cents/kWh. Gunung Patuha (10), which is controlled by the state-owned enterprise GeoDipa, is the least cost undeveloped geothermal site in Java at a cost of between 6.27 and 6.75 US cents/kWh. The expected costs of subsequent greenfield projects in Java are progressively higher with fields such as Citaman – G. Karang (46) and Tankubanperahu (48)

reaching above 10 US cents/kWh. It is important to note that the actual costs of these greenfield developments may be lower once the fields are drilled and resources further confirmed.

A sensitivity analysis was carried out to reflect possible fluctuations in the price of coal, and its impact on price incentives that developers would seek to invest in various geothermal fields. In Java-Bali, a 10% increase in commodity price of coal would not be sufficient to make additional geothermal development attractive on a financial basis over coal-based power. However, an increase of 20% would be sufficient to make it financially attractive to further develop the Kamojang field (1) to its estimated total capacity of 262 MW. Of course, any decrease in the commodity price of coal would further increase the financial gap between geothermal and coal based power.

The Sumatra Grid

Figure A4.6: Financial Cost of Developing Geothermal in Sumatra



Legend

Field Identifier	Name of Field	Field Identifier	Name of Field
2	Sungai Penuh	22	Muaralabuh
6	Suoh Antatai	26	Wai Ratai
11	Sibual Buali = Sarulla	27	Rajabasa
7	Lumut Balai	33	Sarulla
8	Ulubelu	30	S. Merapi - Sampuraga
13	Seulawah Agam	29	Lempur/Kerinci
12	Debuk/Sibayak	31	G. Talang
19	B. Gedung Hulu Lais	41	Marga Bayur
20	Tambang Sawah	43	Sipaholon-Tarutung
21	G. Sekincau	44	Iboih Jaboi

Demand is forecast to increase at a rate of 10.7% per annum in areas outside of Java-Bali. The island of Sumatra is the largest load center next to the Java-Bali grid, and has the fastest forecasted demand growth. Nevertheless, its present power generation capacity of 4,000 MW is substantially smaller than the nearly 20,000 MW present on the Java-Bali grid. But Sumatra also has the largest concentration of geothermal resources in Indonesia based on the JICA analyzed fields, with potential for over 7,800 MW. Still PLN's expansion plans rely predominantly on coal based power, with a total expansion of 3,050 MW planned by 2015. Given that the proposed coal-fired plants in Sumatra are on average 100 MW and smaller than those proposed for the Java-Bali grid, they are also less efficient. As a result, the comparative price of coal in Sumatra is calculated to be 6.17 US cents/kWh.

The geothermal costs in Sumatra, despite its potential, are also relatively higher than many of the fields in Java. This is largely due to the fact that there has been limited development of geothermal fields to date, with future development potential concentrated in greenfield sites. Therefore, the geothermal fields in Sumatra encompass risks that translate into higher expected costs similar to undeveloped sites elsewhere. Consequently, the geothermal costs for most fields in Sumatra are evaluated as a range to reflect this uncertainty and illustrate the variance in potential costs.

Given the set of assumptions made, the least cost development options such as the Sungai Penuh (2) field, would be at the very least above 6.04 US cents/kWh. The Sungai Penuh field could be developed at lower cost than the estimated cost of new coal generation.

The next four lowest cost fields (6,7,8,13) or nearly 3,000 MW in total potential, would require as much as 6.93 US cents/kWh in order to sustain its' investments depending on the success of exploration of the upstream steam fields. These fields are likely to be more expensive than equivalent coal generation. Subsequent fields progressively increase in their development costs ranging from a lower bound of 6.96 US cents/kWh to as much as 8 US cents/kWh. A number of final remaining fields (41,29,43,31) will incur even higher costs to develop reaching in excess of 10 US cents/kWh in some cases.

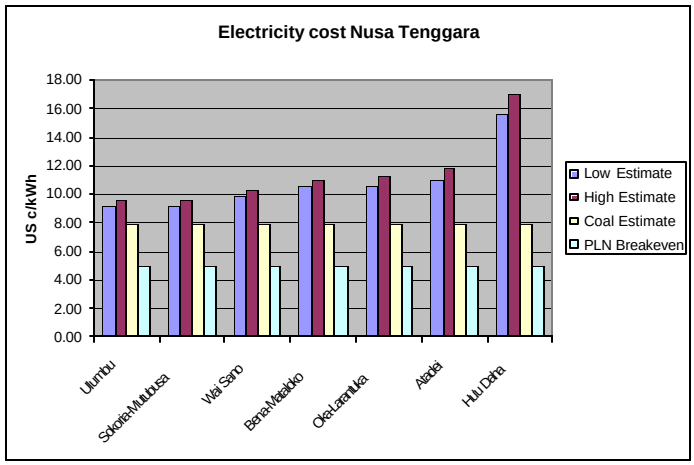
In Sumatra, a 10% increase in the price of coal could lead to the development of over 500 MW without any additional price interventions. If the price of coal increased by a more significant 20%, upwards of 700 MW of geothermal could be financially comparable to the cost of developing coal-fired generation in Sumatra.

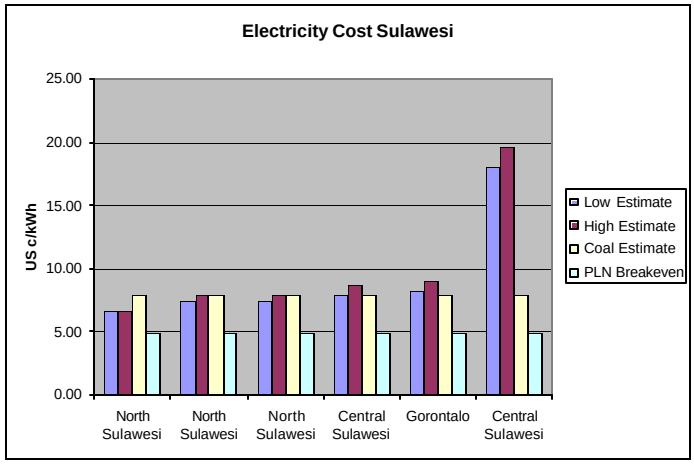
Other Islands

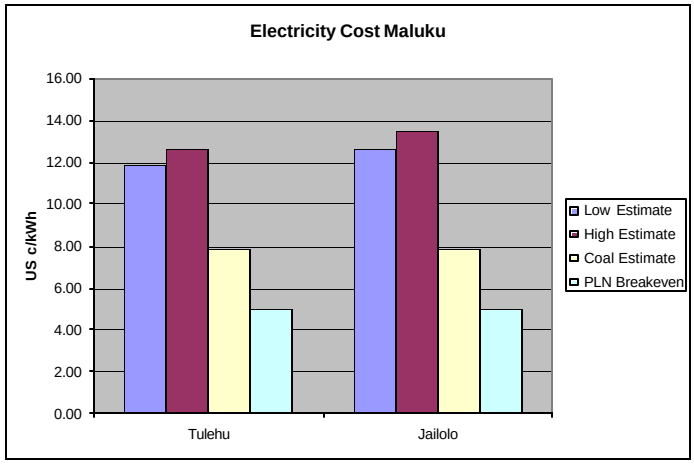
Several other islands such as Sulawesi, Maluku and Nusa Tengara also have the option of exploiting their geothermal resources for power generation. However, the load in these islands is relatively small, and therefore, the power generation options would be mutually exclusive. In many of these islands, geothermal can be an attractive option since the cost of operating relatively small coal-fired power plants of less than 25MW capacity can cost upwards of 7.5 US cents/kWh. In such cases, there would not be an incremental cost of utilizing geothermal over coal, but a cost savings. However, geothermal power from any of the fields in the outer islands

would be higher than the PLN break-even price of 4.95 US cents/kWh, which would require some mechanism to address the incremental financial loss for the utility.

Figure A4.7: Financial Cost of Geothermal in Other Islands







Total Incremental Financial Cost of Achieving GoI Target

Indonesia presently has over 950 MW of geothermal power generation capacity under operation. In order to reach the GoI target of increasing this capacity to 6,000 MW by 2020, an expansion of over 5,000 additional MW is needed. Given the prices forecasted thus far, additional funding would be required to cover the incremental financial costs of this expansion. Progressive development of geothermal capacity would increase the funding requirement due to the additional capacity as well as the higher expected cost of developing subsequent fields. The following table indicates the level of incremental funding that would be required in order to cover the incremental cost requirements as Indonesia proceeds to reach the GoI target. The initial expansion, where the existing brownfield sites present the cheapest option would have the smallest financial burden. Therefore, the next 500 MW – 1000 MW could be developed with an additional $87 – 128 million. Eventually, the capacity of brownfield sites will reach its limits and the potential in greenfields, where the costs and resource potential are more expensive and uncertain, will need to be utilized. As the geothermal power capacity reached 5,000 MW, the incremental financial costs could reach $727 million. It is important to note, however, that with further

exploration and risk mitigation, the greenfield costs may confirmed as being less than they are presently estimated. Therefore, it is not only essential for the GoI to develop a mechanism to address the incremental financial costs to immediately catalyze greater geothermal development, but also identify ways in which risk of developing future sites can be mitigated to reduce their expected costs so that investors are more likely to exploit these resources as well.

Table A4.8: Preliminary Assessment of Incremental Financial Cost of Developing Additional Geothermal Capacity

Additional Geothermal Capacity (MW)	**500**	**1000**	**2000**	**3000**	**4000**	**5000**
estimated additional funding requirements (US$ million per year)	87m	128m	317m	392m	536m	727m

The results of the analysis clearly indicate that there are incremental financial costs beyond what PLN is able to pay for geothermal power without deteriorating its financial position. Similarly, project developers also will be deterred from engaging in further expansion in the sector if they are unable to recover their development costs. Consequently, neither PLN nor geothermal investors would be compelled to reach an agreement to proceed with developing most of these fields since it is in neither group's financial interest. As a result, price negotiations on a case-by-case basis have led to extensive negotiations between PLN and developers that causes either major delays in implementing projects or unresolved impasse. The GoI has recognized the need for addressing the financial gap and ensure off-take by PLN if they are to develop geothermal resources in Indonesia in line with their expansion plan. They have established a multi-agency Tariff Team (Tim Tarif) facilitated by the MEMR to explore and resolve pricing issues related to geothermal development. This group is coordinated by the Directorate of Geothermal Enterprise Supervision and Ground Water Management (DGESGWM). In order to successfully accomplish their task, they will need to prepare a mechanism for addressing the financial shortfall related to geothermal incremental costs.

4.3 Major Risks Associated with Geothermal Development

There are risks associated with geothermal development that are unique, which can deter investors away from the sector. These undiversifiable risks are mostly associated with the technological risks and uncertainty surrounding the cost of developing the upstream steam fields. While the technology for generating power may be relatively standard, there can be considerable uncertainty during the initial stages of exploration before the upstream steam field potential is proven. Therefore, investors would be particularly apprehensive about undertaking the upfront investments in developing geothermal fields when the uncertainty surrounding its potential would be at a maximum. Consequently, they would want these risks to be either mitigated or adequately compensated, if they are to channel resources towards geothermal development.

There are two key risks that predominate geothermal development: i) the technical risks that makes it difficult to estimate the resource capacity of a geothermal field and the costs associated with its development, and ii) the high upfront costs that makes geothermal development financing more risky. These risks are described in greater detail below:

Resource Capacity Risks

The precise power generation potential of a geothermal site and the costs associated with exploiting the resource towards this end would only become clearer with the progressive development of the upstream steam field. A number of key technical parameters determine the power potential for a given geothermal field, which in turn drive the development costs and the price of electricity produced. There is significant scope for the initial assessment of many of these parameters to vary substantially, with the estimates becoming more predictable as the field is progressively developed.

The power generation potential of a geothermal field is a function of the number of wells that are drilled and the production capacity of each. In Indonesia, most of the geothermal wells that are in operation produce on average between 4-7 MW, whereby a 55 MW geothermal power plant may require anywhere from 8-12 wells including those used to re-inject condensed steam to replenish the underground reservoirs. Once these fields are drilled, however, the actual production capacity of each well may vary even substantially as indicated by a single well in the Sarulla field in Sumatra that is estimated to produce 50 MW of power. Some wells can even be fully unsuccessful. The JICA analysis estimates that the success rate of drilling is between 70-80 percent, with the probability higher for brownfields where the field conditions are better know. The other key factor is the depth to which wells need to be drilled to achieve success. Depending on the field, the JICA study estimates that drilling depths could be between 500 – 1500 meters to reach the geothermal reservoirs.

The technical risks associated with the resource capacity will all impact the potential cost of developing the upstream geothermal site. As the number of required wells and the depth to which they must be drilled increases, so will the cost of developing the field. Presently the cost of drilling has risen to around US$4 million per well due to a rise in commodity prices such as steal. In addition, the sector is also experiencing a shortage of drilling rigs as other sectors such as oil and gas, which are also competing for the same equipment since they are also expanding to meet global demand. Therefore, there is significant variability investors would face developing a geothermal field that they would not face with other power generation options.

Financing Risk

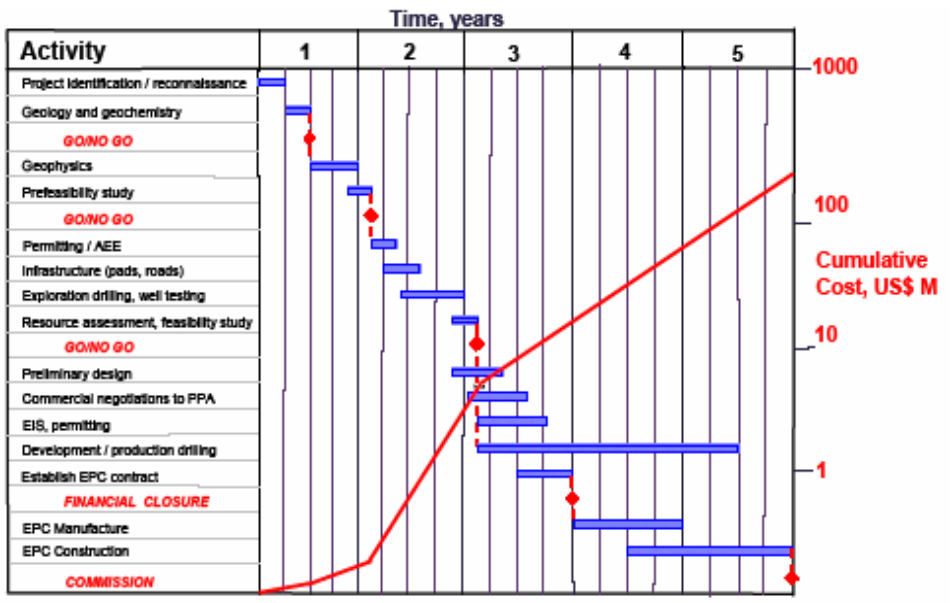
Geothermal projects involve greater up-front commitment of capital compared to coal projects. This is largely due to the costs associated with the upstream development of steam fields. Unlike coal supplies that are purchased over its operations, the upstream development of a steam field amounts to purchasing the lifetime of fuel upfront. Therefore, comparatively higher financing is needed for undertaking geothermal developments. The greater outlay of funds upfront makes geothermal projects more vulnerable to contractual and payment risks. Consequently, investors will require a greater return on their investments to off-set the financing risks that are uniquely related to geothermal development. This is reflected by the difference between the estimated cost of capital geothermal and coal power projects. Independent power producers of coal-fired power plants are found to settle for an overall return of 12 percent on their investment. Geothermal developers, on the other hand, are will require between 14-16 percent based on the

present analysis as well as investor input. It is likely that the lower end of this range reflects brownfield projects that are likely to cost less. Greenfield investors will have to secure more funding in anticipation of the higher expected development costs, whereby, the financing costs would also be at the higher end of the range.

Confirming Upstream Resources

The uncertainty surrounding the exploration of geothermal steam fields can only be reduced through project development. The following graph illustrates the common stages of developing a typical geothermal field. At each successive stage, there is greater understanding of the field characteristics and enhanced certainty of the field potential as well as the additional costs required to fully develop them. In fact, geothermal fields are usually developed progressively in a modular format largely for this reason. The breakthrough in confirming resources usually occurs after initial drilling takes place in a geothermal field. This is also one of the costlier phases in the development process, during which the developer is undertaking investments without knowing the potential for recovering these cost from exploiting the resources in the field. Consequently, many investors would be deterred by such uncertainty or find it difficult to find financiers who would be willing lend money considering such risks. Therefore, both investors and lenders are likely to look for ways on which they could either mitigate or share these risks.

Figure A4.9: Risk, Cumulative Cost and Project Cycle for Geothermal



Upstream Risk Mitigation

Indonesia is likely to attract more investments into the greenfield geothermal developments, if there were opportunities for developers and financiers to hedge against these risks. They are no different than those faced in many other geothermal resource endowed countries. Many of them often employ varying risk mitigation schemes to attract investors and enhance prospects for

developing geothermal. The following illustrate a few of the risk sharing arrangements utilized internationally to catalyze investments into geothermal development:

Government sponsored exploration: In a number of countries, the governments have borne the upstream risk of developing geothermal fields by undertaking exploration activities. In the Philippines, the national oil company (PNOC) took on the responsibility of resource development and exploration, after which, the power generation was offered to private investors through a build-own-transfer (BOT) scheme. The Government also ensured that there was an off take arrangement with the National Power Company (NPC). With implementing such a support scheme, Philippines developed nearly 700 MW of power generation capacity. The government in New Zealand also addressed the issue of upstream risk in the geothermal sector by undertaking the exploration of fields themselves. Once the fields were proven, the government would then offer them to private developers for power generation. The electricity generated from these projects would be sold to the power market in New Zealand.

Exploration risk sharing: In the United States, the world's largest geothermal producing country, the government has provided a guarantee for part of the loan for upstream exploration. The aim was to catalyze private development through the partial guarantee of loan repayments.

Partial risk guarantee: In Eastern Europe, the GeoFund, was established to provide geological risk cover for geothermal development projects. The fund, which is able to pool risks, provides equity funding to lower the risk to lenders. It also provides insurance to cover the risk of drilling unsuccessful wells. The Argeo Fund in the African Rift Valley also aims to pool funds to provide partial guarantees to cover unsuccessful drilling at both the early a well as the advanced stages. These funds expect to be sustainable over time as they revolve the credit they offer by charging a premium for their services.

During the 1990's when Indonesia began to expand its geothermal power capacity, the GoI essentially provided sufficient incentives to developers by offering a relatively high price of between 7-8.5 US cents/kWh for geothermal power. This high price also served to compensate developers for the risks they were undertaking with upstream exploration of geothermal fields. Using price supports to mitigate risks, however, may not be an ideally efficient mechanism. The GoI recognizes that some form of risk sharing arrangement will be vital especially to make "greenfield" projects attractive for investors. Therefore, they intend to evaluate various risk mitigation methods utilized internationally, and then design one that would be suitable for application in Indonesia.

4.4 Challenges Facing Geothermal Transactions in Indonesia

The GoI has tasked the Ministry of Energy and Mineral Resources (MEMR) to expand Indonesia's portfolio of geothermal power generation, by developing new fields, and encouraging existing fields to produce more electricity. There is substantial potential in fields that have already been allocated to private or public developers that are either partially developed "brownfield" sites or remain unexploited "quasi-greenfields". The partially developed "brownfields", where the cost of expansion is expected to be lower due to enhanced knowledge of field conditions and greater certainty of the resource, are likely to present the best option for

immediate expansion of geothermal power generation in Indonesia. These fields have seen little development since the Asian Financial Crisis, largely due to pricing as well as other barriers, and the MEMR plans to address these barriers through its reform program to make their expansion "bankable"[17] to developers. The "quasi greenfields" present a unique challenge. The fact that they have not been developed at would imply some critical flaw either in the project or in the investor. The perceived cost of development is high due to anticipated risks associated with such unexplored fields, but MEMR hopes to catalyze investments in these fields as well through the reforms proposed through this project.

Going forward, the GoI plans to use private investment to mobilize financing for geothermal power generation. The Geothermal Law (2003) stipulates that geothermal fields must be competitively tendered in the future by the Government to qualified developers. The responsibility for conducting such transactions within the government rests with the MEMR, but they have limited capacity and resources available to them for such an undertaking. These "greenfield" sites, where geothermal potential has been identified yet no exploration or development has taken place and rights to develop them are yet to be awarded to investors, make up the vast majority of fields that will be developed in years to come.

The proposed project will assist MEMR to attract "bankable" offers from existing as well as potential developers through credible and transparent transactions. These transactions are expected to immediately catalyze investments in the existing "brownfield sites" while also initiating the longer term development of "greenfield" sites. This section describes the challenges facing the development of these various geothermal sites and the proposed actions to address them and how the project will support these measures.

Background

The total potential in "brownfield" sites under the control of existing developers as targeted in the GoI Geothermal Blueprint GoI is about 4,500MW[18] although only 970MW has been exploited and is presently producing power. Although significant resource potential resides in fields that are publicly controlled, a majority of power generation is from private geothermal fields. These independent power producers (IPP) operate under joint-operating contracts (JOC) with Pertamina[19]. Pertamina is also the largest public sector geothermal developer, while GeoDipa has substantial potential in the fields they control but very little power is being currently produced from them. Many of these developers have been looking to expand fields under their control to utilize the unexploited potential, which is significant. However, they have faced many difficulties in raising the necessary financing, and indications suggest that it is largely due to insufficient prices and the lack of a "bankable" power purchase agreement (PPA).

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17 Having financial and commercial viability sufficient to attract financing sufficient for its requirements.

18 This total is based on the Geothermal Blueprint, although subsequent assessment in the JICA study indicates that the true potential in these fields may be greater. Therefore, the potential indicated in the tables in this section total 5,169 MW, since they are based on the more recent JICA assessment.

19 See page 18 for further discussion of the system of procurement of geothermal investment before the Geothermal Law (2003). Before the law, Pertamina was the regulator for the geothermal sector.

Table A4.10: Privately operated brownfield sites

No	Project	Developer	Contracted or Allocated Amount	Installed	Location
1.	Darajat	Chevron	330MW	260MW	West Java
2.	Salak	Chevron	495MW	377MW	West Java
3.	Wayang Windu	Star Energy/MNL	400MW	110MW	West Java
	TOTAL		1,225MW	747MW	

Source: Indonesia Geothermal Association (2004), and Ministry of Energy and Mineral Resources Indonesia (2007)

Table A4.11: Publicly operated brownfield sites

No	Project	Developer	Contracted or Allocated Amount	Installed	Location
1.	Kamojang	Pertamina	230MW	140MW	West Java
2.	Dieng	Geodipa	400MW	60MW	Central Java
3.	Lahendong	Pertamina	40MW	20MW	N. Sulawesi
4.	Sibayak	Pertamina	120MW	2MW	N. Sumatra
	TOTAL		790MW	222MW	

Source: Indonesia Geothermal Association (2004), and Ministry of Energy and Mineral Resources Indonesia (2007)

The quasi-greenfield sites pose a particular challenge. They are fields already allocated to developers, but from a technical point of view, they would be similar to any unexploited greenfield project. Therefore, it will be important for GoI to create adequate incentives commensurate with these risks in order to mobilize investments to develop these fields under the present contracts or terminate them so that they can be re-bid to other qualified investors. Some of these fields, however, have undergone exploration drilling, which may alter their cost-profile and present a more attractive option for quicker exploitation. It is also important to note that much of these "quasi-greenfields" were previously under private control, but were subsequently transferred to public ownership as a result of arbitration or cancellation of their contracts after the Asian Financial Crisis. Therefore, some of these fields are likely to face additional legal and financial obstacles to developing their resources. The failure to exploit these quasi-greenfield projects also raises questions about other more critical constraints of the project or shortcomings of the investor. Further due diligence will be required to identify all relevant constraints before finalizing the design of the process for expanding brownfield and quasi-greenfield projects.

Table A4.12: Privately controlled quasi-greenfield sites

No	Project	Developer	Contracted or Allocated Amount	Location	Reserves Confirmed through Expl Drilling*
1.	Bedugul	Bali Energy	175MW	Bali	600MW
2.	Cibuni	PT YTG	10MW	W. Java	
3.	Sarulla-Sibual-buali/	Medco	330MW	N. Sumatra	213MW
TOTAL			515MW		

Source: John Whebble and Associates (2007), Indonesia Geothermal Association (2004), and Ministry of Energy and Mineral Resources Indonesia (2007)

Table A4.13: Publicly controlled quasi-greenfield sites

No	Project	Developer	Contracted or Allocated Amount	Location	Reserves Confirmed through Expl. Drilling *
1.	Hululais	Pertamina	440MW	Bengkulu	
2.	Tompasso	Pertamina	150MW	N. Sulawesi	
3.	Kotamobagu	Pertamina	185MW	N. Sulawesi	
4.	Karaha	*Under Dispute*	400MW	W. Java	30MW
5.	Patuha	Geodipa	400MW	W. Java	170MW
6.	Tulehu	PLN/GoI	100MW	Maluku	
7.	Ulumbu	PLN/GoI	200MW	E. Nusa T.	175MW
8.	Sembalun	PLN/GoI	39MW	W. Nusa T.	
9.	Ulubelu	Pertamina	330MW	Lampung	
10.	Lumutbalai	Pertamina	330MW	S. Sumatra	
11.	Mataloko	PLN/GoI	65MW	E. Nusa T.	20MW
TOTAL			2,639MW		

Source: John Whebble and Associates (2007), Indonesia Geothermal Association (2004), and Ministry of Energy and Mineral Resources Indonesia (2007)

* TABLE A4.6 and A4.7: These are sites with complete feasibility studies, where several well drilling and testing have given sufficient outcome to confirm commercially viable development of some specific MW, which is also called as proven reserves, (JICA Masterplan Study, 2007).

In parallel with resolving existing constraints on brownfield and quasi-greenfield projects, the MEMR intends to commence procurement of the Greenfield projects, to tap into about 27GW of suppressed geothermal power generation capacity in Indonesia. The process for preparing greenfield transactions, in particular the first few, will take time and a disproportionate amount of resources until a standardized process can be finalized and implemented. For this reason, the MEMR has requested that greenfield project development form an important part of this project. Presently, there are 253 sites identified throughout the archipelago, with about 53 fields having undergone various geological surveys to estimate prospects. Based on the Geothermal Law, those fields that are not yet awarded to any developer are under the purview of the MEMR, and will need to be awarded to developers through competitive tender. The MEMR is now evaluating these fields in order to sequence them to begin preparation of the initial batch for tenders. Since MEMR has limited prior experience conducting such transactions, the initial undertakings will serve as a key measure in building market confidence, which is likely to impact the success of geothermal development for some time to come. Therefore, it is essential that these initial transactions are well developed, seen by investors to be "bankable", and tendered in a transparent manner.

Challenges Facing the Implementation of Successful Transactions

A number of challenges presently constrain the expansion of geothermal power generation through "brownfield" and "greenfield" projects. This project will help identify, analyze and resolve such constraints, including:

Pricing: The pricing mechanism must bridge the incremental cost associated with geothermal power. Many existing producers undertook their investments on the basis of generous terms that

were offered prior to the Asian Economic Crisis. With a favorable exchange rate at the time, geothermal developers were offered electricity sales prices that were fixed in US dollars, with a typical range of 7-8.5 US cents/kWh. Subsequently, these agreements were re-negotiated to levels that developers claim may be suitable to carry on existing operations, but insufficient to justify further expansion. With the limited data available to GoI, it has been challenging to develop appropriate incentive mechanisms to catalyze further investments in these fields. Clearly, the expansion of "Greenfield" projects will suffer from similar pricing incentive requirements, with higher associated upstream development risks. Therefore, this project will propose mechanisms to address incremental costs appropriate for the different types of transaction to be undertaken by the MEMR.

Consistency with the power development plans: There are indications that it can take substantial time for geothermal developers and PLN to reach agreement on terms of their arrangements and conclude power purchase agreements. In addition to delaying development of geothermal fields, it also undermines PLN's ability to reliably include these projects in their overall expansion plans. A few recent PPA discussions have lasted anywhere from 2-3 years before they were concluded. Although pricing remains a key issue, various other factors, such as associated investments by PLN, also contribute to these delays. Equally, investors' confidence will depend on the inclusion of a "bankable" PPA with PLN as a part of the transaction. The project includes the agreement with PLN of standard PPA terms and procurement plans (for green and brownfield projects) to stream-line the process, accelerate project development and protect the MEMR and PLN's interests.

Investor confidence in the geothermal sector: Private developers and financial markets have been reluctant to invest at a significant level in the geothermal sector in Indonesia due to years of inaction and the negative experiences following the Asian Financial Crisis. The present set of reforms presents GoI with a sound opportunity to build investor confidence in the sector. It will be crucially important to adequately prepare and properly conduct these initial transactions so that the credibility of the sector is progressively enhanced.

Transaction experience at MEMR: There is limited transaction experience within the MEMR Geothermal Department as it was only recently established. Transaction processing is also a new responsibility for the MEMR, which has relied on state-owned enterprises to engage investors in the past. Therefore, the proposed project will play a critical role in augmenting their capacity to undertake transactions as well as to strengthen their dialog with PLN, which remains a key stakeholder as the dominant power purchaser in Indonesia.

Additional Challenges Unique to "Brownfield" Sites

Addressing legacy issues in JOCs: In addition to the high prices that were offered to private developers during the 1990's, they were attracted with other incentives to invest in geothermal. This included fiscal incentives in the form of reduced corporate taxes and refunds on import duties as well as the value added tax. It also includes other terms that were previously agreed, which they may want to consider changing or replacing altogether given the present conditions in the sector as well as the country. The Ministry of Finance has indicated that many of these concessions are inconsistent with today's fiscal policy of the government, which has created a

point of contention with developers. It will be important for MEMR to ensure that any offer made to catalyze the expansion of "brownfield" sites takes into consideration these prior commitments, and any offer made is legally unambiguous, and fair to the developers and the government.

5.4 Additional challenges facing "Greenfield" transactions

Standardized procedures and documentation: The Geothermal Law requires that all future awards of geothermal sites be made through public procurement on a concession basis. At present, there is no clear procedure or process for undertaking a geothermal transaction through a competitive tender. Nor is there standard documentation or a power purchase agreement (PPA) agreed with PLN that could be offered in a transaction. Previously, the GoI reached negotiated agreements with developers rather than through a competitive tender process.

Project selection criteria: Currently, the Geothermal Department at MEMR uses criteria that only focus on the geothermal field development for selecting priority projects. However, given that geothermal resource development is intricately linked to power generation, it will be important to incorporate additional criteria when determining the viability of projects before they are tendered. Such criteria would also likely include environmental and social concerns that could raise investor concerns and prevent GoI from successfully concluding a transaction.

Legal and policy ambiguity: Despite the Geothermal Law being enacted in 2003, a robust set of implementing rules and regulations are yet to be issued. Although the Law stipulates that the government competitively tender future geothermal projects, it remains ambiguous as to the separation of roles between central and sub-national governments. Developers have informally raised concern regarding an uncoordinated effort between central and local governments that could enhance uncertainty in the sector and undermine investor confidence.

Integration of geothermal development and power generation: The upstream geothermal resource development and the downstream power generation are legally separated in Indonesia. Therefore, a geothermal site that is tendered does not necessarily provide the winning bidder with the right to generate and sell power. Since PLN is the dominant purchaser in the power sector, investors are unlikely to invest significant funds to develop upstream resources without assurances that they can recover these costs through PPAs. The MEMR, which regulates both the geothermal and the power sector, has begun to address the issue of integrating geothermal sites that are tendered, and will need to formalize these arrangements prior to undertaking any transaction.

Upstream risk mitigation: Initial assessments indicate that the perceived costs of "greenfield" sites are higher than those that are already partially developed, largely due to the inherent risks associated with upstream geothermal development. Much of these risks are likely to remain until some test and production geothermal wells are drilled. In order to get maximum efficiency from investors and through the competitive process, the GoI will need to consider the allocation of these risks and possibly the need for mitigation measures to provide developers with adequate incentives.

Annex 5: Detailed Project Description

INDONESIA: GEOTHERMAL POWER GENERATION DEVELOPMENT PROJECT

Component 1: Policy Framework for Scaling-up the Development of Geothermal Power (proposed GEF funding: US$1,100,000, GoI funding US$2,500,000). This component will assist the GoI in developing and implementing an integrated set of policies that will provide sufficient regulatory certainty, risk mitigation, and economic incentives for increased public and private investments toward developing geothermal power in Indonesia. Three key areas of assistance are proposed:

C1.1: *Development and implementation of policy to address incremental costs (proposed GEF funding: US$600,000)*. This subcomponent is designed to develop a pricing mechanism to provide adequate economic incentives for developing geothermal resources. It will also address any incremental costs that may be associated with some geothermal developments as a result of the market failure to incorporate the environmental externalities into investment decisions, which remains a key barrier to geothermal development. The project will study international experiences in formulating pricing and economic incentive mechanisms, evaluate the extent of the market failure and assess the incremental costs, confirm the funding requirements and sources, and develop the operational procedures required to implement the selected option. Many other countries have implemented policies that favor the development of renewable resources, such as geothermal, and these will be carefully studied during the project to identify ones that would be suitable for application in Indonesia. When implemented, this pricing mechanism would cover any incremental costs and provide sufficient economic incentives to immediately benefit developments under the control of existing developers, but would also extend to provide support to the longer terms development of unallocated geothermal resources in the country.

Phase I: Select suitable option (s) for addressing incremental costs - During the first phase, the broad objective is to determine the design of the pricing mechanism and identify any incremental costs. During this phase, the MEMR will need to revisit the GoI geothermal expansion plan and confirm the incremental cost estimates. Based on these requirements, they will need to explore the sources for bridging this funding gap and develop a system through which they would extend sufficient economic incentives for developers to undertake investments. A GoI decision on the form of this mechanism will be an important milestone before successfully offering investment opportunities through the transactions proposed in project component 2. During this phase, MEMR will also work with PLN to develop a pricing structure that could be implemented through a standardized power purchase agreement Investors will look for a clear and practical solution that will confirm the "bankability" of the projects offered by GoI. Therefore, it will be vital to engage stakeholders at this stage including PLN in order to incorporate their views in the final design of the pricing policy.

Phase II: Implement mechanism for addressing incremental costs - Phase two would comprise of designing the implementation measures for the pricing mechanism. This would include developing the operational procedures that would be required to secure funding from the

selected sources. . MEMR would also finalize any legal and policy documentation that is required to formalize the pricing policy and offer its options to investors.

C1.2: *Development and introduction of risk mitigation measure(s) (proposed GEF funding US$400,000)*. This sub-component is designed to create a mechanism for mitigating upstream resource development risks faced by geothermal developers in Indonesia (See Annex 4, Section 3). It is intended to limit investor's exposure to uncertainty stemming from the potential power capacity in geothermal fields and the relatively higher upfront investment costs – both of which can be prohibitive for commercial financing of geothermal projects. International experience will be evaluated before selecting a risk mitigation mechanism applicable to Indonesia, after which, the project will develop procedures and arrange necessary funding for implementing the selected mechanism. The development of risk mitigation measures will be carefully coordinated with other aspects of the Geothermal Policy Framework (Component 1) and with the management of transactions (Component 2 below) to ensure its integration.

Phase I: Select risk mitigation scheme to be implemented in Indonesia - During the first phase, the MEMR will evaluate and identify the risks that predominate in geothermal development in Indonesia, compare them with international experience, and formulate a suitable mechanism for application. During this assessment, they will specifically identify risks that are unique to geothermal power development, and also consider existing risk mitigation measures that may be in use for other areas in infrastructure. In developing a risk mitigation policy, the MEMR will also engage investors to confirm their finding and also validate the proposed solutions. At the conclusion of phase 1, the GoI would have selected the specific mechanism (s) they plan to apply for reducing risks in the geothermal sector in Indonesia. The selection of a suitable risk mitigation scheme will be an important aspect when offering investment opportunities in geothermal fields that are deemed to carry considerable upstream development risks (i.e. greenfields).

Phase II: Develop procedure for implementing scheme and arrange necessary funding - In the second phase, the MEMR will develop the mechanism and procedures for implementing the risk mitigation scheme. This would include the finalization of any operational guidelines, financing arrangements, and legal obligations. At its conclusion, the GoI would be ready to apply risk mitigation options to provide sufficient incentives for investors to exploit geothermal fields where the uncertainty surrounding upstream development is substantial.

C1.3: *Support the implementation of the Geothermal Law (proposed GEF funding: US$100,000)*. This sub-component will review the Geothermal Law and the draft Implementation Rules and Regulations of the Geothermal Law, identify gaps within the documents and potential hindrances to future geothermal power project investments, and recommend necessary amendments and supplementary policies and regulations, in view of the coherence of the overall policy framework for geothermal power development in Indonesia. The implementation of this sub-component will be done in conjunction with the component on transaction management (Component 2), since the application of the Geothermal Law has far ranging implications for geothermal investors.

53. **Component 2: Transactions Management for Mobilizing Investments in the Geothermal Power (proposed GEF funding: US$2,350,000, GoI funding: US$1,000,000).** This component will assist the GoI, especially the MEMR, to develop the capacity for planning and transacting geothermal power developments in an efficient and transparent manner. The present lack of a credible mechanism for offering geothermal development opportunities is a key shortcoming to attracting investors (Annex 4 Section 4). The transactions would be the conduit through which the pricing and economic incentives in the new policy framework would be integrated as a "bankable" project to be offered to investors. It will aim to mobilize two distinct groups of investors: (i) existing developers who were given control of geothermal fields under PD45/1991, and (ii) new investment opportunities to exploit geothermal resources in greenfield sites. At a strategic level, the activities in this component will help operationalize policies and procedures necessary for eventually realizing the government's goal of 6,000 MW installed geothermal power capacity by 2020. Through this component, the GoI will be able to directly leverage investments in the geothermal sector, and also establish procedures and processes that can be replicated beyond the duration of the project.

C2.1: *Expanding power generation in geothermal fields already allocated to investors (proposed GEF funding: US$350,000)*. This sub-component is designed to catalyze investments by existing developers to expand geothermal power generation in fields under their control. These geothermal fields present an interesting challenge since GoI will likely need to rely on the same existing developers to undertake the expansion, but many of them have grievances that remain from offers made during the early 90's. Therefore, the project will review the legacy issues of the geothermal fields which were allocated to investors under PD45/1991, identify and recommend appropriate solutions, develop and implement transaction agreements/arrangements consistent with the economic incentives provided in the new policy framework developed in Component 1, and achieve financial closures for installation of at least 300 MW of new generation capacity in these geothermal fields. The specific activities of this subcomponent will include:

- Detailed review of issues related to existing geothermal fields including prior JOC commitments, to identify applicable constraints and methods of overcoming those constraints.
- Develop transaction arrangements consistent with new policy framework for mobilizing investments and pricing mechanism.
- Design procurement process and operational guidance note, including standard form bidding documents, PPA, standard form waiver and restatement agreement (to replace existing PPA), standard form land lease, and pricing arrangements.
- Obtain approval of process and documentation within GoI and amongst stakeholders, in particular PLN.
- Engage existing investors on concepts proposed to gather market feedback and implement into standard form documentation.
- Prepare necessary legal and policy documentation that would need to be issued.
- Finalize agreements between developers and GoI indicating acceptance of offer and then ensure financial closure.

It is important to note that some "brownfield" projects face barriers that are unique beyond those identified previously. Addressing these isolated issues goes beyond the scope of the proposed project, which will focus more on resolving the primary obstacles to achieve maximum impact.

C2.2: *Facilitating transactions of new geothermal fields for development (proposed GEF funding: US$2,000,000)*. This sub-component will develop the procedures through which MEMR will offer new geothermal development opportunities to potential investors in line with their long-term development plans. This will include the development of criteria for project selection, the transaction procedures, and model bidding documents, which would be consistent with the Geothermal Law and the new policy framework for economic incentives and risk mitigation as well as meet international standards of good practice. This sub-component will also financially engineer a selected project (50 MW installed capacity or greater in scale) to ensure that it is "bankable" and offer it to investors through the transaction process towards achieving financial closure of the investment. This sub-component can be subsequently customized for offering further investment opportunities in geothermal development. The main tasks that will be undertaken include the following:

- Develop criteria for selecting fields to be tendered based on geothermal as well as power sector factors, and reevaluate proposed sites. As part of this process, an analysis will be made of the optimal amount of technical information (e.g. analysis of the steam capacity of the site) that should be made available to bidders, from a value for money perspective. The marginal cost of additional information is high; this analysis will indicate how much the MEMR should spend on gathering such information given the reduction of power prices and the time needed to obtain such information.
- Design, agree and market test a standard form procurement process, including bidding documents, land lease, PPA and pricing mechanism to strengthen transaction process so it is robust and transparent raising credibility with investors. PLN and other key stakeholders will be consulted on this process, and PLN's approval of the PPA and procurement process obtained. Market testing will also allow a preliminary market consultation on the future of geothermal power generation in Indonesia, the pricing and procurement policies to be used, and assessing market appetite for new projects (allowing the MEMR to design a program for letting brownfield and greenfield projects to the market at the right pace).
- Guidance note on the above process and approval within GoI and associated stakeholders, in particular PLN. The guidance note process will help capacity amongst MEMR staff to manage the procurement process, and broad consultation with PLN will reduce the likelihood of confusion/competition amongst different entities once the procurement processes commence in earnest. More than a note, this will provide practical advice, documentation, checklists and other tools useful to the team implementing such projects.
- Firm up arrangements with local governments including issues related to land acquisition, permits and royalty payments. These interfaces create particular stumbling blocks in infrastructure projects of all sorts, wherever land acquisition is needed. By developing these arrangements in advance, MEMR will be able to avoid much of the time constraint created by the land acquisition process, and potential conflict with local authorities whose priorities may differ from the MEMR in particular in relation to the royalty payments

charged to investors and paid to the local government. By addressing these issues in advance, greater efficiency should result from the procurement process.

- Firm up arrangements for defining and applying safeguard regimes, in particular in relation to environmental risk assessment and resettlement. This will clarify the application of Indonesian law on the se subjects but also best practice risk management to remove the constraints often associated with such issues where they are not addressed early in the project development cycle. MEMR and PLN will input into this strategy. Guidance will be provided on the practical application of the safeguards, including timing of application and associated resource requirements. This is further elaborated in Annex 10 on Safeguards.
- Processes and documentation while useful will be ineffective without comprehensive training regimes for MEMR and other stakeholder staff. This will include classic training but also learning while doing by integrating MEMR staff into the project development advisory team, allowing GoI staff to learn from experts with significant experience in geothermal PPP transactions, best practice procurement methods and IPP projects.

In Phase II, Project funding will be used to support the implementation of a select greenfield transaction from pre-feasibility through the tender process towards financial closure with the selected investor. It is conservatively envisaged that the selected investment project would be at least 50 MW comprising a total investment upwards of $100 million. By undertaking the transaction, MEMR will be able to market-test the standard form process and documentation developed in Phase I of this sub-component. It will also enable GoI to enhance their transaction capacity by working with international expert transaction advisors. The key elements of the transaction process will include:

- Pre-feasibility Study - basic financial and technical review of the project using the revised selection criteria.
- Feasibility Study - financial analysis and structuring of transaction, economic analysis and safeguard requirements.
- Design procurement process/documentation based on the standard forms developed, including market interaction such as investor road shows to promote project/transaction.
- Implement procurement process, with prequalification and bid process, managing bidder comments and negotiations, encouraging financier involvement and further refinement of documentation.
- Evaluate and select winning bidder
- Negotiate with successful bidder/financial close.

Component 3: Geothermal Sector Technical Capacity Building (proposed GEF funding: US$350,000, GoI funding: US$1,300,000). This component will address the limited domestic technical capacity for handling most geothermal related activities, and support the long-term development prospects of the sector.

C3.1: *Training of government officials and technical staff in planning and transaction management (proposed GEF funding: US$150,000).* Presently, MEMR staff and other relevant GoI officials have limited experience with competitively transacting geothermal development opportunities to investors. This sub-component will train relevant staff in the central and local

governments in preparing transactions, engaging investors, evaluating bids, and negotiating financial closings. The specific training needs will be identified as part of the transactions assistance work in Component 2. The proposed activities will mainly involve training workshops and seminars, in addition to the on-the-job training they will receive through their work facilitating actual transactions.

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C3.2: *Building awareness (proposed GEF funding: US$50,000)* This sub-component is designed to enhance the familiarity of various stakeholders with the implementation aspects of the Geothermal Law as well as the GoI geothermal power development targets and sector reform program. It will also specifically focus on sharing information regarding the transaction regime developed and demonstrated by the proposed project. The MEMR has already held several such information discussions with a broad set of stakeholders including civil society during project preparation. The sub-compnent will support a series of seminars and stakeholder dialogs to promote the sector as well as obtain feedback that can be incorporated into the ongoing reform program. Key subject areas of focus during the activities will include:

- Project information dissemination to stakeholders and civil society
- Geothermal Law and Implementing Rules and Regulations
- Geothermal Reform Program (pricing, risk, transactions)
- Role of Local Governments in Geothermal Development

C3.3: *Options for long-term cost reduction (proposed GEF funding: US$150,000)* As a preparation for implementing a cost reduction program in geothermal related industries in Indonesia for enhanced domestic participation and competitiveness, the project will support an industrial analysis that will be conducted to identify key areas where local industries maintain a comparative advantage, and develop a sector strategy to strengthen their roles and participation in the geothermal power development industry. The following broad tasks will be undertaken in the development of the study:

- Review geothermal sector for technical needs
- Assess present domestic participation
- Conduct industrial analysis to identify comparative advantages
- Develop cost reduction strategy for geothermal
- Propose implementation plan for strategy

Component 4: Project management assistance (proposed proposed GEF funding: US$200,000, GoI funding: US$200,000). This component will provide the necessary technical consultant support to the Directorate of Geothermal Enterprise Supervision and Ground Water Management, the executive implementation unit, for the management and supervision of the project. It will ensure the efficient implementation of the aforementioned activities by assisting with project implementation, monitoring and reporting, including a project manager to assist DGESGWM, as well as additional consultant assistance for procurement and financial management.

Annex 6: Project Costs and Financing

INDONESIA: GEOTHERMAL POWER GENERATION DEVELOPMENT PROJECT

1. Estimated Project Costs by Costing Category

		Estimated Cost	GEF Financing	GOI Cash & In-kind
Component 1	**Policy Framework**	**$ 3,600,000**	**$ 1,100,000**	**$ 2,500,000**
C1.1	Development and Implementation of Economic Incentives	$ 2,400,000	$ 600,000	$ 1,800,000
C1.2	Development and introduction of risk mitigation measures	$ 900,000	$ 400,000	$ 500,000
C1.3	Support the implementation of the Geothermal Law	$ 300,000	$ 100,000	$ 200,000
Component 2	**Transactions Management**	**$ 3,350,000**	**$ 2,350,000**	**$ 1,000,000**
C2.1	Expanding power generation in "brown" geothermal fields	$ 600,000	$ 350,000	$ 250,000
C2.2	Facilitating transactions of "green" geothermal fields	$ 2,750,000	$ 2,000,000	$ 750,000
Component 3	**Technical Capacity Building**	**$ 1,650,000**	**$ 350,000**	**$ 1,300,000**
C3.1	Training of government officials and technical staff	$ 480,000	$ 150,000	$ 330,000
C3.2	Building awareness	$ 700,000	$ 50,000	$ 650,000
C3.3	Options for long-term cost reduction	$ 470,000	$ 150,000	$ 320,000
Component 4	**Project Management Assistance**	**$ 400,000**	**$ 200,000**	**$ 200,000**
Subtotal		**$ 9,000,000**	**$ 4,000,000**	**$ 5,000,000**

Annex 7: Implementation Arrangements

INDONESIA: GEOTHERMAL POWER GENERATION DEVELOPMENT PROJECT

1. Key entities and responsibilities and/or functions

Implementation agency: Ministry of Energy and Mineral Resources (MEMR)

Responsible department of MEMR: Directorate General of Mineral, Coal, and Geothermal (DGMCG)

Executive implementation agency within DGMCG: Directorate of Geothermal Enterprise Supervision and Ground Water Management (DGESGWM). The director of DGESGWM will be responsible for carrying out the implementation activities.

Project manager: Individual consultant hired by DGESGWM, reports directly to the director of DGESGWM, day-to-day coordination of project implementation activities, project progress monitoring and reporting.

Stakeholder advisory group: Representative of key stakeholders and concerned government agencies, including: Ministries of Finance, Planning, Forestry, Environment, Energy and Mineral Resources, PLN, and investors/operators of producing geothermal fields. The main function of the stakeholder advisory group is to provide timely comments and feedbacks on the policy development work undertaken by the project so as to enhance the applicability and effectiveness of proposed policies. The advisory group will meet twice a year or depending on work progress.

2. Other important institutional arrangements

Bappenas will be involved in the monitoring of project implementation, in particular related to the progress towards achievement of outputs and objectives of the project. The Directorate for Energy, Mining and Mineral Resources, will be the main counterpart in Bappenas for the monitoring of this project's implementation. In addition, the Directorate for Electricity, Telecommunication and Informatics in Bappenas is responsible for matters concerning power generation, hence also has a stake in this project.

Since geothermal involves non oil and gas energy resource extraction as well as generation of electricity (downstream), DGMCG, which regulates the upstream geothermal activities needs to cooperate with Directorate General for Electricity and Energy Utilization (DGEEU), which regulates the downstream power generation. The State Electricity Company (PLN) as the single grid off-taker for all power generation, including geothermal, is under the supervision of DGEEU. Both DGEEU and DGMCG are under the jurisdiction of MEMR. Cooperation between DGMCG and DGEEU is vital in ensuring the effective implementation of geothermal power development that inevitably involves PLN.

The Ministry of Finance is responsible for the fiscal aspects relating to geothermal power generation, including the tax regime and provision of any fiscal incentives. In addition, the Public Service Obligation (PSO) subsidy mechanism to PLN is implemented by the Ministry of Finance. The Ministry of Finance is an important stakeholder, particularly for the aspect of pricing and incentives, as well as the risk allocation embedded in a transaction's agreement as far as government is among the bearer of any one or more risks that may arise due to such geothermal power development transaction.

Other concerned government agencies include the Ministry of Environment and the Ministry of Forestry, with the former responsible for environmental management issues and the latter for the permits to utilize forest areas. Under the Geothermal Law, local governments are the holder of the rights to issue mining license and to conduct transaction of geothermal fields.

2. Main activities and implementation arrangements

The main implementation activities are described as follows:

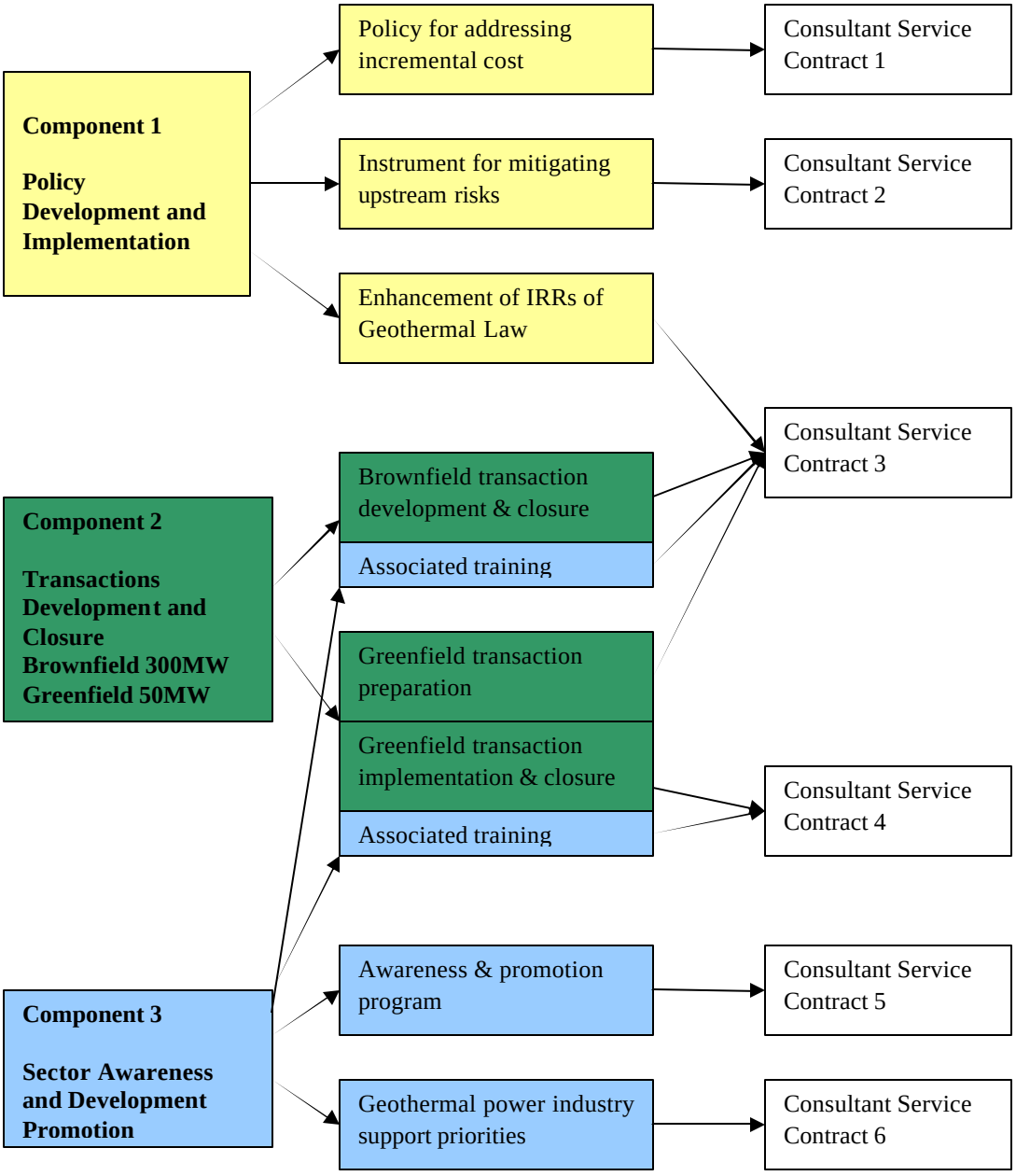
Component 1: Policy development and implementation, including three areas of activities: (i) selecting and implementing a policy and funding mechanism for addressing incremental costs; (ii) selecting and developing instrument and related procedures for mitigating upstream risks; (iii) assisting the review and enhancement of the Implementation Rules and Regulations (IRRs)of Geothermal Law.

Component 2: Transactions development and management, involving three lines of activities: (i) expansion of generation capacity in operating brownfields, with a target of reaching financial closure on about 300 MW newly installed capacity at the completion of project implementation; and (ii) development of a 50 MW greenfield project, with a target of reaching financial closure at the completion of the project.

Component 3: Sector technical capacity building, including three lines of activities: (i) transactions management training, through on-the-job mentoring and targeted workshops; (ii) awareness and promotion programs about sector policies and investment opportunities; and (iii) an industry survey to determine domestic comparative advantages and priorities for targeted government support in national technical capacity development.

From a project management point of view, the project activities (Components 1-3) are covered by five consultant service contracts provided by firms and several small individual constant contracts. Two of the consultant service contracts will cut across components due to the closely relationships of concerned activities. This is illustrated by the color-coded diagram below.

Figure A7.1: Division of Project Implementation Activities by Consultant Service Contract



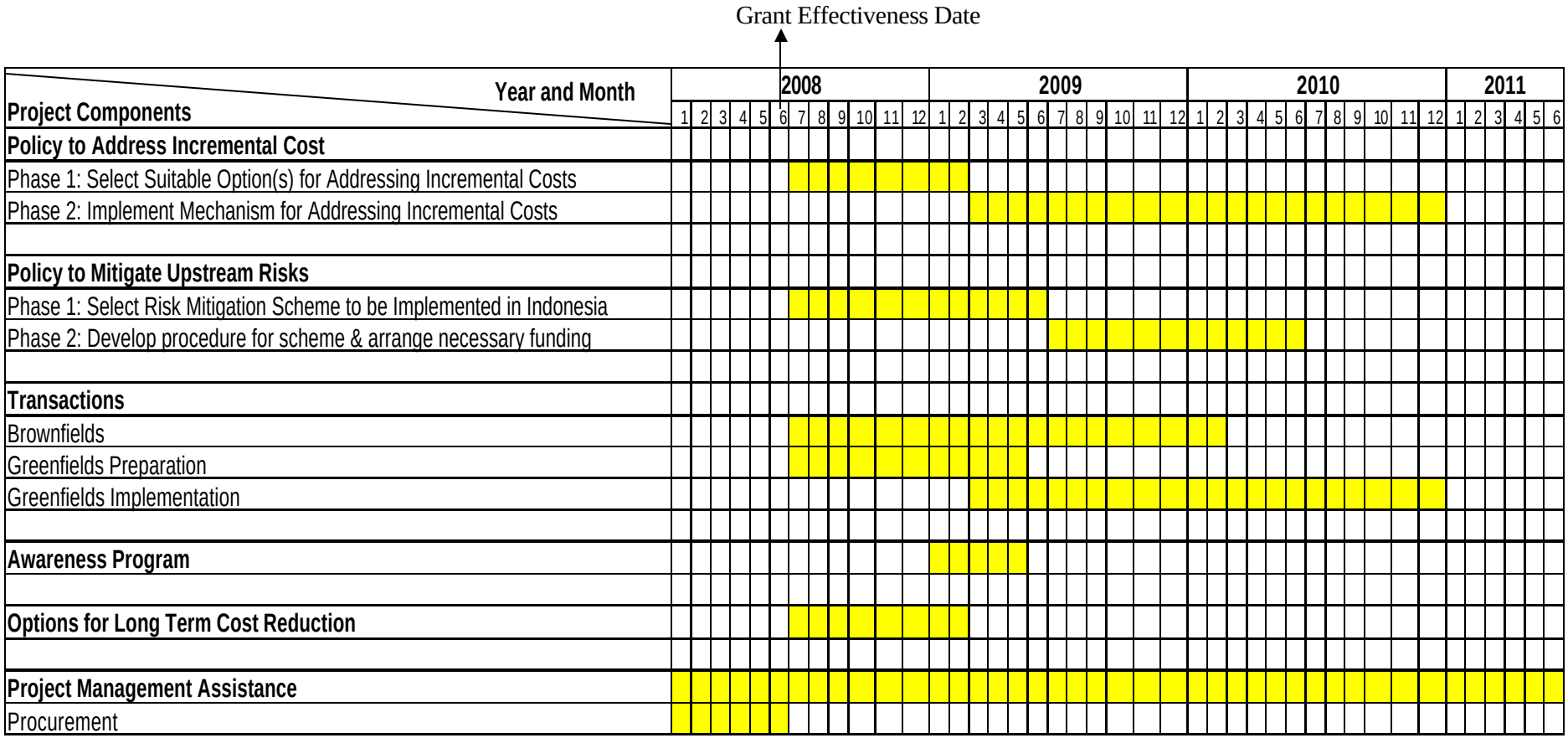
Due to the cross links between policy development/implementation and transactions activities, coordination of between Component 1 and Component 2 activities is very important. In fact without some critical outputs of the Component 1 activities, implementation of transactions will not be fruitful since there will be no concrete policy support. To enhance the cross-linkage between Component 1 and Component 2 activities and improve the overall effectiveness of the propose project in achieving financial closures on new geothermal power capacity, two cross-link triggers are identified as crucial conditions for proceeding with transactions implementation:

Cross-link trigger 1: GoI endorsement of a measure to address the incremental cost of geothermal power and related funding mechanism. The endorsed measure must include a clearly defined mechanism to identify the off-take price of geothermal electricity, the related funding mechanism, the process for awarding the new off-take pricing to specific projects, and the implementation schedule.

Cross-link trigger 2: PLN agreement on adopting a model power purchase agreement (PPA) which is endorsed by MEMR. The model PPA will include conditions for connecting a geothermal power plant to the grid and other remaining terms within a given period.

The general sequence of individual project activities and the particular stages where the triggers and consequential actions are assessed are identified in the following figure A7.2

Figure A7.2: Project Implementation Sequences and Milestones



Annex 8: Financial Management and Disbursement Arrangements

INDONESIA: GEOTHERMAL POWER GENERATION DEVELOPMENT PROJECT

Executive Summary and Conclusion

The project will be financed from GEF amounted to $4 million and implemented over four years (2008-2011). The objective of the project is to assist the government to prepare and implement their geothermal reform program designed to address key policy, institutional, and risk associated barriers in order to promote the progressively greater utilization of geothermal resources that will provide renewable energy to the electricity market in an efficient, cost-effective, and environmentally friendly manner.

Director General of Mineral, Coal and Geothermal (DGMCG), Ministry of Energy and Mineral Resources (MEMR), will be the executing agency for the project implementation. Directorate of Geothermal Enterprise Supervision and Ground Water Management (DGESGWM) will be responsible for managing the project, and will serve as a project management unit. The objective of the project's financial management assessment is to determine whether the financial management system of the implementing agency is capable of producing timely, relevant and reliable financial information on the project activities, and if the accounting systems for the project expenditures and underlying internal controls are adequate to meet fiduciary requirements and allow the Bank to monitor compliance with agreed implementation procedures and appraise progress towards its objectives.

The financial management assessment has identified that risks could arise from some factors and have taken into account the on-going reforms in financial management in the country. One inherent risk is related to DGESGWM staff capacity. DGMCG staff does not have experience with Bank financed projects. The financial management (FM) staff capacity needs further strengthening. Secondly, risks may arise from weaknesses in internal control over training and seminar expenditures, which, in other similar projects in Indonesia, have been found to be vulnerable to lapses in control.

These risks will be mitigated by i) providing appropriate technical assistance to the DGESGWM for fulfilling its required financial management responsibilities; ii) putting in place additional financial control procedures on training/workshops expenditures in the project operation manual, such as supporting documentation that all activities are supported by reports, attendance lists for workshops and trainings and third party invoices. The additional financial control procedures should be included in the project operation manual.

Overall, the project financial management risk is assessed as being moderate. This assessment has concluded that, with the successful implementation of the proposed actions, the risks will be substantially mitigated, and the proposed financial management arrangements will satisfy the Bank's minimum requirements under OP/BP10.02 and are adequate to provide, with reasonable assurance, accurate and timely information on the status of the grant required by the Bank. More details of the financial management assessment are detailed in the remainder of the annex.

Summary of Project Description

The total proposed project cost is US$ 4 million. The project will consist of the following components and activities:

Component 1 *Policy Framework for Scaling up the Development of Geothermal Power***,** **(**estimate USD 1,100,000). The project will aim to assist the GOI improve the present set of policies in order to enhance the investment climate for high quality geothermal development. The project will assist MEMR implement a policy mechanisms to address pricing issues and economic incentives, develop an instrument to mitigate upstream geothermal risks, and help implement the geothermal law.

Component 2: *Transactions to mobilize investments in the Geothermal Sector (Estimated US$ 2,350,000).* In this component, the project will leverage funding for geothermal projects by (1) expanding development in fields that are already allocated to investors, and (2) develop the procedures and implement a competitive tender for an unallocated geothermal field.

Component 3: *Technical capacity building* and *Project Management Assistance (Estimated US$ 550,000).* This component includes training to facilitate geothermal transactions, seminars and stakeholder dialogues to increase awareness regarding sector development among local governments and other stakeholders. Assistance to DGESGWM to assist with the incremental costs of managing the project is also included.

Country Issues

Based on the most recent Country Financial Management Assessment (CFAA) and other diagnostic reports, there are major acknowledged deficiencies in Public Financial Management (PFM) systems in the country that have been accepted by the government. These include:

- Unreliable accounting and reporting systems whereas the central government financial report has been disclaimed by the auditors for the past three years;
- Un-reconciled expenditures at the ministries;
- Fragmented cash management and government banking arrangements;
- Unclear roles of various internal government internal auditors; and
- Poor salary structure and absence of sanctions in the civil services.

The PFM reform agenda has been defined and led by the Government, and is being supported by several donors, including the World Bank. Significant progresses have been made in some PFM areas to date, including the completion of a legal and regulatory architecture for modern PFM, such as a the issuances of implementing rules and regulations on state finances and state treasury, implementation of treasury single account system and the consolidation of fragmented government bank accounts.

Strengths and Weaknesses

The project has strengths and weakness in several areas. The project design has the following strengths:

- The project design is simple, with mainly technical assistance, training and workshops activities; and
- Project location is only in Jakarta.

Some weaknesses noted during the assessment are as follows:

- Project staff does not have prior experience with the Bank's rules and procedures. It may delay project implementation and slow disbursement; and
- Risks may exist in internal control over training and workshops expenditures, which in the past have been found to be prone to misuse in other similar projects in Indonesia.

The project's weaknesses may create some risks during implementation. The project includes several mechanisms to mitigate these risks. Among them are:

- FM consultant assistance will be secured by DGESGWM for fulfilling its required financial management responsibilities;
- Putting in place additional financial control procedures on training/workshops expenditures in the project operation manual, such as supporting documentation that all activities are supported by reports, attendance lists for workshops and trainings and third party invoices
- Participation of civil society in project outreach as well as public procurement activities;
- The Project's financial transactions and activities will be subject to audits by the Inspector General of the Ministry; and
- An independent financial audit will be performed annually by an auditor acceptable to the Bank.

Risk Assessment Summary

A detailed analysis of financial management risks arising from the country situation, the proposed project entities and specific project features and related internal controls has been completed during the assessment, and is summarized below. These risks have been rated on a scale consisting of *High, Substantial, Moderate and Low*.

Issues	*Risks [High / Substantial / Moderate / Low]*	Summary Comments And Risk Mitigation	**Condition of Negotiations/of Effectiveness (Y/N?)**
A. Inherent Risks			
Country Level			
1. Government Financial Reporting	S	Government financial reporting is often unreliable with un-reconciled, expenditure differences between Line Ministries and the Treasury offices. The government has on going activities to improve the PFM through GFMRAP project.	N
2. Civil Services *Poor civil service payment structures incentives*	S	The government has started to consider civil services reforms. However, payment structure, internal incentives, staff capability in general remain inadequate and need further improvement	N
Overall Country Risk	S		
Entity Level			
1. Implementing Entity Organization *Status of the entity*	S	Although the DG MCG has engaged the World Bank to advise the newly developed directorate on geothermal development, it has never managed the Bank's grant or loan before. Additional FM support will be provided to DGESGWM through consultant services as a part of project management assistance.	N
Overall Entity Risk	S		
Project Level			
1. Project Complexity	M	The Project is relatively simple because it consists of technical assistance and training & workshops. The qualification and selection criteria of consultants who will provide technical assistance and facilitate trainings & workshops should be defined in the Project Manual. This Manual should be developed and acceptable to the Bank prior to project effectiveness.	Y, project manual prior to project effectiveness
2. FM staff capacity. *Inadequate FM staff*	S	DGESGWM has inadequate FM staff capacity that has previous experiences with the Bank financed project. Additional FM support will be provided to DGESGWM through consultant services as a part of project management assistance.	N
Overall Project Risk	M		
B. Control Risk			
1. Budget *Delay in issue of budget documents*	S	Currently DGMCG is preparing the budget proposal (RKA-KL) for FY 2008. The proposal only included the government part, instead of grant allocation. Unless, DGMCG includes the grant allocation in the proposal, the project implementation may delay due to late issuance of the budget documents (DIPA).	N
2. Accounting *Reliability of accounting system*	M	All project transaction will be recorded in the government accounting system. In addition, DGESGWM will have additional accounting code for the project purposes. The specific accounting code & procedures will be included in the Project Manual.	N

Issues	*Risks [High / Substantial / Moderate / Low]*	Summary Comments And Risk Mitigation	**Condition of Negotiations/of Effectiveness (Y/N?)**
3. Internal Control *Inadequate payment verification*	S	DGESGWM should include additional financial control procedures on soft expenditures in the project operation manual such as accounting evidence that all activities are supported by output reports, attendance lists for trainings and seminars. In addition, IG will perform internal audit function to the project implementation.	N
4. Flow of Fund	M	Flow of fund will use existing government procedures where KPPN (Treasury Office) transfer the fund directly to consultant or suppliers' account.	N
5. Financial Report *Reliability and timeliness of financial reports*	M	DGESGWM will prepare a separate set of project financial report for the Bank reporting purposes. The specific reporting procedures will be included in the Project Manual.	N
6. External Audit *Integrity of the auditor and poor follow up on the audit findings*	M	BPKP will be accepted as the project auditor. The auditor will audit the project annual financial statements and submit the report to the Bank six months after the fiscal year closes. The audit report and the management letter will be made available to the public.	Y, Acceptable Audit TOR to be agreed with the Bank before negotiation
Overall Control Risk	M		
Overall Risk	M		

Implementing Entity

The grant will be implemented by the Directorate of Geothermal Enterprise Supervision and Ground Water Management (DGESGWM), Director General of Mineral, Coal and Geothermal (DGMCG), Ministry of Energy and Mineral Resources (MEMR). The Directorate has inadequate FM staff capacity as it has never managed a Bank financed project. MEMR should assign internal staff into DGESGWM who has previous experience with the donors financed project such as form DG Electricity and Energy Utilization (DGEEU). In addition, the project should have provision to hire an FM consultant to assist the DGESGWM. The consultants will provide technical assistance on financial management, including budget document preparation, disbursement mechanism, accounting and reporting. The consultant will also assist the DGESGWM to prepare quarterly financial reports for the project purposes.

Accounting and Reporting

All financial transaction for the project will be recorded in the government accounting system and included in the central government financial report. For the Bank purpose, the project will prepare a separate set of project financial report which suitable for project monitoring purposes. The specific accounting procedures for the project financial report should be included in the Project Operation Manual.

PMU will maintain separate accounting records, on cash basis. FM consultants will assist DGESGWM on financial administration. DGESGWM will be responsible to prepare an aggregate Interim Financial Reports (IFR) and submit this to the Bank on quarterly basis, in

formats to be agreed with the bank. Special purpose financial statements for this project will be prepared annually for audit purposes.

Internal Audit

MEMR has Inspector General that performs as internal auditor for the Minister. The project will be part of IG supervision and monitoring. IG will perform an operational audit for the project activities, includes reviewing internal control mechanism in the project implementing unit (DGESGWM). A copy of IG audit report should be available upon the Bank request.

External Audit

The annual audit of the project financial statement will be carried out by auditor acceptable to the Bank. The audit report will be furnished to the Bank no later than six months after the end of the government's fiscal year. The audit assignment will be performed in accordance with the agreed Terms of Reference. The annual audit will include a review and reconciliation of Special Account transactions.

Disbursement Arrangement

In order to facilitate disbursements, a Designated (Special) Account (DA) denominated in US dollars will be opened by DG Treasury in the Central Bank (BI) or a commercial bank acceptable to the Bank under the name of Ministry of Finance. DG Treasury will authorize its relevant Treasury Office (KPPN) to authorize payments of eligible project expenditures by issuance of SP2D (remittance order) charging the DA. For this purpose, DG Treasury shall issue a circular letter to the relevant KPPN Offices providing guidelines and criteria for eligible project expenditures in accordance with the Grant Agreement.

When expenditures are due for payment, DGESGWM will prepare SPP (payment request) to the payment officer within the Satker. After documents verification, the payment officer will issue SPM (payment order) together with the supporting documentation for submission to the relevant KPPN. The KPPN will check the budget eligibility and issue SP2D to the DA holding bank which will transfer the fund directly to the consultant or supplier's account and debit to the DA for the Grant portion.

The applicable disbursement method is advance to the DA. The DA will be solely used to finance eligible project expenditures. While the DA will be under the name of DG Treasury MOF, the DGESGWM will be the one responsible to reconcile the DA and to prepare the application for withdrawal for advances and reporting the use of the DA, duly approved by DG Treasury before their submissions to the Bank. Copies of the DA's bank statement will be provided to the DGESGWM by DG Treasury, MOF.

The ceiling of the advance to DA will be fixed at $600,000. Applications for replenishment to the DA would be submitted monthly, based on the reporting of use of the DA, including: (i) list payments for contracts under Bank's prior-review and records evidencing such expenditures, or (ii) statement of expenditures (SOEs) for all other expenses, and (iii) DA reconciliation

statement. When the DGESGWM has the capability to produce timely the quarterly Interim Financial Report (IFR), reporting the use of funds would be based on the IFR.

All documentation for expenditures submitted for disbursement will be retained at the implementing unit and shall be made available to the auditors for the annual audit and to the Bank and its representatives if requested.

Allocation of Grants proceeds (USD)

Category Description	Allocation	% of expenditures to be financed
(1) Consultant Services	3,970,000	100
(2) Workshops, goods and supplies*	30,000	100
Total	4,000,000	-

**For the purposes of this Schedule, the term "Workshops" means the expenses for materials, equipment, stationary, communications charges and location rental incurred on account of Project implementation of workshops. "Goods and supplies" means other goods and supplies required for the implementation of the Project.*

Supervision Plan

Supervision of project financial management will be performed on a risk-based approach at least twice a year. The supervision will review the project's financial management system, including but not limited to budgeting, payment verification, accounting, reporting and internal control. The financial management supervision will be conducted by financial management specialist and Bank consultants.

Action Plan & Conditionality

Action	Responsibility	Due Date
1. A draft project management manual to be submitted to the Bank for approval.	DGESGWM	Before Negotiation
2. A final project management manual acceptable to the Bank is formally adopted for the project.	DGESGWM	Before Effectiveness
3. A confirmation letter from the Inspector General on internal audit assignment is submitted to the Bank confirming that this project activity is included in its annual work program and that copies of their reports would be submitted to the Bank.	IG	Before Negotiation
4. Individual FM consultant services have been selected. The consultant services are to assist DGESGWM on financial management aspects, including budget, control and report preparation.	DGESGWM	Dated 1 June 2008.

Annex 9: Procurement Arrangements

INDONESIA: GEOTHERMAL POWER GENERATION DEVELOPMENT PROJECT

A. General

Procurement for the proposed project will be carried out in accordance with the World Bank's "Guidelines: Procurement under IBRD Loans and IDA Credits" dated May 2004 and Revised October 1, 2006; and "Guidelines: Selection and Employment of Consultants by World Bank Borrowers" dated May 2004 and Revised October 1, 2006; and the provisions stipulated in the Legal Agreements. The general descriptions of various items under different expenditure category are described below. For each contract to be financed by the GEF Grant, the different procurement methods or consultant selection methods, estimated costs, prior review requirements, and time frame are agreed between the Recipient and the Bank project team in the Procurement Plan. The Procurement Plan will be updated annually or as required to reflect the actual project implementation needs and improvements in institutional capacity.

Procurement of Works and Goods: No procurement of works is anticipated. Goods to be procured would include training materials and limited office equipment (computers and peripherals). The contract value is expected to be very small (less than $50,000) and the procurement will be based on the Shopping procedures.

Selection of Consultants: Consultant services are expected in the following areas: pricing mechanism to provide adequate economic incentives; instrument for upstream risk mitigation; design, preparation, and implementation for geothermal investment transactions; awareness program for geothermal development; long-term cost reduction options; and project management support. These services would be procured mostly through Quality and Cost Based Selection (QCBS). If applicable, Selection Based on Consultants' Qualifications (CQS) may be used for consulting services estimated to cost less than $200,000. Individual consultants would be selected in accordance with the Section V of the Bank's Consultant Guidelines. If warranted, short lists of consultants for services estimated to cost less than $400,000 equivalent per contract may be composed entirely of national consultants in accordance with the provisions of paragraph 2.7 of the Consultant Guidelines. To expedite the Project implementation, the implementing agency will carry out advance procurement for some of the consultant services contracts. The number of advance procurement, as well as the threshold of retroactive financing needed to finance the contracts will be finalized during negotiation.

Operational Costs: All incremental operating costs will be covered by the local counterpart funds.

B. Assessment of the Agency's Capacity to Implement Procurement

The main implementing agency (IA) is the Directorate of Geothermal under the Directorate General of Mineral, Coal and Geothermal, Ministry of Energy and Mineral Resources.

Assessments of the IA's procurement capacity for the project have been carried out as part of the project preparation. The assessments reviewed the organizational structure for project implementation and an assessment report is available in the project files.
The main procurement related risks identified and the mitigation measures adopted are summarized below:

- To mitigate the risk associated with the low capacity in handling Bank financed procurement, the Bank has provided procurement training during the preparation phase of the Project.

- To mitigate the risk associated with any confusion between provisions in Keppres 80/2003 and in Bank's Procurement Guidelines, the IA should prepare a Project Management Manual (PMM) that includes a Procurement Section. The section should contain simplified and easy to understand instructions based on Bank's Procurement Guidelines. The section should also clearly state that Bank rules shall prevail in the case of conflicts between the Bank procurement guidelines and Keppres 80/2003 or other local rules and regulations.

- To mitigate the risk of corruption, the IA should include the established measures to address corruption issues in the PMM, such as steps to report and investigate any cases of collusion, fraudulent, corrupt and coercive practices, as well as remedial actions. It should clarify the complaint handling procedures that are in place. This should include automatic referrals to BPKP and KPK (the national Corruption Eradication Commission) to conduct investigative audits if there are strong indications of such irregular practice.

Procurement under the Project would be straightforward involving only consultant selections and almost all the contracts will be subject to the Bank prior review. Based on this, and taking into account the above risks and risk mitigation measures, the overall project risk for procurement is rated as "AVERAGE".

C. Procurement Plan

A Procurement Plan has been developed and agreed between the IA and the Bank Project Team and is available at the IA's office. The Procurement Plan will also be available in the Project's database and in the Bank's external website. It should be updated in agreement with the Project Team annually or as required to reflect the actual project implementation needs.

D. Frequency of Procurement Supervision

All major contracts will be subject to prior review, for which the review, monitoring and supervision will be carried out from Bank office based in Jakarta on a regular basis. In addition, procurement supervision and post review will be conducted as part of the regular project supervision missions at least twice per year.

E. Details of the Procurement Arrangements

1. Goods and Works

Shopping procedures will be followed for the purchase of training materials and limited office equipment (computers and peripherals). (Estimated cost US$30,000)

2. Consulting Services.

(a) List of Consulting Assignments with short-list of international firms.

Note: all contracts may be carried out through advance procurement

1	2	3	4	5	6	7
Ref. No.	**Description of Assignment**	**Estimated Cost (US$)**	**Selection Method**	**Review by WB (Prior / Post)**	**Expected Proposals Submission Date**	**Comments**
The following assignments will be carried out by consulting firms.						
1.	Policy to Address Incremental Costs	600,000	QCBS	Prior	May, 2008	
2.	Instrument for Upstream Risk Mitigation	400,000	QCBS	Prior	May, 2008	
3.	Design and Preparation for Geothermal Investment Transactions	900,000	QCBS	Prior	May, 2008	
4.	Implementation for Geothermal Investment Transactions	1,700,000	QCBS	Prior	May, 2009	To be carried out after the Assignment 3. The consultant for "3" will not be eligible for "4".
5.	Long-Term Cost Reduction Options	150,000	CQS/ QCBS	Prior	May, 2008	
6.	Awareness Program	20,000	IC	Post		Multiple contracts
The following assignments will be carried out by individual consultants.						
7.	Overall Project Management Support	200,000	IC	Prior or Post		Multiple contracts

(b) Consultancy services estimated to cost above $100,000 for firms and $50,000 for individuals (if any) per contract and all Single Source Selection of consultants (if any) will be subject to prior review by the Bank.

(c) **Short lists composed entirely of national consultants**: Not expected at the time of project appraisal. However, if need arises during project implementation and justified, short lists of consultants for services estimated to cost less than $400,000 equivalent per contract may be composed entirely of national consultants in accordance with the provisions of paragraph 2.7 of the Consultant Guidelines.

F. Bank Prior Review Thresholds

Expenditure Category	Contract Value Threshold (US$,000)	Procurement Method	Contracts Subject to Prior Review (US$'000)
Goods	<50	Shopping	First two contracts
Consultant services	>=200	QCBS, QBS, FBS	>=100 & all SSS
	<200	CQS	
	NA	IC	>=50 & all SSS

QCBS: Quality and Cost Based Selection
QBS: Quality Based Selection
FBS: Fixed Budget Selection
CQS: Selection Based on Consultant's Qualifications
IC: Individual Consultants
SSS: Single Source Selection

Annex 10: Safeguard Policy Issues

INDONESIA: GEOTHERMAL POWER GENERATION DEVELOPMENT PROJECT

Introduction

This operation is not financing investments such as exploration for or development of geothermal energy sources and consequently will not have environmental or social impacts. It aims to remove barriers that have impeded expansion of geothermal power generation in resource-rich Indonesia and to make investment in geothermal power more attractive and efficient. The investments that will follow, if this operation meets its development objective, will be positive in their global environmental impacts in that the additions they will make to generating capacity in Indonesia will be through the tapping of a renewable resource, with vastly smaller emissions of greenhouse gases, other air pollutants, water pollutants and solid wastes in comparison with oil or coal-fired generating plants. However, geothermal power development can have potential impacts that can be adverse to the natural and human environments. As part of the reforms the project seeks to achieve, it will develop guidelines and models for prospective investors in geothermal power to assist them in complying with the applicable social and environmental laws, regulations and guidelines of Indonesia, taking into account international good practice.

Potential Adverse Impacts of Geothermal Power Generation

Impacts can occur in any of four stages of geothermal energy development: exploration, construction, operation, and decommissioning. Environmental issues that arise during drilling are the main environmental concerns during the pre-feasibility/exploration stage and during construction. During operations, the issues are noise, water pollution, and, to a lesser extent, air emissions. Once a plant has outlived its useful life, the decommissioning plan needs to address safety hazards and possible contamination of groundwater. Occupational health and safety are concerns in all four stages. The stages are discussed in more detail below.

Exploration/Pre-feasibility

The first perceptible effect on the environment is that of drilling, whether the boreholes are shallow to measure the geothermal gradient in the pre-feasibility exploration phase, or exploratory to assess the production potential. Installation of a drilling rig and all the accessory equipment entails the construction of access roads and a drilling pad. These operations will modify the surface morphology of the area and could damage local plants and wildlife as well as physical cultural resources. Land may have to be acquired, at least temporarily, necessitating consultation with local communities and compensation for loss of access, crops, trees, and structures. Development of roads opens remote areas to a variety of human activities, some of which, such as poaching, illegal logging, and swidden agriculture, result in degradation of natural habitat. Well testing generates noise and air emissions. Drilling muds, heated water with dissolved gases and contaminants such as heavy metals, sour gases, and decant water from drilling mud impoundments all have the potential to cause water and air pollution. Water

withdrawal from local streams or wells for drilling can affect other water users and uses. Inaccuracies in understanding the local hydrogeology (in particular the relationship between freshwater and geothermal water sources), and poor drilling practices can lead to pollution of underground drinking water aquifers during construction and operation and after decommissioning.

Construction

Once a site has been selected for development, more land area will be disturbed, and land will have to be acquired permanently. Access will be improved (with sustained potential for environmental degradation); material hauling will have impacts on local roads traffic and noise levels; construction wastes will be generated; and the influx of workers from outside the area may have environmental and social impacts including conflict with residents, transmission of STDs and other diseases, pollution from work camp wastes, interruption of business activities and poaching. On the positive side, there will be some opportunities for local employment and for small businesses, such as food sellers, most of which will be temporary. The potential impacts of drilling will exist, on a larger scale. Undesirable gases may be discharged into the atmosphere. Wells for production and for re-injection of wastewater have the potential to cause groundwater contamination by allowing fluid from thermal layers to penetrate shallower aquifers that feed surface streams and meet the water supply needs of local communities. They must be constructed with proper casings to prevent leakage from one layer to another. Installation of the pipelines that will transport the geothermal fluids and construction of the utilization plants will also affect animal and plant life and the surface morphology. The scenic view will be modified. Construction site safety should be addressed.

Operation

Environmental problems also arise during plant operation. Geothermal fluids (steam or hot water) usually contain gases such as carbon dioxide (CO_2), hydrogen sulfide (H_2S), ammonia (NH_3), methane (CH_4), and trace amounts of other gases, as well as dissolved substances whose concentrations usually increase with temperature. For example, sodium chloride (NaCl), boron (B), arsenic (As) and mercury (Hg) are a source of pollution if discharged into the environment. Some geothermal fluids, such as those utilized for district heating in Iceland, are freshwaters, but this is an exception to the rule. The wastewaters from geothermal plants also have a higher temperature than the environment and therefore constitute a potential thermal pollutant. Normally only the lower-temperature geothermal waters that are of drinking-water quality should be allowed to flow into surface waters, but there are circumstances in which the quality of the receiving water is already affected by geothermal springs, so that discharges of lower quality would have no additional adverse impact. All other geothermal applications require that the cooled water be injected back into the reservoir. Well casings need to be inspected periodically so that corrosion that could lead to blowout or contamination of shallow aquifers can be detected and managed.

Air pollution may become a problem when generating electricity in geothermal power plants. However, for the same output of electricity, carbon dioxide emissions from geothermal power plants range anywhere from zero to only a fraction of emissions from fossil-burning power

plants, depending on the particular reservoir and its characteristics. Hydrogen sulfide can reach moderate concentrations in the steam produced from some geothermal fields. This gas presents a pollution problem because, besides being corrosive, it is easily detected at low concentrations by humans. Ammonia occurs in small quantities in many geothermal systems; but, in flashed-steam geothermal power plants, the ammonia is oxidized to nitrogen and water as it passes into the atmosphere.

The noise associated with operating geothermal power plants could be a problem. During the production phase there is a higher-pitched noise of steam traveling through pipelines and the occasional vent discharge. These are normally acceptable. At the power plant the main noise pollution comes from the cooling tower fans, the steam ejector, and the turbine 'hum'. The noise generated in direct heat applications is usually negligible. Noise abatement measures should achieve either the appropriate international standard or the respective national standards, whichever is lower.

In addition to domestic wastewater and solid waste produced by the plant staff, there are solid wastes such as cooling tower sludge that will require special handling.

Workplace health and safety are important issues to be addressed in environmental assessment and in developing operating procedures and guidelines.

Decommissioning and Closure

The scope of the project EIA (Environmental Impact Assessment) should include post-operation impacts, and the plan for decommissioning and closure should be developed early in the project. Community health and safety as well as environmental and social issues need to be taken into consideration. Potential impacts to be prevented or mitigated include accidents to children that may play among the facilities; releases of steam and hot water from failure of pipes or valves, with resulting water and air pollution; contamination of shallow aquifers if well casings corrode and leak; and accumulations of solid waste and abandoned materials and equipment. The plan should address the sealing of wells, the removal and disposal of production facilities in an environmentally sensitive manner, the restoration of the site, and provisions for any ongoing maintenance issues.

Impacts of Associated Facilities

Transmission lines are a major type of investment that will be associated with geothermal power plants. Even when they are going to be developed as separate projects, standard EA practice requires the impacts of new or expanded lines to be considered in the EIA for the power plant. The typical environmental and social impacts are acquisition of land for tower footings; restriction of land uses elsewhere in the power line right-of-way, involuntary resettlement when a residence must be moved or so much of a property is affected that it is no longer a viable place to reside, damage to or degradation of physical cultural property, conversion of natural habitat, opening of access to remote natural areas leading to encroachment and illegal activities, and visual impacts.

Indonesian Safeguards Requirements for Geothermal Power Plants

Indonesian law and regulations for environmental impact assessment (AMDAL) are being revised. The legal requirement for EA is specified in Article 18(1) of Law Number 23 of 1997 Concerning Environmental Management: "Every business and/or activity that gives rise to a major and significant impact on the environment must possess an environmental impact analysis to obtain the license to conduct the business and/or activity." Government Regulation Number 27 of 1999 Concerning Environmental Impact Assessment describes the procedures for the preparation, review, approval and public disclosure of environmental assessments. Article 3 of the regulation obliges the Minister of Environment to specify the types of businesses that are likely to give rise to major and significant impacts. The Minister does this through issuance of a Ministerial Decree, the most recent of which is PerMen 11/2006. Annex I of PerMen 11/2006 specifies that projects involving exploitation or development of geothermal energy of 55 megawatts or greater require an EIA and calls attention to potential impacts on water, air, flora and fauna, social and economic activities, and local culture. Annex II of PerMen 11/2006 also lists the types of conservation areas within which any proposed project, regardless of type or size, must have an EIA: conservation forest, peat swamps, aquifer recharge areas, beaches and riverbanks, areas surrounding lakes and springs, national parks and reserves, marine parks and reserves, and national parks, tourism parks and forest reserves. The content of an EIA is specified in PerMen 08/2006 Geothermal power projects smaller than 55 MW and not located in any of the conservation areas would require an environmental management plan and monitoring plan, the contents of which are specified in KepMen 86/2002.

The AMDAL requirements are generally adequate to address environmental and social safeguards, but their implementation in various sectors including energy often falls short of the standards desired by the Ministry of Environment (MOE). Typical problems are: lack of shared understanding among developer, EA preparer, and concerned government on the scope of an environmental assessment; failure to collect sufficient data and apply analytical techniques so that impacts can be predicted in quantitative terms; disconnects between EA and project planning and licensing, so that permits are issued without regard to EA approval; and weak implementation of mitigation and monitoring plans. This project is not an appropriate vehicle to correct those systemic problems; MOE has in progress a program of "AMDAL Reformasi" to address them, and the Bank is supporting that work through ESW.

International Practice in Environmental Assessment of Geothermal Power Projects

It is possible that investors planning to develop geothermal projects in Indonesia will be seeking financing, insurance, or guarantees from bilateral or multilateral development finance agencies, or commercial banks that subscribe to the Equator Principles. Funding may also be available from GEF or under various mechanisms based on the Kyoto Protocol, from individual sources or through carbon off-set financing. To access such financial support, the prospective developer will want to prepare a proposal that is "bankable" – i.e., that not only complies with national requirements but is also consistent with the environmental and social policies and standards of the institutions that offer the types of support being sought. Therefore, geothermal investors who are seeking such international financing options would want to adhere to various standards of international good practice to be able to secure such funds. .

There are numerous sources that may be drawn upon as international best practice in meeting environmental and social obligations when developing geothermal resources. If developers are considering international financing through public channels, the guidelines from multilateral and bilateral financiers may serve as useful examples. The World Bank's (IBRD and IDA) environmental and social guidelines for power generation and transmission may be one such example, although it does not specifically address geothermal power development. Other international financiers such as ADB and JBIC also have similar guidelines that must be complied with in order to secure their funding. IFC has also just released (April 30, 2007) new *Environmental, Health and Safety Guidelines* that include specific consideration for geothermal power generation and on electric power transmission and distribution. All of these agencies have policies, performance standards, or guidelines for environmental assessment, and investors who comply with them are likely to be viewed more favorably by most international financiers.

Approach to Safeguards for the Project

As a technical assistance operation, this project has no direct environmental or social impacts since it does not directly finance any power projects. Therefore, the project is classified as environmental assessment Category C, where an environmental assessment is not required. However, one of its key aims is to facilitate increased private sector investment in geothermal power generation projects which will require the developer to comply with the environmental regulations in Indonesia. Therefore, as a part of transactions in Component 2, which is designed to assist MEMR develop model procedures and processes along with documentation for transacting geothermal power development investments, a Guidance Document on environmental and social aspects of geothermal development will be developed and included in the bid package.

Consequently, Component 2, which is designed to assist MEMR develop model procedures and processes along with documentation for transacting geothermal power development investments, will also ensure that environmental and social aspects are covered. The model bidding documents will clearly identify the responsibilities of the developer to carry out safeguards work so that developers can sufficiently develop environmental and social mitigation and monitoring measures as they prepare the EIA for the project. The model documents will also explain the review and approval functions of government agencies and other stakeholders. This will be done through a guidance document that would be included in the bid package for geothermal power investors (and will be available for any other agencies responsible for environmental review, licensing, monitoring and oversight). The objective is to improve the application of safeguards in geothermal power investments, both in terms of quality and efficiency. The Guidance Document will include:

(a) guidelines, timelines and models for compliance with GOI environmental and social requirements, and

(b) suggestions based on international good practice to enhance the "bankability" of potential projects for investors intending to make proposed projects suitable for international financiers.

Stakeholder Consultations and Disclosure

Disclosure of the ISDS and PID will be adequate to inform interested stakeholders of the safeguards arrangements for the project. Consultation will become important when the guidance document is drafted. MEMR will arrange for consultations on the drafts with stakeholders that will include MOE, environmental NGOs, industry representatives, a sample of sub-national environmental and development planning agencies (drawing from areas where geothermal power development is most likely), and interested bilateral and multilateral development agencies. The completed guidance document will be made available to the public in Indonesia and in the Bank's InfoShop.

Annex 11: Governance and Accountability Framework (GAF)

1. The GAF summarizes the actions that have been agreed to and will be undertaken by the Ministry of Energy and Mineral Resources (MEMR) in terms of reinforcing project governance, enhancing transparency of project activities, increasing public accountability and reducing opportunities for corruption, collusion or fraud. All measures mentioned below will be incorporated into the Project Management Manual (PMM), which has been developed by the MEMR to serve as a comprehensive guide to assist with project implementation.

Risk Analysis

2. Overall governance and accountability risk rating for this project is low. This is based on the fact that the financial aspects of the major project components consist of a limited number of consultant contracts, all of which will be managed by MEMR from Jakarta. There are no works contracts while goods contracts are minimal (estimated at less than $50,000 of the overall $4 million project expenditures). Activities related to training and workshops make up a minor component, and will be subject to additional checks and balances as described below.

3. Social accountability mechanisms have been incorporated as a key part of the project's design. Since the project in large part is promoting policies and transactions to attract investments and promote the benefits of geothermal energy, it contains important public awareness and engagement components. These are designed to include regular contact with relevant stakeholders including civil society groups. It is meant as a channel not only for information dissemination purposes, but also to obtain feedback from stakeholders so that the reform solutions can be optimized through an iterative dialogue. Additional governance and anti-corruption measures that have been included in the project are described below.

Transparency and Public Disclosure

4. With a view to enhancing public awareness related to the development and provision of geothermal energy, the project includes a public engagement component that will be used to ensure the widespread circulation of project information to interested parties in the public and private sectors as well as among civil society groups. This will include an ongoing policy dialogue engaging civil society groups with affiliations in the energy sector, such as Bimasena (the Mines and Energy Society, which include major private/public/non-government/research representations), INAGA (Indonesian Geothermal Association, which involves key public, private and academic stakeholders), and academic/research entities (that would include the Bandung Institute of Technology or ITB) and other civil society groups concerned with Indonesian policy in the energy sector. In fact, MEMR has already begun the public engagement campaign with several events during project preparation that were used to confirm the design of the proposed reform program and publicize their goals for developing the sector.

Financial Management Measures

5. The financial management measures to mitigate risks are summarized below and are further detailed in Annex 8: The Inspector General for the MEMR has formally agreed to conduct a yearly internal audit of the project activities. Furthermore, MEMR has also agreed to an external audit, for which the draft terms of reference have already been agreed with the Bank. Additional scrutiny will also be applied to training activities through the implementation of additional financial control procedures including the provision of signed attendance lists for all training/workshops and third party invoices. MEMR also plans to enhance their financial management capabilities by securing specialized consultant assistance.

Procurement Measures

6. The key procurement measures to mitigate risks are summarized below and are further detailed in Annex 9: The five major contracts to be awarded under this project will require prior review by the World Bank. Furthermore, sealed financial bids will be held for safekeeping by notary publics or a similarly secure institution to be agreed upon with the Bank. MEMR will also invite external observers from outside government to attend public bid openings as independent observers. The World Bank has already provided procurement training to MEMR officials, and the project will support MEMR secure specialized consultant assistance to assist with project procurement activities.

Complaints Handling

7. In addition to the provisions allowed in Keppres 80 providing bidders a 5-day period after bid opening to register any complaints regarding the procurement process, the project will also ensure that a secure email account is established through which any interested individual can, anonymously or otherwise, seek additional information or register complaints of any nature regarding the project. The email address will be made available on all bidding documents pertaining to contracts under this project as well as during any events organized under the public engagement component of the project. There will be Ministry oversight to ensure that any issues raised are resolved adequately. This mechanism will be subject to regular supervision by the World Bank.

Sanctions and Remedies

8. The Implementing Agency will apply remedial actions and sanctions for cases of fraud and corruption that are reported and for which evidence is found. This will include sanctions against agency staff and/or contractors proven to be involved in such cases. In all procurement contracts, evidence of fraud, corruption, collusion or coercive practices will result in termination of the contract with additional penalties imposed in accordance with World Bank and Government of Indonesia regulations. Disbursement of funds to any project activity may be suspended in cases where there appear to be significant problems and where the Implementing Agency has not taken appropriate actions to rectify the problems.

Supervision

9. The Implementing Agency is expected to review all aspects of the GAF on an annual basis and to include a summary of their findings (including the rationale for any problems encountered) as part of their regular reports to the World Bank. For its part, the World Bank will review the GAF as part of its regular supervision missions. By mutual agreement, the GAF can be jointly reviewed and revised on an annual basis.

Annex 12: Project Preparation and Supervision

INDONESIA: GEOTHERMAL POWER GENERATION DEVELOPMENT PROJECT

	Planned	Actual
PCN review	06/29/2007	06/18/2007
Initial PID to PIC	May 2007	11/07/2007
Initial ISDS to PIC	May 2007	11/07/2007
Appraisal	January 2007	
Negotiations	02/26/2008	
Board/RVP approval	04/30/2008	
Planned date of effectiveness	May 2008	
Planned date of mid-term review	December 2009	
Planned closing date	June 2011	

Key institutions responsible for preparation of the project:

- The National Development Planning Agency, BAPPENAS – Directorate for Energy, Mining and Mineral Resources; and
- The Ministry of Energy and Mineral Resources – Directorate for Geothermal Enterprise Supervision and Groundwater Management.

Bank staff and consultants who worked on the project included:

Name	Title	Unit
Migara Jayawardena	Senior Infrastructure Economist/Task Team Leader	EASTE
Leiping Wang	Senior Energy Specialist/ Engineer	EASTE
Noureddine Berrah	Energy Policy Advisor Consultant	EASTE
Jeff Delmon	Senior Infrastructure Specialist/ Transactions	FEU
Yuling Zhou	Senior Operations Officer/ Procurement	EASTE
Feng Liu	Energy Specialist Consultant	EASCS
Emil Elestianto	Development Specialist Consultant	EASTE
Rajiv Sondhi	Senior Financial Management Specialist/ FMS	LOAFC
Ximing Peng	Energy Specialist	EASCS
Bisma Husen	Procurement Specialist	EAPCO
Unggul Suprayitno	Financial Management Specialist	EAPCO
Tom Walton	Environmental Specialist Consultant/Safeguards	AFTTR
Viviante Rambe	Environmental Specialist	EASIS
Bruce Harris	Social Development Specialist Consultant/Safeguards	EASTE
Teri Velilla	Program Assistant	EASTE
Julia Hanniawaty	Team Assistant	EACIF

Bank funds expended to date on project preparation:

1. Bank resources: US$183,164.69
2. Trust funds: -0-
3. Total: US$183,164.69

Estimated Approval and Supervision costs:

1. Remaining costs to approval: US$15,000
2. Estimated annual supervision cost: US$65,000

Annex 13: Documents in the Project File

INDONESIA: GEOTHERMAL POWER GENERATION DEVELOPMENT PROJECT

Bank Staff Assessments

Detailed Project Assessments from Identification, Preparation and Pre-Appraisal Missions

World Bank, Country Brief – Indonesia
World Bank (2003), Country Assistance Strategy for Indonesia, 2004-2007
World Bank (2006), Electricity for All: Options for Increasing Access in Indonesia
World Bank (2004), Averting an Infrastructure Crisis

Other

APEC (1996), Energy Overview
PEACE (2007), Indonesia and Climate Change: Current Status and Policies
JICA (2007), Masterplan Study for Geothermal Development in Indonesia
Martinot, E. (2002), Grid-based Renewable Energy in Developing Countries: Policies, Strategies, and Lessons from the GEF
Indonesia Geothermal Association (2004), Geothermal Development in Indonesia
Ministry of Energy and Mineral Resources Indonesia (2007), Geothermal Investment Opportunities in Indonesia,

Annex 14: Statement of Loans and Credits

INDONESIA: GEOTHERMAL POWER GENERATION DEVELOPMENT PROJECT

			Original Amount in US$ Millions						Difference between expected and actual disbursements	
Project ID	FY	Purpose	IBRD	IDA	SF	GEF	Cancel.	Undisb.	Orig.	Frm. Rev'd
P079906	2007	ID-STRATEGIC ROADS INFRA	208.00	0.00	0.00	0.00	0.00	208.00	0.00	0.00
P083742	2007	ID-Farmer Empower. Agric.Tech.&Info	32.80	60.00	0.00	0.00	0.00	93.18	0.00	0.00
P089479	2006	ID-Early Childhood Education and Dev	0.00	67.50	0.00	0.00	0.00	69.88	0.01	0.00
P085375	2006	ID-WSSLIC III (co-TTL=Claudia Rokx)	0.00	137.50	0.00	0.00	0.00	138.32	4.48	0.00
P077175	2006	ID-Domestic Gas Market Development Proj.	80.00	0.00	0.00	0.00	0.00	68.73	5.40	0.00
P076174	2005	ID-Initiatives for Local Govern. Reform	14.50	15.00	0.00	0.00	0.00	38.29	12.33	0.00
P078070	2005	Support for Poor and Disadvantaged Areas	69.00	35.00	0.00	0.00	0.00	102.29	14.02	0.00
P084583	2005	ID-UPP3	67.30	71.40	0.00	0.00	0.00	78.74	-26.67	0.00
P071296	2005	ID-USDRP	45.00	0.00	0.00	0.00	0.00	42.76	0.71	0.00
P085133	2005	Govt Finl Mgt & Revenue Admin Project	55.00	5.00	0.00	0.00	0.00	55.07	20.14	0.00
P085374	2005	ID-HIGHER EDUCATION	50.00	30.00	0.00	0.00	0.00	68.71	9.49	0.00
P092019	2005	Kecamatan Development Project 3B	80.00	80.00	0.00	0.00	0.00	59.70	9.78	0.00
P084860	2004	ID-PCF-Indocement Cement	0.00	0.00	0.00	0.00	0.00	10.73	0.00	0.00
P074290	2004	ID-E. IND REG TRANSPT 2	200.00	0.00	0.00	0.00	1.00	159.19	90.86	0.00
P064728	2004	ID-LAND MANAGEMENT &POLICY DEVT PROJECT	32.80	32.80	0.00	0.00	0.16	44.62	9.48	0.00
P071316	2004	ID - Coral Reef Rehab and Mgmt Prog II	33.20	23.00	0.00	0.00	0.17	44.51	10.91	0.00
P071318	2004	ID - Coral Reef Rehab and Management II	0.00	0.00	0.00	7.50	0.00	6.89	2.55	0.00
P059931	2003	ID-Water Resources & Irr.Sector Mgt Prog	45.00	25.00	0.00	0.00	0.00	64.51	59.01	11.22
P063913	2003	ID-Java-Bali Pwr Sector & Strength	141.00	0.00	0.00	0.00	0.00	115.10	98.68	7.35
P079156	2003	ID Third Kecamatan Development Project	204.30	45.50	0.00	0.00	0.00	2.29	-8.62	0.00
P076271	2003	ID-PPITA	17.10	0.00	0.00	0.00	0.00	4.52	4.52	1.16
P073772	2003	ID-Health Workforce & Services (PHP 3)	31.10	74.50	0.00	0.00	0.00	74.41	50.09	-3.50
P073970	2002	ID-GLOBAL DEV LEARNING (LIL)	2.66	0.00	0.00	0.00	0.00	1.30	1.30	0.00
P072852	2002	ID-UPP2	29.50	70.50	0.00	0.00	0.00	4.37	-16.07	0.00
P073025	2001	ID-SECOND KECAMATAN DEVELOPMENT PROJECT	208.90	111.30	0.00	0.00	0.00	5.79	-8.88	0.00
P049539	2001	ID-PROVINCIAL HEALTH II	63.20	40.00	0.00	0.00	32.00	1.40	27.13	0.00
P059477	2000	ID-WSSLIC II (co-TTL=Claudia Rokx)	0.00	77.40	0.00	0.00	0.00	18.92	11.87	0.00
P049545	2000	ID-PROVINCIAL HEALTH I	0.00	38.00	0.00	0.00	3.17	7.72	8.19	8.19
P045337	1998	ID-KECAMATAN DEV FUND	225.00	0.00	0.00	0.00	11.03	125.20	-37.41	0.00
		Total:	1,935.36	1,039.40	0.00	7.50	47.53	1,715.14	353.30	24.42

INDONESIA
STATEMENT OF IFC's
Held and Disbursed Portfolio
In Millions of US Dollars

		Committed				Disbursed			
		IFC				IFC			
FY Approval	Company	Loan	Equity	Quasi	Partic.	Loan	Equity	Quasi	Partic.
2006	Bank Danamon	155.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2004	BonaVista School	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00
2006	Buana Bank	5.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2006	Centralpertiwi	45.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2004	Medan NP School	1.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2002	P.T. Gawi	11.05	0.00	0.00	3.49	4.90	0.00	0.00	3.49
1989	PT Agro Muko	0.00	2.20	0.00	0.00	0.00	2.20	0.00	0.00
1997	PT Alumindo	2.73	0.00	0.00	0.00	2.73	0.00	0.00	0.00
1989	PT Astra	0.00	0.20	0.00	0.00	0.00	0.20	0.00	0.00
1994	PT Astra	0.00	0.19	0.00	0.00	0.00	0.19	0.00	0.00
2003	PT Astra	0.00	0.12	0.00	0.00	0.00	0.12	0.00	0.00
	PT Astra Otopart	0.00	0.70	0.00	0.00	0.00	0.70	0.00	0.00
2005	PT Astra Otopart	24.00	0.00	0.00	0.00	24.00	0.00	0.00	0.00
2000	PT Bank NISP	0.00	2.85	2.86	0.00	0.00	2.85	2.83	0.00
2002	PT Bank NISP	0.00	2.04	0.00	0.00	0.00	2.04	0.00	0.00
2004	PT Bank NISP	35.00	0.00	0.00	0.00	35.00	0.00	0.00	0.00
1997	PT Berlian	0.00	3.35	0.00	0.00	0.00	0.00	0.00	0.00
1993	PT Bina Danatama	0.05	0.00	0.00	0.00	0.05	0.00	0.00	0.00
1996	PT Bina Danatama	0.00	0.00	2.58	4.81	0.00	0.00	2.58	4.81
2004	PT Ecogreen	30.00	0.00	0.00	0.00	30.00	0.00	0.00	0.00
2005	PT Ecogreen	25.00	0.00	0.00	0.00	20.00	0.00	0.00	0.00
	PT Grahawita	0.00	0.00	3.75	0.00	0.00	0.00	3.75	0.00
1991	PT Indo-Rama	0.00	3.82	0.00	0.00	0.00	3.82	0.00	0.00
1995	PT Indo-Rama	0.00	1.57	0.00	0.00	0.00	1.57	0.00	0.00
1999	PT Indo-Rama	0.00	0.81	0.00	0.00	0.00	0.81	0.00	0.00
2001	PT Indo-Rama	20.00	0.00	0.00	0.00	0.33	0.00	0.00	0.00
2004	PT Indo-Rama	48.00	0.00	0.00	0.00	41.00	0.00	0.00	0.00
1992	PT KIA Keramik	0.23	0.00	0.00	2.00	0.23	0.00	0.00	2.00
1996	PT KIA Keramik	1.65	0.00	0.00	53.49	1.65	0.00	0.00	53.49
1995	PT KIA Serpih	4.50	0.00	0.00	49.50	4.50	0.00	0.00	49.50
1997	PT Kalimantan	9.38	0.00	0.00	0.00	9.38	0.00	0.00	0.00
	PT Karunia (KAS)	16.45	0.00	0.00	3.56	16.45	0.00	0.00	3.56
2006	PT Karunia (KAS)	20.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	PT Makro	0.00	2.34	0.00	0.00	0.00	2.34	0.00	0.00
2000	PT Makro	0.00	1.21	0.00	0.00	0.00	0.71	0.00	0.00
2006	PT Makro	0.00	0.66	0.00	0.00	0.00	0.66	0.00	0.00
1998	PT Megaplast	0.00	2.50	0.00	0.00	0.00	2.50	0.00	0.00
1993	PT Nusantara	0.00	0.00	10.16	7.90	0.00	0.00	10.16	7.90
2004	PT Prakars (PAS)	15.36	0.00	0.00	3.20	15.36	0.00	0.00	3.20
1997	PT Sayap	0.83	0.00	0.00	0.00	0.83	0.00	0.00	0.00
2001	PT Sigma	0.00	1.03	0.00	0.00	0.00	1.03	0.00	0.00

		Committed				Disbursed			
		IFC				IFC			
FY Approval	Company	Loan	Equity	Quasi	Partic.	Loan	Equity	Quasi	Partic.
2006	PT TAS	7.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1995	PT Viscose	7.81	0.00	0.00	0.00	7.81	0.00	0.00	0.00
2004	PT Viscose	8.31	0.00	0.00	0.00	8.31	0.00	0.00	0.00
1997	PT Wings	0.72	0.00	0.00	0.00	0.72	0.00	0.00	0.00
2001	Sunson	11.62	0.00	0.00	7.35	11.62	0.00	0.00	7.35
2005	WOM	0.00	15.82	0.00	0.00	0.00	15.74	0.00	0.00
2006	WOM	20.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2004	Wilmar	33.33	0.00	0.00	0.00	33.33	0.00	0.00	0.00
	Total portfolio:	560.77	41.41	19.35	135.30	269.20	37.48	19.32	135.30

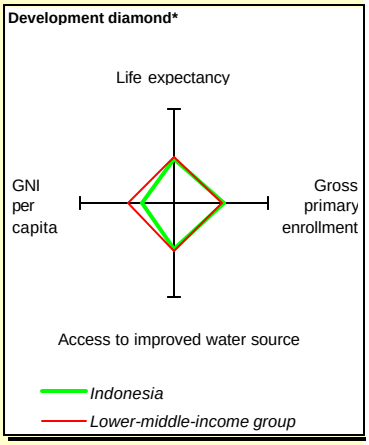
		Approvals Pending Commitment			
FY Approval	Company	Loan	Equity	Quasi	Partic.
2005	Bank NISP SELF	0.03	0.00	0.00	0.00
2006	Bank NISP Swap	0.00	0.00	0.00	0.00
2006	Orix Indonesia	0.08	0.00	0.00	0.00
	Total pending commitment:	0.11	0.00	0.00	0.00

Annex 15: Country at a Glance

Indonesia at a glance

9/28/07

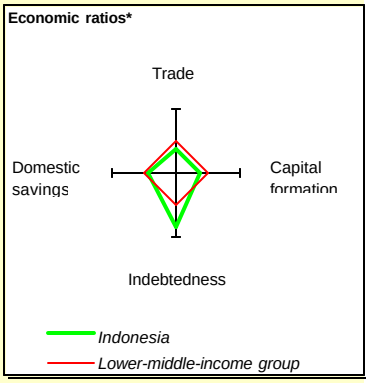
POVERTY and SOCIAL	Indonesia	East Asia & Pacific	Lower-middle-income
2006			
Population, mid-year *(millions)*	223.0	1,900	2,276
GNI per capita *(Atlas method, US$)*	1,420	1,863	2,037
GNI *(Atlas method, US$ billions)*	316.7	3,539	4,635
Average annual growth, 2000-06			
Population *(%)*	1.3	0.9	0.9
Labor force *(%)*	1.9	1.3	1.4
Most recent estimate (latest year available, 2000-06)			
Poverty *(% of population below national poverty line)*	18	..	..
Urban population *(% of total population)*	49	42	47
Life expectancy at birth *(years)*	68	71	71
Infant mortality *(per 1,000 live births)*	28	26	31
Child malnutrition *(% of children under 5)*	28	15	13
Access to an improved water source *(% of population)*	77	79	81
Literacy *(% of population age 15+)*	90	91	89
Gross primary enrollment *(% of school-age population)*	117	114	113
Male	119	115	117
Female	115	113	114



KEY ECONOMIC RATIOS and LONG-TERM TRENDS

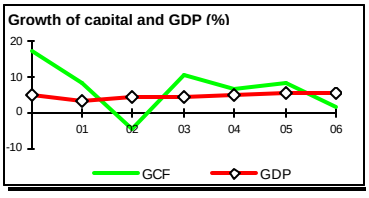
	1986	1996	2005	2006
GDP *(US$ billions)*	80.1	227.4	287.0	364.8
Gross capital formation/GDP	29.5	30.7	24.6	24.6
Exports of goods and services/GDP	19.5	25.8	33.6	30.9
Gross domestic savings/GDP	28.5	30.1	28.9	29.4
Gross national savings/GDP	23.8	27.8	25.7	26.4
Current account balance/GDP	-4.9	-3.4	0.1	2.7
Interest payments/GDP	3.0	2.2	1.1	1.3
Total debt/GDP	53.6	56.7	48.2	35.3
Total debt service/exports	37.3	36.6	16.8	22.3
Present value of debt/GDP	..	..	48.3	..
Present value of debt/exports	..	..	129.0	..

	1986-96	1996-06	2005	2006	2006-10
(average annual growth)					
GDP	7.9	2.7	5.7	5.5	6.5
GDP per capita	6.1	1.3	4.3	4.3	5.3
Exports of goods and services	9.1	3.8	16.4	9.2	8.3

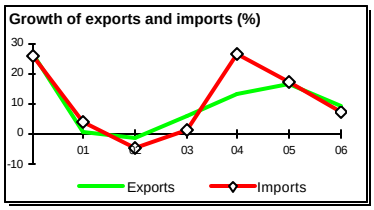


STRUCTURE of the ECONOMY

	1986	1996	2005	2006
(% of GDP)				
Agriculture	24.2	16.7	13.1	12.9
Industry	33.7	43.5	46.8	47.0
Manufacturing	16.7	25.6	27.7	28.0
Services	42.0	39.9	40.2	40.1
Household final consumption expenditure	60.4	62.4	63.0	62.0
General gov't final consumption expenditure	11.0	7.6	8.1	8.6
Imports of goods and services	20.5	26.4	29.3	26.1



	1986-96	1996-06	2005	2006
(average annual growth)				
Agriculture	3.3	2.5	2.7	3.0
Industry	9.9	2.4	4.7	4.7
Manufacturing	11.2	3.5	4.6	4.6
Services	8.1	3.2	7.9	7.2
Household final consumption expenditure	7.7	3.1	3.5	5.0
General gov't final consumption expenditure	4.3	4.9	6.6	9.6
Gross capital formation	10.6	-1.3	8.4	1.4
Imports of goods and services	10.3	1.8	17.1	7.6



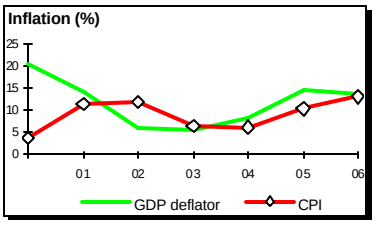
Note: 2006 data are preliminary estimates.

This table was produced from the Development Economics LDB database.

* The diamonds show four key indicators in the country (in bold) compared with its income-group average. If data are missing, the diamond will

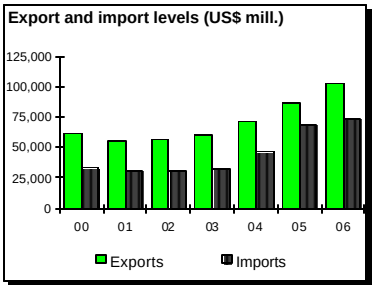
PRICES and GOVERNMENT FINANCE

	1986	1996	2005	2006
Domestic prices				
(% change)				
Consumer prices	5.8	8.0	10.5	13.1
Implicit GDP deflator	-0.1	8.9	14.8	13.6
Government finance				
(% of GDP, includes current grants)				
Current revenue	15.9	16.5	17.8	19.1
Current budget balance	-4.6	8.0	6.2	7.6
Overall surplus/deficit	-3.5	3.0	-0.5	-0.9



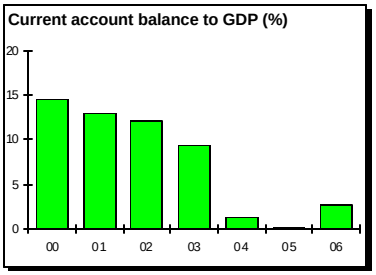
TRADE

	1986	1996	2005	2006
(US$ millions)				
Total exports (fob)	..	49,815	86,995	103,514
Fuel	..	12.861	23.717	27.619
Estate crop	..	3.998	4.918	5.483
Manufactures	..	10.795	14.402	17.190
Total imports (cif)	..	42.929	69.462	73.868
Food	..	3.931	3.888	4.709
Fuel and energy	..	3.670	17.429	19.028
Capital goods	..	17.497	15.262	4.877
Export price index *(2000=100)*	..	80	140	167
Import price index *(2000=100)*	..	128	207	220
Terms of trade *(2000=100)*	..	63	68	76



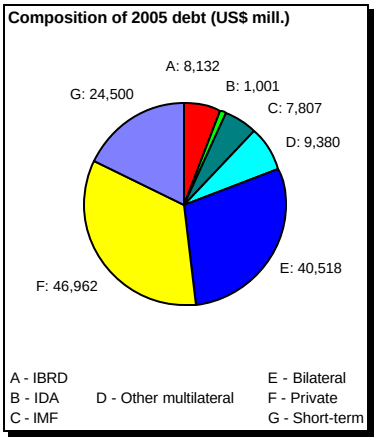
BALANCE of PAYMENTS

	1986	1996	2005	2006
(US$ millions)				
Exports of goods and services	15,240	56,787	99,760	115,032
Imports of goods and services	16,194	59,379	91,319	95,493
Resource balance	-1,908	-5,184	8,441	19,539
Net income	-6,432	-6,008	-12,927	-14,465
Net current transfers	259	937	4.793	4.863
Current account balance	-3,911	-7,663	307	9,937
Financing items (net)	1,904	16,668	-970	-3,035
Changes in net reserves	2.007	-9.005	663	-6.902
Memo:				
Reserves including gold *(US$ millions)*	4.814	19.281	36.181	43.083
Conversion rate *(DEC. local/US$)*	1.282.6	2.342.3	9.705.0	9.151.0



EXTERNAL DEBT and RESOURCE FLOWS

	1986	1996	2005	2006
(US$ millions)				
Total debt outstanding and disbursed	42.916	128.937	138.300	128.917
IBRD	5.058	11.138	8.132	7.423
IDA	857	736	1.001	1.318
Total debt service	5.984	21.543	18.045	27.345
IBRD	636	2.249	1.871	1.827
IDA	12	26	36	37
Composition of net resource flows				
Official grants	136	190	998	..
Official creditors	1,016	-792	-611	..
Private creditors	528	6,869	1,485	..
Foreign direct investment (net inflows)	258	6,194	5,260	..
Portfolio equity (net inflows)	0	1,819	-165	..
World Bank program				
Commitments	982	1,194	1,027	105
Disbursements	828	905	652	1.012
Principal repayments	236	1.429	1.417	1.430
Net flows	592	-523	-765	-418
Interest payments	411	846	489	434
Net transfers	180	-1.370	-1.254	-852



Note: This table was produced from the Development Economics LDB database. 9/28/07

Annex 16: Incremental Cost Analysis

INDONESIA: GEOTHERMAL POWER GENERATION DEVELOPMENT PROJECT

1. The Business-as-Usual Scenario

Indonesia has the largest estimated geothermal power potential in the world with about 27,000 MWe of estimated resources. Yet, the exploitation and utilization of geothermal energy has been slow to develop and currently face a number of challenges. Over a span of 20 years, Indonesia was only able to develop 970 MW of geothermal power as of 2007, or less than 4 percent of the total potential. In October 2003, the Geothermal Law (Law No. 27/2003) was passed to provide a legislative basis for geothermal resource development in Indonesia. According to this law, all geothermal resources will be controlled by the state and any sites for development will be defined and then tendered to business entities by the central or local government authorities in accordance with their respective jurisdictions. An exception was made for those geothermal field development contracts awarded to private sectors under the PD45/1991 regime, while for geothermal fields allocated without contracts to the SOE during the PD45/1991 regime, a specific agreement between GoI and the SOE (Pertamina and PLN) was made to determine a deadline in which GoI can take possession of these fields should there be no development. These geothermal fields with a total of about 5,000 MW, including 970 MW presently already installed production and nearly 3,000 MW proven reserves which can be developed quickly if investments can be mobilized. The remaining fields, with a total potential of about 22,000 MW are unproven resources with different degree of resources knowledge (Annex 1) and will be tendered under the supervision of the government in accordance with the Geothermal Law. In 2004, the Government consolidated all of this information into a geothermal resource development road map aimed at planning and further promoting the utilization of geothermal resources up to 2020 (Table A15.1). According to the Road Map, the total installed capacity of geothermal power generation in Indonesia is expected to progressively increase to reach 6,000 MW by 2020.

Table A15.1: Geothermal Development Target (2004 – 2020)

	2004	2008	2012	2016	2020
Installed Capacity (MW)	807	2,000	3,442	4,600	6,000
Incremental Capacity (MW)					
Existing Working Areas		1,193	1,442		
New Working Areas				1,158	1,400

Source: Indonesia Geothermal Development Road Map (2004-2020)

To achieve these targets, the government's strategy is (i) to speed-up the development of the geothermal fields allocated under PD45/1991 regime, and at the same time (ii) to build the necessary capacity for the future development of additional geothermal fields in accordance with the new Geothermal Law. Progress towards the targets, however, has been very slow due to major gaps in the current policy framework, which does not provide any economic incentives for current operators to expand generation capacity. Nor does it include certain upstream risk mitigation instrument to facilitate the tendering of new fields. The Geothermal Law only provided the principles for geothermal resources management and is not operational without

detailed implementation rules and regulations, leaving many a regulatory uncertainty for potential investors. Moreover, the national government, with its two-year old special sector management unit, the Directorate of Geothermal Enterprise Supervision and Ground Water Management (DGESGWM) in the MEMR, and the local governments, with its recently gained rights to geothermal development, has little experience and no track record of conducting competitive tendering. These problems have seriously dampened the prospect for geothermal power development proposed by the Geothermal Road Map. Recent estimates indicate that the existing investors/operators have been unable to develop many of the fields awarded to them (under the PD45/1991), and that only around 300 MW of new geothermal power generation capacity is expected to be commissioned by 2008. This is about 75% short of the target of about 1,190 additional MW of capacity indicated in the Geothermal Road Map. The inability to develop already proven fields is likely cast doubt on future exploration as well.

Without significant additional efforts to overcome the key barriers outlined above (detailed description in Section I.A of the Project Appraisal Document), Indonesia will find it challenging to even expand the generation capacity in the geothermal fields already partially developed. There would be neither firm economic incentive policies nor concrete upstream risk mitigation measures to promote geothermal power investments. There would be no standard bidding documents and transparent transaction processes to speed up the tendering of new projects. The national capability for regulating, developing and operating geothermal power generation facilities along with related businesses would improve but at a slower pace than presently planned by the Government. As a result, a business environment conducive to private participation in geothermal resource development would not develop quickly, hindering the sustainable development of the geothermal energy business in the country in line with the 2003 Geothermal Law. Therefore, the Baseline Scenario assumes a gradual ramping up of the geothermal power generation in the partially developed fields with no development in unexplored "green" fields. This would amount to about 2,000 MW of total additional power by 2020 for a total of around 2,800 MW installed capacity, less than half of the 6,000 MW target set by the Government. The shortfall in expected geothermal power capacity would translate into the development of around 3,200 MW of additional coal-fired power plants, the least cost expansion option without considering global environmental benefits.

The GoI is fully aware of the barriers and the consequences of not addressing them immediately. It has requested a technical assistance from the World Bank to specifically help develop and implement concrete economic incentive and risk mitigation mechanisms and strengthen the government's capacity to manage and support geothermal investment transactions.

2. The Proposed Project and the Global Environmental Benefits

In contrast to the Baseline Scenario, GEF incremental cost financing support for barrier removal will break the major constraints on geothermal power investment and lead to an accelerated development of geothermal resources in Indonesia. With an enabling policy framework in place, successfully demonstrated transactions procedures, and strengthened government capacity to support sector growth, it is expected that Indonesia will be able to quickly take advantage of its sizable geothermal power potential (up to 2.3 GW) in the fields already partially developed or with confirmed reserves and effectively tapping into its large pool of economically viable

geothermal fields (up to 10 GW). Therefore, the GEF alternative scenario assumes a fast scaling-up of installed geothermal power capacity and that GoI's goal of developing 6,000 MW geothermal power by 2020 is attainable. Consequently, Indonesia would have 3,200 MW more geothermal power generation capacity than under the baseline scenario, replacing an equivalent amount of coal-fired capacity. Additionally, the mechanisms instituted through the GEF project would be available to facilitate the development of the remaining resources beyond 2020.

Table A15.2: Alternative Path of Geothermal Power Development

	2006	2008	2011	2020
Business as Usual Scenario (MW)	807	1,100	1,380	2,800
GEF Alternative Scenario (MW)	807	1,100	1,730	6,000

The proposed project is expected to directly leverage private and/or public investments in about 350 MW installed geothermal power capacity by assisting the transactions of these investments to reach financial closures by the time of project completion in 2011. The expected incremental global environment benefits will be 60 million tons of avoided CO2 emissions (over the lifecycle of geothermal power plants) directly resulted from the incremental installed geothermal power capacity achieved at the completion of the project. The long-term benefits are expected to be much larger, in the order of 500 million tons of avoided CO2 emissions over the life-cycles of the incremental geothermal power capacity by 2020.

3. Incremental Costs and GEF Role

Table 3: Value added by Involving the GEF

Area of Assistance	Business as Usual	GEF Alternative	GEF Increment
Policy framework development	Government, mostly working on its own, adopts piecemeal approach to policy development. This would lead to (i) delaying of the formulation and implementation of the economic incentive policy (incremental cost bridging mechanism), discouraging existing investor/operator's desire to expand generation capacity; (ii) prolonged track to developing proper upstream mitigation instruments, dampening investors' interest in developing new geothermal power projects; and (iii) further postponing of the issuance of the Implementation Rules and Regulations of the Geothermal Law, leaving many regulatory uncertainties unresolved and undermining investor confidence.	With strong international assistance Government adopts integrated approach to develop an enabling policy framework which both provides impetus (incremental cost bridging mechanism) for immediate expansion of generation capacity in low-risk fields and lays a solid foundation (through upstream risk mitigation instrument and regulatory clarity) for sustained growth.	Economic incentive policy implemented Upstream risk mitigation mechanism introduced Implementation rules and regulations of the Geothermal Law promulgated
Cost estimate	GoI budget of US$2,500,000 over three years	GoI budget of US$2,500,000 over three years International assistance cost of US$1,100,000 over three years	Proposed GEF incremental cost financing of US$1,100,000 over three years

Area of Assistance	Business as Usual	GEF Alternative	GEF Increment
Geothermal investment transactions	Government is able to mobilize some investment in expanding power generation in a few operating fields through its "team tariff" measure which is currently being developed. Government will not be able to tender new geothermal fields successfully because of the lack of concrete policy support in incremental cost bridging and risk mitigation and the lack of credible transaction management procedures and insufficient capacity.	With a concrete enabling policy framework shaping up and with hands-on international assistance, Government will be able to achieve financial closure on a group of expansion projects in operating geothermal fields, develop model procedures and standard documents and build a credible transaction process, and successfully tender a large new geothermal field to new investors.	Financial closure on a group of expansion project on operating fields, resulting in at least an additional 300 MW of installed capacity over three years Model transaction procedures and standard documents for tendering new geothermal field Financial closure on investment in at least 55 MW installed capacity in a new geothermal field
Cost estimate	Government budget of US$1,000,000 over three years	Government budget of US$1,000,000 over three years International assistance cost of US$2,350,000 over three years	Proposed GEF incremental cost financing of US$2,350,000 over three years
Technical capacity building	The capacity of concerned national government agency and local government to conduct geothermal investment transaction will be slow to develop; stakeholder engagement will be lacking; and attention to domestic participation will be limited due to strained government capacity	Rapid improvement of government capacity to handle geothermal investment transactions through on-the-job training alongside the actual transactions conducted through the project as well as tailored special training; stakeholder engagement broadened through awareness program, and strategy for domestic participation in sector development is formulated	Improved transaction skills and efficiency of concerned government agencies and officials Improved stakeholder understanding of sector policies and investment opportunities National strategy on geothermal technology development formulated
Cost estimate	Government budget US$1,300,000 over three years	Government budget US$1,300,000 over three years International assistance cost US$350,000 over three years	Proposed GEF incremental cost financing of US$350,000 over three years
Cost estimate subtotal	Government budget US$4,800,000 over three years	Government budget US$4,800,000 over three years International assistance cost US$3,800,000 over three years	Proposed GEF incremental cost financing of US$3,800,000 over three years

Including a proposed funding of US$200,000 (with additional US$200,000 in-kind from GoI) for project management, monitoring and reporting, the over all proposed GEF incremental cost financing is US$4,000,000. Considering the global environment benefit achieved through incremental geothermal power generation directly leveraged by the proposed project at implementation completion, the (undiscounted) cost effectiveness of the GEF incremental cost financing is about US$0.07/ton CO2 abated. The overall cost-effectiveness of mitigated CO2 emissions, considering levelized cost of energy, is estimated at US$12/ton-CO2 abated.

4. Assumptions and Methodology for Estimating Incremental Benefits and Cost

The global environment benefit is assessment based on comparison of geothermal power generation, using prevailing technology in Indonesia, with coal-fired power generation, using 300 to 600 MW units with electrostatic precipitators and standard wet-process sulfur scrubbers. The following assumptions are used in calculation of CO2 emissions and incremental cost (geothermal vs. coal-fired):

Geothermal plants:

Capacity factor	80%
Lifecycle	30 years

Coal-fired plants:

Capacity factor	75%
Lifecycle	30 years
CO2 emission factor	800 kg/MWh

Details on cost calculations and additional assumptions are available in Annex 4

Annex 17: STAP Roster Review

INDONESIA: GEOTHERMAL POWER GENERATION DEVELOPMENT PROJECT

The following comments were provided by STAP Roster Reviewer Jayant Sathaye, Senior Staff Scientist, Lawrence Berkeley National Laboratory, USA. The response to each comment is inserted immediately after the comment in bold *Italic* font.

WORLD BANK INDONESIA GEOTHERMAL POWER GENERATION DEVELOPMENT PROJECT:

Review and Comments

by

Jayant Sathaye

25 November 2007

Summary and Conclusion

The goal of this project is to promote geothermal energy development in Indonesia as an alternative to the development of coal power plants. This will help reduce emissions of particulates and sulfur and nitrogen oxides, and carbon dioxide, which is a major contributor to climate change. Indonesia possesses significant geothermal resources but its exploitation is hampered because of the lack of capacity in project development and also lack of ready access to investment in this resource. The project aims to address both issues.

The technical problems identified by the World Bank are familiar and widespread in many electricity generation companies in developing countries. Lack of knowledge about the design and implementation of new generation technologies particularly renewable ones is not uncommon. The project thus provides a viable platform for improving Indonesia's capability in this sector. It is technically feasible and manageable and reflects priorities that will have both local and global benefits. It will also enhance the credibility of geothermal energy as a developable resource in Indonesia and other countries.

In summary, this project is well suited to provide tangible sustainable development benefits in the power generation sector in Indonesia. .

General and specific comments by paragraph are noted in the sections below.

General Comments

The project is aimed at improving the exploitation of brownfield and greenfield geothermal energy resources. The proposed project will build capacity for project design and implementation, and increase access to investment in this sector. The project goals are not tied to

an IBRD loan since that might delay the development of geothermal resources in the country. While this is acceptable, it is important that the project activities be closely tied to some ongoing investment program in geothermal energy. This would enable the project to demonstrate tangible benefits of capacity building that otherwise might be difficult to track and verify.

Response: The proposed project is indeed closely tied to actual investments in geothermal power development by investors and project developers. This is supported by Component 2 of the proposed project which will assist GoI undertake actual investment transactions and leverage in excess of 350 MW of geothermal power generation capacity (at least 300 MW brownfields and at least 50 MW greenfields). More importantly, the policies and model transaction procedures developed and implemented in the proposed project will continue to progressively catalyze up to 3,200 MW incremental geothermal power capacity by 2020. Paragraph 19 in the revised PAD better reflects these linkages.

The project appraisal document (PAD) does not provide a description of Indonesia's geothermal resource and the technologies that will be used in brownfield and greenfield projects to exploit the resources. A description of the steam or hot water temperature, field depth, level of impurities, types of turbines used to extract energy, etc. will help the reader to relate the costs with resource size and efficiency estimates.

Response: The Japan International Corporation Agency (JICA) has sponsored a comprehensive geothermal resources assessment of Indonesia for the preparation of GoI's Master Plan for Geothermal Power Development. The interim JICA report, which contained detailed data and information of 51 geothermal fields with a total estimated capacity of 13, 824 MW, provided the basis for the cost and technical evaluation of geothermal power investments during the preparation of the proposed project. The JICA report and the cost analysis report are in the project file (Annex 12 of PAD)

Geothermal electricity generation typically releases some greenhouse gases, particularly carbon dioxide. Admittedly, these are relatively small compared to those from the major alternative, coal power plants, but need to be accounted for in the document. For instance, a survey of geothermal facilities in several countries concluded that the carbon dioxide coefficient was 122 g/kWh.[20]

Response: The relatively smaller emissions from geothermal plants is already reflected in the estimation of avoided CO2 emissions.

Specific Comments

I would like to suggest the following specific considerations to improve various sections of the main text, and appendices.

Section A. Strategy Context and Rationale

- Para (P).3 What were the lower tariff levels? Can you provide a range?

[20] http://www.pi.energy.gov/enhancingGHGregistry/comments/documents/davis.pdf

***Response**: The original tariffs ranged from 7-9 US cents and they were renegotiated to around 5 US cents.*

- P. 5 It would be useful to provide information on the range of geothermal and coal power plant costs in Indonesia.

***Response**: Both geothermal and coal capital cost estimates are indicated in the economimc and financial analysis section (Annex 4). Further underlying assumptions are on project file in the study by Japan International Corporation Agency (JICA).*

Section B: Project Description

- P.6-C1.1 Please list the types of preliminary alternative policy and technology options that MEMR could choose from. Will R&D be one of the options?

***Response**:* **Alternative policy options that were considered during project preparation are described in Section 5 of the PAD. In terms of technology choice, it is optimally determined by the developers who will be making the investment rather than being predetermined by the Government. Therefore, the MEMR, b design, would not want to pre-specify a technical solution, and instead provide developers with the latitude to evaluate each field and determined the most suitable and least cost technological option.**

- P.6-C1.2 Please list the countries with geothermal resources that you are referring to here and also list the types of options that they have or are taking into consideration.

***Response**: this is summarized in Paragraph 29 as well as Annex 4 of the PAD.*

Annex 1. Country and Sector Background:

- P.20 – I am somewhat surprised that Indonesia has extensive geothermal resources but the resource is not cost-effective enough to generate electricity when compared with coal powered generation. In California, geothermal has traditionally out-competed other baseload resources. Here it would be good to add more background on technologies, quality of resource base, and the cost of generating electricity relative to other locations worldwide.

***Response**: the costs are higher in Indonesia in large part due to the fact that most geothermal power components have to be imported from industrialized countries and have limited related human resources, while new coal-fired plants using Chinese technologies are significantly cheaper than similar plants relying on technologies from industrialized countries, such as Japan.*

Annex 4. Results of Project Analysis

- P.28 – The three basic approaches for estimating local pollution damage costs are appropriate. However, the SO_2 and NOx costs in the US were to a large extent driven down by the increased availability of low sulfur coal and not as much due to technological improvement. A similar situation could arise in Indonesia if low sulfur coal is utilized as an alternative source of coal. This should be noted either in the text or as a

footnote so that the reader is aware of the source of the costs and also its implications for the Indonesia situation.

***Response*: Footnote added in Annex 4.**

- P.29 – Please make a note in the text that scrubber and precipitator costs are included. How much do they add to the power plant investment cost? Is the coal only 60% carbon because of large ash content? Is the coal washed?

***Response*: The assumptions table for coal fired thermal power plants in Annex 4 already indicates the environmental control considerations and reflects its associated costs. The cost of ESP adds 2-3% to the power plant investment and the cost of FGD adds another 3-4%. In general Indonesian coal has very lower sulfur (less than 0.5%) and FGD is normally not needed and is not included in the investment for power plant in the project analysis. The 60% carbon content is based on coal chemistry analysis data from PLN, the national power company. The ash content of Indonesia coal is low, too, and coal washing is not necessary.**

- P. 35 – Apparently there is no electricity shortage in Indonesia today. Might there be one in the future? Would this help in making a stronger case for geothermal?

***Response*: the Java-Bali power grid, accounting for 75% of installed power generation capacity in all of Indonesia, is already under pressure with deteriorating reserve margin in recent years, forcing PLN to undertake a crash program of building 10 GW new coal-fired plants by 2009. This indeed makes a stronger case for accelerating geothermal power development and is reflected in the main text as well as the annexes.**

Annex 7. Implementation Arrangement

- P.57-60 – Project implementation needs to be tied to actual projects that are being or will be implemented shortly. This will allow a closer link to be established between proposed project activities and the expected results from the project.

***Response*: the proposed project will involve actual transactions of investment in at least 350 MW of geothermal power capacity.**

Appendix 10: Safeguard Policy Issues:

- Page 73, Operation paragraph – Need to report pollutant emissions from Indonesian geothermal plants, and if none are available, this project needs to provide indicative measurements of the values or use IPCC default factors for these.

***Response*: the suggestion will be considered as part of the Component 2 activities to develop environmental and social guidance document to assist geothermal power investors and agencies in complying with Indonesian requirements.**

Appendix 11: Incremental cost analysis:

- Page 90 – Are the capacity factors and pollutant emissions factors based on experience to date? If the current values are different, is there a reason to believe that the assumed values will actually materialize?

<u>Response</u>: Yes, they are based on actual experiences in Indonesia. The capacity factors and the emissions factors applied in the analysis are relatively conservative to avoid overestimating.

Annex 18: Map

INDONESIA: GEOTHERMAL POWER GENERATION DEVELOPMENT PROJECT