INDONESIA'S GEOTHERMAL DEVELOPMENT

Summary

Although Indonesia is among only a handful of countries to develop geothermal energy, utilization of geothermal potential has proceeded very slowly and is currently facing difficult challenges and uncertainty. Over a span of 20 years, Indonesia developed only 787 MW of geothermal power, or 4 percent of 20,000 MW of geothermal potential. The early 1990s saw the awarding of eleven contracts for development of geothermal power plants, with a total committed capacity of 3,417 MW and original completion dates between 1998 and 2002. As a result of the 1997-1998 financial crisis, the Government suspended nine conventionally powered Independent Power Projects (IPPs) and seven geothermal projects. The government is now attempting to resuscitate the seven contracts but with little progress.

Private sector development of geothermal projects differs from Independent Power Project (IPPs). While Presidential Directive (PD) 37 of 1992 forms the legal basis for IPPs, PD 45 of 1991 authorized private sector development of geothermal potential with fundamentally different terms. PD No. 45/1991 outlines two alternative paths for geothermal energy development in Indonesia. Under the first, Pertamina or its joint operation contractors develop and operate the steam field only, selling the steam to PLN or other parties for electricity generation. The second alternative allows Pertamina or its contractors to generate electricity as well as develop and operate the steam field, with the electricity produced sold to either PLN or other consumers. A Joint Operating Contract (JOC) governs the contractor's relationship with Pertamina. PLN buys electricity on the basis of an Energy Sales Contract (ESC), which is normally denominated in dollars and obligates PLN to purchase electricity on a take-or-pay basis for a period of 30 years or more. So far, Joint Operation Contractors of Pertamina have added 405 MW to geothermal generation capacity. U.S. companies that are or have been involved in geothermal development projects in Indonesia include Unocal, Amoseas (a wholly owned subsidiary of ChevronTexaco), Mid-American (formerly California Energy), Magma Power Co., Caithness, and Florida Power & Light. (We provide a detailed project-by-project description and update in Section VII.)

The new oil and gas law, passed in October 2001, removes geothermal as an area of regulation, requiring the Indonesian Government to develop a new legislative basis quickly. A Parliamentary commission is examining the Indonesian Geothermal Association's December 2001 submission of a draft geothermal law. The law's drafters hope it will open up new opportunities for geothermal development. In the meantime, Presidential Decree No. 22/1981, amended by PD No. 45/1991, continues to regulate geothermal energy exploitation.

PLN understands that geothermal's future development will depend on its competitiveness against other electricity generation. High capital costs and the associated electricity tariff required remain core problems. In addition, unresolved decentralization issues, uncertainties in security and contracts, and the potential regulatory changes of a planned geothermal law discourage investment in geothermal projects. In the long run, Indonesia still presents one of the world's most attractive geothermal regions, but the Indonesian Government must develop new approaches to maximize its potential.

Renewable energy and primary energy consumption

Indonesia possesses a variety of energy resources. While the country's energy mix relies substantially on oil, energy planners are pushing for greater utilization of other primary sources of energy, particularly coal and "non-transportable" fuels such as geothermal and natural gas. Energy diversification needs, rising concern over environmental issues, and declining non-renewable energy resources have also prompted greater interest in geothermal and hydropower. The National Committee on Climate Change recommended conversion from coal and petroleum-based fuels to renewable energy sources to reduce emissions. The government's general policy for energy (KUBE) also clearly advocated diversification of energy sources.

The government, however, has had little success in promoting development of renewable resources over the past several years. Ministry of Energy and Mineral Resources (MEMR) statistics indicate that renewable energy utilization (hydropower, geothermal and biomass) accounts for only 3.4% of total potential reserves. Nor has the growth of electricity demand been enough to drive renewable energy development. The Government's recent moves to increase petroleum fuel prices, which have long diminished the viability of more environmentally friendly energy sources, may stimulate further utilization of alternative, including renewable, energy resources.

Geothermal's place in the country's primary energy consumption is very low, accounting for only one percent, or about 7.7 million barrels of oil equivalent (BOE), out of a total 574.6 million BOE consumed in 1999.

Table 1: Renewable energy utilization (MW)

		Installed	
	Potential	Capacity	(%)
Hydro (large scale)	75,674.0	3,854.0	5.1
Microhydro	458.8	54.0	11.8
Geothermal	19,658.0	787.0	4.0
Biomass	49,807.4	302.4	0.6
Total	**145,598.2**	**4,997.4**	**3.4**
Solar Energy	4.8 KWh/m2/day	5.0	
Wind energy	3-6 m/second	0.5	

Section II: Indonesia's Geothermal Potential

Geothermal energy has unique attributes, which pose challenges to its development. The following factors explain Indonesia's lagging development of its geothermal resource:

- Commercial development of geothermal energy requires electrical power plant development on-site. Consequently, this requirement may limit the resource to a small local market or one not well connected to a larger load center.

- Development requires high initial capital costs, including initial exploration and the commitment to purchase a large portion of the eventual fuel supply at start-up in the form of development wells. Long term operating costs, however, are quite low. Thus, geothermal contracts require base load status and long term price security in order to justify development.

- Several significant benefits of geothermal development are not effectively represented in the valuation of the electricity. These benefits include the long-term low cost operation, contributions to preserving the environment, and the resultant diversification of supply with an indigenous, distributed resource.

CDM incentives

The 1992 United Nations Framework Convention on Climate Change (UNFCC) provided an avenue for Indonesia's geothermal investments to capture the broader value of geothermal power. Indonesia, due to its attractive geothermal potential and geothermal expansion opportunities, has started to prepare for investments under the Kyoto Protocol's Clean Development Mechanism (CDM) and under other unilateral environmental initiatives oriented toward Greenhouse Gas (GHG) reductions. Under these concepts, companies from developed countries can invest or purchase "GHG emission reductions" from renewable energy or energy efficiency projects in developing countries as a way to offset their GHG emissions.

For geothermal, the CDM can become a powerful financial incentive and increase geothermal's competitiveness with traditionally cheaper fossil-fuel fired systems. Compared to coal-fired systems, Indonesia has the potential to reduce GHG emissions by about 4.8 billion tons of carbon dioxide equivalent (tCO2-e) per year at a cost as low as US $1/tCO2-e (depending on the project's finance mix). Recognizing that each ton of GHG emission reduction can be securitized and sold in the emerging GHG market, Indonesia has much to gain from developing geothermal CDM opportunities. Indonesia's UNFCC National Communication and recent COP-related "position statements" have begun to actively promote geothermal energy as a means to reduce GHG emissions.

In an encouraging development, Unocal Geothermal Indonesia, PT PLN (Persero), and Pertamina announced the first sale of GHG emission reduction credits from Indonesia. The sale involved GHG emission reduction credits from Units 4, 5 and 6 of the Gunung Salak Geothermal Project on the Island of Java to the World Economic Forum. The credits will offset emissions associated with

the WEF annual meeting, which opened at the end of January 2002 in New York, and make the WEF meeting GHG emissions neutral. The 362 MW Gunung Salak Geothermal Project emits approximately 2.6 million metric tons (mt)/year less carbon dioxide than a comparably sized coal-fired electric generating plant. The WEF sale involved 4,000 mt of carbon dioxide-equivalent emissions reductions.

Resource Potential

According to the MEMR, the indicated resource base for geothermal energy totaled about 20,000 MW (9 billion barrels of oil equivalent). Almost half (8,000 MW) of this potential is located in Java and Bali, the most populous islands with the highest demand for electricity. MEMR estimates that there are 217 geothermal locations in the country, including 71 in Sumatra, 62 in Java, 52 in Sulawesi, 15 in Nusa Tenggara, 2 in Irian Jaya and 1 in Maluku. Geological surveys have been carried out on 214 locations, geochemical surveys on 200 locations and geophysical surveys on 45 locations.

Pertamina and other government agencies have drilled 110 wells in ten geothermal prospects. Pertamina's JOC partners drilled 261 wells in eight prospects. Exploration identified 70 geothermal prospects. Sixteen exploration wells and 56 development wells drilled during 1989 to 2000 confirmed a total proven reserve of 2,245 MW and total probable and possible reserves of 7,165 MW.

Table 2: Indonesia geothermal proven reserves (MW)
(Source: Pertamina)

Area	1995	2000	2005 Est
Jawa/Bali			
Kamojang	200	230	260
G. Salak	485	485	600
Darajat	140	280	350
Dieng	280	280	350
Wayang Windhu	280	280	400
Patuha	-	250	250
Karaha	-	110	250
Cibuni	-	120	60
Bedugul	-	30	150
Sub Total	1,105	1,785	2,630
Sumatra			
Sibayak	44	40	40
Sarulla	80	290	500
Ulubelu	-	-	200
Kerinci	40	40	40
Sub Total	160	370	780
Others			
Lahendong	65	80	80
Ulumbu	-	10	30
Sub Total	65	90	110
Total	**1,330**	**2,245**	**3,520**

Section III: Structural Obstacles – Pricing and Autonomy

Investment in geothermal development faces substantial uncertainties and continuing challenges. The industry has identified low steam and electricity prices high capital costs, resource risk, long pay back periods for investment, financing mechanisms, a lack of market opportunities, inappropriate regulation, and uncertainty over implementation of regional autonomy as major issues impeding geothermal development.

Prices

The pricing of steam and electricity is the main obstacle to the development of geothermal energy in Indonesia. The price needs to be competitive with other energy alternatives, and at the same time offer the contractor or producer an attractive rate of return. According to PLN, the cost of electricity produced by geothermal power plants varied between Rp 89.60 to Rp 451.0/KWh for PLN owned power plants, US $0.042/KWh for negotiated Energy Sales Contracts (ESCs), and as high as US $0.085/KWh for original ESC terms. The contrast between the PLN-owned price and the ESC prices reflect implicit subsidies as well as the fact that ESC electricity prices have risen in Rupiah terms as the Rupiah depreciated. Contractual obligations are set in dollars, while the PLN's Rupiah selling price is currently Rp 350 (US $0.035)/KwH. The geothermal industry argues that the price could be more competitive if up- and downstream activities could be integrated, with VAT applied only to electricity sales. A significant factor affecting geothermal's price is the 34-percent tax rate applied to electricity sales.

PLN is currently negotiating to bring down tariff rates on various geothermal ESCs, with the intent of lowering prices from US 6-8 cents/KwH agreed under Power Purchase Agreements (PPAs) to around US 4 cents/KwH. The following shows the original price contracted under PPAs.

Table 3: PLN's ESC prices

Power Plant	Selling Prices, US cents/KwH
1. Bedugul, Bali	7.15
2. Cibuni, West Java	6.90
3. Daradjat, West Java	6.95
4. Dieng, West Java	9.81
5. Kamojang, West Java	7.03
6. Karaha Bodas, West Java	8.46
7. Patuha, West Java	7.25
8. Salak Units 4,5 and 6	8.46
9. Sibayak, North Sumatra	7.10
10. Wayang Windhu, West Java	8.39

(Source: PLN)

Regional autonomy

Geothermal resources were in the past put under the supervision of Pertamina, but the Government transferred the supervisory rights to regions in May 2000. The concept of regional autonomy is still undefined and ambiguous. Investors, however, expect Regulation No. 22/1999 on Regional Autonomy to enhance prospects for development of geothermal projects, since such projects can contribute to regional development. Once regional autonomy is fully implemented, geothermal will offer a viable alternative to supply the energy needs of many of Indonesia's remote areas. The autonomy law allows the regional government to exercise control over the development of electricity infrastructure. For regional autonomy to have a beneficial effect on geothermal development, however, there must be a system in place that removes or reduces the uncertainty regarding which party or parties will regulate geothermal development. There must also be a clear legal framework that will give investors confidence that payment obligations will be honored.

Section IV: Geothermal Law

Law and regulation – Insufficient legal protection

Indonesia's geothermal industry needs a new legal basis. Investors want legal and business certainty, beginning with an immediate review of existing laws and regulations related to energy and natural resources to bring them into conformity with new requirements of regional autonomy and fiscal decentralization. Previously, law No 44 of 1960 on Oil and Gas regulated the geothermal sector. But the new oil and gas law, passed on October 23, 2001, removes geothermal as an area of oil and gas regulation. Thus, the legislative changes created a gap as far as regulation of geothermal investment, a situation that prompted Parliament to call on the industry and government to develop a geothermal law.

In light of geothermal's importance as a sustainable energy source, Parliament's Commission VIII on energy affairs formed a team to draft a bill to promote its utilization. The commission is still in the early stages of drafting the bill, and a deadline for its passage has not been set. The Commission invited various representatives from the government, non-governmental organizations, universities and industrial experts to provide input in preparation of the bill. Among other areas, the bill will aim to resolve taxation issues deterring geothermal development. It would make geothermal exploration tax-exempt until a given geothermal resource has been developed and begun generating power.

In December 2001, the Indonesia Geothermal Association (INAGA) submitted its draft geothermal law to the Commission. This version limits Pertamina's authority, provides guidelines for geothermal investment, and sets forth the basic context for and the rules governing administration of geothermal energy. It will further define local government authority over geothermal development and eliminate differences in treatment of foreign and domestic investors by allowing both to receive an operational permit. The law's drafters hope it will open up new opportunities for the development of Indonesia's geothermal energy. A PLN senior official, however, criticized INAGA's draft geothermal law as an inadequate legislative framework. In his view, the draft law's philosophy and approach are counterproductive to geothermal development. Parliament is also considering developing a law for natural resources development to complement laws on energy, electricity, general mining, and the environment.

For the moment, PD No. 22/1981, amended by PD No. 45/1991, regulates geothermal energy. These decrees authorize Pertamina to undertake exploration and exploitation of geothermal energy resources in Indonesia and to generate and sell electricity to PLN and to other bodies such as the Government or private companies (including cooperatives). The later decree improved and simplified geothermal undertakings and introduced a total-project concept. Article Six of PD No. 45/1991 says that the Directorate General of Oil and Gas and the Directorate General of Electricity and New Energy control and provide technical guidance for the implementation of geothermal exploitation according to their respective duties and field of authority. Thereafter, the Ministry of Energy and Mineral Resources (MEMR), through the Directorate General of Oil and Gas, would be responsible for issuing a principal permit and for setting up joint operation

contracts among investors, Pertamina, and PLN, with Pertamina responsible for upstream certification and PLN for the energy sales contracts. The Directorate General of Electricity and Energy Development is responsible for downstream certification. The Government supported the development of geothermal resources by lessening the risk. Under the PD No.76 of 2000 on geothermal exploration for electric generating purposes, the government bears the risk of exploration failure when such exploration does not result in a well of sufficient potential.

Early in Abdurrahman Wahid's administration, the government decided to completely revise the existing PDs, separately from enactment of a new geothermal law, with a primary objective to liberalize the geothermal sector and remove Pertamina's absolute authority. The government also planned to establish PT. Geothermal Indonesia (PTGI), a joint venture between PLN and Pertamina, to replace Pertamina in the management of geothermal projects. These plans have not yet materialized.

Section V: Contractual Arrangements

At present, private companies operate most geothermal fields under a Joint Operating Contract with Pertamina that allocates 4% of net operating income to Pertamina, and an additional 34% of net operating income to the government. PD No. 45/1991 outlines two alternative paths for geothermal energy development in Indonesia. Under the first, Pertamina or its joint operation contractors develop and operate the steam field only, selling the steam to PLN or other parties for electricity generation. The second alternative allows Pertamina or its contractors to generate electricity as well as develop and operate the steam field, with the electricity produced sold to either PLN or other consumers.

Joint Operation Contract (JOC)

A JOC is a legal agreement between the contractors and Pertamina, representing the government. Pertamina is responsible for the management of the operation and the contractor is responsible for the production of geothermal energy from the contract area, the conversion of energy to electricity and the delivery of geothermal energy or electricity. The JOC allows operations for 42 years, including a production period of 30 years. The Build-Own-Operate contracts have, in each case, a partnership equity split of 90-10. Pertamina presently has no equity stake in any of the projects, its role being to collect compensation as the resource holder. The electricity is sold on the basis of an Energy Sales Contract, which is normally denominated in dollars and obligates PLN to purchase electricity on a take-or-pay basis for a period of 30 years or more. Many ESCs are being renegotiated.

Energy Sales Contract (ESC)

An ESC, an integral part of the JOC, is an agreement among the contractor and supplier of geothermal steam, Pertamina as the seller, and PLN as the purchaser of geothermal energy. Under this agreement, the production period for delivery of geothermal energy from each unit is 30 years from the date of commercial generation for each unit. The term of an ESC is 42 years. (Also see appendix 2.)

New Geothermal Guidelines

The very attractive incentive decrees of the mid-1990's were replaced in 2000 with Presidential Decree No. 76. Under PD 76/2000, the GOI proposes to take all or part of the exploration activities. Tax payments, however, will be in accordance with general tax law rates, i.e., 47% instead of 34% under previous PDs. No exploration activities have taken place since the enactment of PD 76/200. The geothermal industry has been attempting since the enactment of PD 76/2000 to develop a geothermal law which would more permanently fix the conditions of taxation, regional authorities, and exploration-risk sharing. The draft law is currently still being debated. (See Section IV.)

Section VI: Current Utilization

Indonesia utilizes 525 MW of geothermal energy from 787 MW of installed geothermal capacity. This number accounts for 2.2 percent of 35,709 MW of total installed electric capacity (of which PLN generates 20,592 MW, private power developers 1,600 MW, and captive power 13,519 MW). PLN built 380 MW of total geothermal capacity and Pertamina and its contractors built the remaining 407 MW. As a result, Indonesia saves the equivalent of some 6,300 barrels/day of oil. According the Directorate General of Oil and Gas, Indonesia produced 37.6 million tons of geothermal steam in 2000, which translates into 4,696 GwH of electricity.

Table 4: Installed capacity of commercial geothermal power plants (MW)

Fields	PLN	JOC	Total
Kamojang, West Java	140 (3 units)	-	140 (3 units)
Sibayak		2	2 (see note)
Darajat, West Java	55 (1 unit)	70 (1 unit)	125 (2 units)
Gunung Salak, West Java	165 (3 units)	165 (3 units)	330 (6 units)
Wayang Windhu, West Java	-	110 (1 unit)	110 (1 unit)
Dieng, Central Java	-	60 (1 unit)	60 (1 unit)
Lahendong	20 (1 unit)	-	20 (1 unit)
TOTAL	380	407	787

Note: Developed and operated by Pertamina

Direct utilization

Indonesia began developing geothermal direct utilization (non-electricity) more than ten years ago. Geothermal energy most commonly and traditionally heats swimming pools and provides water for hot springs. Three years ago, a group of researchers in the government-sponsored research and technology agency (BPPT) investigated methods to apply geothermal energy in the agricultural sector, particularly to sterilize the growing medium used in mushroom cultivation. The concept is still under research and development at the Kamojang geothermal field.

Geothermal contracts concluded

Over a span of 20 years, PLN signed 11 geothermal power sales contract with total capacity of 3,417 MW, but only three have moved forward. The planned projects were previously expected to come on stream between 1998 and 2002. Seven of the contracts were suspended after 1998, and are being restructured in accordance with Presidential Decree No. 133 of 2000 through a process of negotiation. Greater economic stability and certainty for investors in Indonesia will be required to revive the projects.

Section VII: Field Development and Contractor Status

Pertamina

Kamojang (140 MW): Pertamina started exploration activities in Kamojang in 1974 and installed a 250 KW non-condensing geothermal power turbine in 1978. PLN built on this initial success with the construction of Indonesia's first commercial geothermal electric power plant in late 1982 with a capacity of 30 MW. Units II and III (2x55 MW), the US$61 million World Bank financed project, commenced operation in 1987. The facility at present draws from 24 production wells. The size of the productive area is about 9.9 square km with an estimated electrical potential equal to 240 MW. Exploration activities identified resources sufficient to increase the existing plant by an additional 110 MW. PLN plans to build a fourth geothermal plant with an output capacity of 55 MW.

In December 1994, Asia Power and PT. Latoka Trimas Bina Energy signed an ESC agreement with PLN to develop 2x30 MW in Kamojang field, West Java, with an investment of US$72 million. PD No.5/1998 postponed this project.

Sibayak: Pertamina and PT. Dizamatra are developing the Sibayak geothermal field in North Sumatra. Pertamina has invested US $3 million in drilling activity. The area is expected to supply steam for a 240-MW power plant. The field produced 2,829.4 MwH of electricity since October 2000.

Lahendong: In May 1999, Pertamina signed a contract with PLN to supply steam to a unit I (20 MW) geothermal power plant constructed by PLN. The two parties also agreed on a steam price of Rp 161.50/KWh (US$0.02/KWh). The project became operational in August 2001, after waiting over one year for commercial operation. Pertamina expects to derive an annual income of Rp 22 billion from this project. Recently, PLN offered to cooperate with Pertamina in the development of unit II (20 MW) in anticipation of continuing electricity demand growth in North Sulawesi. Pertamina also operated Indonesia's first binary cycle power plant in the area, with the assistance of a $5 million soft loan from France. The 2.5-MW plant is a pilot scheme to gather experience in the development of other small-scale geothermal power stations.

Unocal

Gunung Salak (165 MW-PLN): In1982, Unocal Geothermal Indonesia signed the first Joint Operation Contract (JOC) and Energy Sales Contract (ESC) for geothermal exploration and development covering an area of 117,650 hectares in Gunung Salak, West Java. Unocal is responsible for supplying steam to Pertamina, which in turn sells it to PLN for power generation. PLN completed construction of the 2x55-MW geothermal power plant in 1994 and another 55 MW in 1997. Unocal invested more than $100 million to develop the field. The company reported that the field is able to supply a power plant with a capacity of 400 MW. PLN and Unocal reached an agreement on pricing of geothermal steam at US $0.047/kWh. This enables Unocal to recover its exploration and development activities within 7-10 years.

Gunung Salak (165 MW-JOC): In November 1994, Unocal and its local partner, Nusamba, signed an amended ESC with PLN and JOC with PLN and Pertamina for the construction of an additional 165-MW power plant. The three 55 MW units started operation in 1997. Under the terms of the original agreement, Unocal was to operate these units for 15 years, and then transfer operatorship to PLN under a BOT mechanism. Unocal would continue to sell geothermal steam for the power plants for the full 30-year life of the plants. Unocal spent approximately $380 million in development of geothermal resources for the three new power plants.

Sarulla: In February 1993, Unocal signed another geothermal contract to exploit geothermal resources in a 980-square-kilometer area around Sarulla and Sibualbuali, North Sumatra. The agreement is a total project contract consisting of a JOC agreement with Pertamina and ESC with PLN. Pursuant to the terms of the JOC, Unocal agreed to spend at least $28 million during the first seven years of the exploration period. Unocal invested over US $45 million in resource exploration and development and drilled 13 wells. PLN and Unocal agreed to the development of a power facility with a total capacity of 220 MW, with 55 MW to be completed by 1999. The power price for the contract was to be $0.07597/kWh for the first 14 years, $0.05750/kWh for the following 8 years and $0.05208/kWh for the remaining 8 years. As a first stage Unocal planned to construct a 2x55-MW power plant. Unocal would operate and maintain the field facilities and electricity generation facilities, under a BOT for the first 15 years. Following the contract agreement, the company invested US $100 million for the development of infrastructures and plant site. The government postponed the project in 1998, but PLN recently renewed discussion on Sarulla with Unocal.

Lumut Balai: Unocal and PT. Daya Bumi Lumut Balai initiated to sign contract to develop 150 MW geothermal power plant in Lumut Balai, South Sumatra, with total investment of US $330 million. The contract was not signed, and negotiations ended after the negotiation period expired.

Amoseas

Daradjat (Phase I): In December 1984 Amoseas signed a JOC with Pertamina and an ESC with PLN to develop up to 330 MW of geothermal energy within a 56,650 hectare area in Daradjat, West Java. Amoseas, which acts as the operator for the project, confirmed a resource sufficient to generate a 55-MW power plant and with potential for at least 400 MW. After investing US $55.2 million for the construction of 55-MW power plant, PLN started commercial operation in November 1994, with steam supplied by Amoseas. In 1995 Amoseas re-negotiated and amended the ESC that enabled the company to build all the future units at Darajat. This enabled Amoseas to plan Unit II and drill 17 more development wells in anticipation of further development.

Daradjat (Phase II): Amoseas initiated construction of unit II (nominal 70 MW) in 1997, but the government suspended plant construction in 1998. As a result of contract renegotiations, PLN and Amoseas reached a final long-term solution in April 2000, with price of electricity reportedly dropping to US $0.0420/KWh from US$0.0695 in the original ESC. Officials said PLN could save

US $829 million if the new price would be applied to the entire 330 MW power plants planned for the area.

Caithness and Florida Power & Light

Karaha Bodas: In December 1994, Karaha Bodas Company LLC signed an ESC with PLN for the construction of a 220-MW geothermal power plant in West Java, with 55 MW to be completed by 1998. Karaha Bodas Company LLC. was a joint venture between Caithness (40.5%) and Florida Power & Light (40.5%), both of the US, and Tomen of Japan (9%) and a local company (Sumarah Daya Sakti (10%). KBC drilled 22 wells and invested US $100 million when the project was postponed. The total planned investment amounted to US $264 million. Under the contract, PLN was to buy electricity from Karaha Bodas at between 5.6 cents and 8.4 cents per kilowatt-hour (kWh) for 30 years.

KBC filed an international arbitration claim against the Indonesian government for the postponement of its contract. In December 2001, an arbitration tribunal in Geneva issued a ruling ordering both Pertamina and state electricity company PLN to pay $261.1 million to Karaha Bodas, plus interest of 4 percent per year, starting from January 2001. The amount comprises $111 million for lost expenditure, $150 million for lost profit and $66,654.92 for costs and expenses during arbitration. The ruling further required Pertamina to initiate discussions with Karaha Bodas to recommence development of the US $1 billion Karaha power project in Telaga Bodas and Karaha villages, in Tasikmalaya and Garut. PLN and Karaha Bodas PLN will also have to renegotiate the selling rate, as has happened with projects that were completed after the financial crisis. The negotiation will also determine the amount of arrears to be paid by either Pertamina or PLN to Karaha Bodas. Claiming that the verdict was not final, Pertamina filed an appeal against the ruling. Karaha Bodas is required to resolve the dispute through an out-of-court mechanism for the sake of all parties.

California Energy

Dieng (60MW-JOC): In December 1994, Himpurna California Energy Limited (HCE), a joint venture between PT Himpurna Enersindo Abadi (10 percent) and California Energy International of the U.S. (90 percent) signed a contract to build the Dieng geothermal project in Central Java. The contract was for a total power capacity of 150 MW, with total investment of US $192 million to be completed by 2001. The plant was planned as 4 units. Unit I, with a capacity of 60 MW, was certified for commercial operations in July 1998. All construction, exploration activities and operations for Unit II were suspended in 1998. From the 48 exploration and development wells drilled, HCE identified the field's potential as 350 MW.

In November 1999, the Overseas Private Insurance Corporation (OPIC) and a consortium of private insurers paid $290 million to Mid-American, which acquired California Energy, under separate contracts of insurance covering the U.S. company's equity investments in Dieng and Patuha (see below). OPIC and the private insurers determined that compensation was payable under their respective contracts of insurance after an international arbitral panel awarded the project companies a total of $575 million against the GOI. On August 27, 2001, Indonesian

Government and OPIC representatives signed a settlement agreement transferring OPIC's shares in the Dieng and Patuha project to the Indonesian Government. A Recommissioning Loan Agreement and Note also provided OPIC funding to recommission the Dieng Geothermal project's 60-MW unit.

Patuha: HCE signed a total project contract for the development of Patuha geothermal field in West Java, with a total capacity of 220 MW. California Energy teamed with PT Enersindo Supra Abadi, whose President is entrepreneur Fadel Muhammed, President of PT Bukaka. Total investment was planned to reach $264 million. Unit 1 (55 MW) is under review status and units 2,3 and 4 were postponed in 1998. Originally scheduled for completion in 1999, Patuha power had spent US $136 million for construction and financing. The Government hopes to build another 160 MW (plant) in Patuha, which would make the power plants economically viable.

Bedugul: In November 1994, Bali Energy, a joint venture between California Energy and local company PT Pandan Wangi Sekartaji, signed a JOC with Pertamina and ESC with PLN for a 4x55 MW power plant. Units 1 and 2 were under review status and units 2 and 3 were postponed. At present, the government has invited investors to continue the Bedugul geothermal energy project to meet the increasing electricity demand in Bali.

Asia Power Ltd

Wayang Windhu: In December 1994, Mandala Magma Nusantara BV signed a total project contract for the development of the Wayang Windhu geothermal field in West Java, with a total capacity of 220 MW. Mandala Magma Nusantara BV was a joint venture between the Indonesian companies Figears and Oko Satrya Mandala (both owned by the ex-President Soeharto's son Hutomo Mandala Putra) and Magma Power Co. of the US. However, after the merger between California Energy and Magma Power Company, the contract principal party was changed to Asia Power Ltd, a subsidiary of New Zealand's Brierley Investments Ltd. The contractor was supposed to build an initial 220-MW plant at a cost of $264 million, later to be increased to 400 MW, with an estimated total investment of $800 million. In 2000, Asia Power completed a 110-MW geothermal power plant but it was handed over to bank creditors following its failure to repay loans.

Asia Power had a 95 percent stake in the power plant before it ceased operation, with the remaining shares owned by Indonesian firm Bumi Mandala Perkasa. At present, Unocal owns 50 percent of the power plant through its subsidiary, Unocal Global Venture, and the banks own 50 percent via a holding company, Magma Nusantara Ltd. The lenders appointed Unocal as the operator of the power plant early this year following AsiaPower's pullout. Deutsche Bank and Credit Suisse have offered their 50-percent stake to Pertamina. Pertamina would purchase it if Unocal also sold its 50 percent stake. The lenders set the price for their 50 percent stake at US $250 million.

PT. Wahana Komunikatama

Tompaso: In 1997, PT. Wahana Komunikatama decided to invest US $400 million to develop the first phase of a 150-MW geothermal power plant in Tompaso, North Sulawesi. The project is scheduled to come on stream in 2003.

Section VIII: Further Development Plans

The Indonesian Government also permits other agencies and private developers to undertake geothermal development on a small-scale basis (less than 10 MW) for power generation or other utilization, without a partnership with Pertamina. The Director General of Oil and Gas in the Ministry of Energy and Mineral Resources supervises this program.

In addition, Table 5 provides the Government's plans to develop additional geothermal power plants with 1,000 MW of capacity in the near term and 2,005 MW before 2010. PLN hopes to invite tender, with electricity prices fixed by PLN.

Table 5: Projects recommended until 2010

Name	MWe
Daradjat	275 (additional)
Dieng	180 (additional)
Wayang Windhu	220 (additional)
Kamojang	200 (additional)
Sarulla	330
Patuha	220
Bedugul	220
Karaha	220
Sibayak	120
Cibuni	20
TOTAL	2,005

Section IX: Appendices

Appendix 1: Indonesia's Geothermal Potential (MW)

Prospect Areas	Installed	Reserves		Resources	Total
		Proven	Possible		
Aceh					
Jaboi – Sabang	-	-	-	250	250
Lha Pria loat	-	-	-	250	250
Seulawah	-	-	-	185	185
G. Geuredong	-	-	-	250	250
G. Kembar	-	-	-	250	250
North Sumatra					
G. Sinabung	-	-	-	150	150
Sibayak	2	39	131	70	240
Sarulla	-	280	-	100	380
Sibualbuali	-	-	600	150	750
Sorik Merapi	-	-	250	150	400
Pusuk Buhit	-	-	-	250	250
Simbolon	-	-	-	250	250
West Sumatra					
Muara Laboh	-	-	200	125	325
G. Talang	-	-	80	80	160
Jambi					
Kerinci	-	40	35	40	115
Sungai Tenang	-	-	-	250	250
Sungai Penuh	-	-	160	110	270
Sungai Betung	-	-	-	250	250
Gunung Kaca	-	-	-	250	250
Air Dikit	-	-	-	250	250
South Sumatra					
Marga Bayur	-	-	200	50	250
Lumut Balai	-	-	600	235	835
Rantau Dedap	-	-	-	250	250
Bengkulu					
Hulu Lais	-	-	500	150	650
Tambang Sawah	-	-	100	73	173
Bukit Daun	-	-	-	250	250
Lampung					
Ulubelu	-	-	400	156	556
Suoh	-	-	300	163	463
Sekincau	-	-	130	100	230
Rajabasa	-	-	40	40	80
Ratai	-	-	-	250	250

Prospect Areas	Installed	Reserves		Resources	Total
		Proven	Possible		
West Java					
Kamojang	140	230	70	-	300
Salak	330	485	115	-	600
Darajat	125	280	70	-	350
Cisolok	-	-	50	50	100
Patuha	-	170	247	65	482
Wayang Windu	110	250	135	75	460
Karaha	-	30	170	50	250
Telaga Bodas	-	-	200	75	275
Cibuni	-	120	-	-	120
Tangkuban Perahu	-	-	90	100	190
Batukuwung	-	-	55	50	105
Citaman	-	-	25	50	75
G, Endut	-	-	30	20	50
G. Gede-Pangrango	-	-	130	130	260
Central Java					
Dieng	60	280	300	200	780
Mangunan	-	-	93	60	153
Telomoyo	-	-	140	45	185
Ungaran	-	-	52	50	102
G. Slamet	-	-	90	110	200
East Java					
G.Arjuno - Welirang	-	-	110	120	230
Willis	-	-	60	70	130
Ijen	-	-	104	50	154
Bali/Nusa Tenggara					
Bedugul	-	30	245	75	350
Hu'u Daha (NTB)	-	-	-	250	250
Uluumbu (NTT)	-	10	190	150	350
Sukoria	-	-	-	250	250
Ili Muda	-	-	-	250	250
Oka Larantuka	-	-	-	250	250
Ili Labaleken	-	-	-	250	250
Bena- Mataloko	-	-	-	250	250
Mengeboha	-	-	-	250	250
Sulawesi					
Lahendong	20	80	95	125	300
Kotamobagu	-	-	185	100	285
Tompaso	-	-	130	100	230
Bora	-	-	-	250	250
Bituang	-	-	-	250	250
Lainea	-	-	-	250	250

Prospect Areas	Installed	Reserves		Resources	Total
		Proven	Possible		
Maluku					
Tonga Wayana	-	-	-	250	250
Tulehu	-	-	-	250	250
Jailolo	-	-	-	250	250
TOTAL	**787.0**	**2,245**	**6,646**	**10,537**	**19,658**

Source: Pertamina, Indonesia geothermal reserves and resources, 1999

Appendix 2: Production and utilization of geothermal steam

Field – Area	1998	1999	2000
Production (1000 MT)			
Kamojang, West Java	8,807.9	8,377.5	7,976.3
G. Salak, West Java	18,664.2	19,517.9	20,359.5
Darajat, West Java	2,663.5	3,754.7	5,474.1
Sibayak, N. Sumatra	51.6		72.6
Wayang Windu	-	-	3,750.7
TOTAL	**30,187.1**	**31,650.1**	**37,633.2**
Utilization (1000 MT)			
Kamojang, West Java	8,428.4	8,040.0	7,685.0
G. Salak, West Java	16,317.2	18,908.5	19,884.3
Darajat, West Java	2,277.0	2,794.6	4,891.3
Sibayak, N. Sumatra	27.6	-	66.3
Wayang Windu			36,244.3
TOTAL	**27,050.3**	**29,743.1**	**32,526.9**
Electricity produced (MwH)			
Kamojang, West Java	1,094,434	1,045,889	1,000,023
G. Salak, West Java	2,264,304	2,346,896	2,441,086
Darajat, West Java	366,394	398,957	744,897
Sibayak, N. Sumatra	734	-	2,829
Wayang Windu		-	506,840
TOTAL	**3,725,867**	**3,791,742**	**4,695,675**

Source: MIGAS

Appendix 3: Major Terms and Provisions of Geothermal Contracts

a. Joint Operation Contract

Terms

1. Exploration period including feasibility study is seven years commencing on the effective date.
2. Production period for delivery of geothermal energy to or electricity from each unit is 30 years starting on the date of commercial generation.
3. The running of the contract term is for a period ending 42 years after the effective date.

Areas

4. Contract area should be surrendered twenty percent at the end of the third contract year.
5. A further 30 percent of the original contract area should be surrendered at the end of the seventh contract year.

Work Program and expenditure

6. Contractor should commence geothermal operation within six months of the effective date.
7. Contractor should spend a specified amount of money during the first seven years of exploration period.
8. Contractor should prepare and summit to Pertamina for approval a work program and estimate of the expenditures required for the contract area.

Others

9. Contractor should operate and maintain the field facilities and electricity generation facilities.
10. All electricity produced pursuant to Geothermal operations should be delivered to the point of interconnection and sold to buyer under the terms of energy sales contract.
11. Contractor should pay to the government corporate tax in respect of annual production.
12. Contractor should pay to Pertamina a production allowance equivalent to four percent of net operating income.

b. Energy Sales Contract

Term

1. Production period for delivery of geothermal energy to or electricity from each unit is 30 years commencing on the date of commercial generation for each unit.
2. The term of the energy sales contract is for a period 42 years after the effective date.

Price

3. Base resource price = 0.04307 dollars per KwH

Appendix 4: Geothermal Power Plant Development Projects

No	Name of the Project, Location Company/Shareholder	Capacity (MW)	PPA signed Contracted tariff (US$ Cent/KwH)	Investment (US$ Mln)	Status (Completion plan)
1	**Patuha** (Unit 1, 2,3,4), West Java Patuha Power Ltd. Mid-American	220	12/94 Years 1-15: 7.26 Years 16-22: 3.46	264	Unit 1: Reviewed Units 2,3,4: postponed Project ownership transferred from OPIC to GOI on August 21, 2001.
2	**Wayang Windu**, West Java Asian Power Ltd PT. Mandala Nusantara	220	12/94 Years 1-14: 8.39 Years 15-22: 6.52 Years 22-30: 5.58	264	Continued 1999 Interim agreement
3	**Dieng** (Unit 1,2,3,4), Central Java Mid-American Himpurna	150	12/94 Years 1-14: 9.81 Years 15-22: 7.41 Years 22-30: 6.21	192	Commissioned 1998 Not currently operating Project ownership transferred from OPIC to GOI on August 21, 2001.
4	**Sarulla** (Unit 1,2,3,4,5,6), N. Sumatra Unocal (90%) PT. Prama Geopower-Nusamba (10%)	330	2/93	396	Postponed 1998-2001 Under re-negotiation
5	**Daradjat** (Unit 1,2,3,4), West Java PT. Prasarana Nusantara (20%) Amoseas (Chevron/Texaco) (80%)	275	1/96 6.95	330	Postponed 1999/2002 Reached long-term agreement
6	**Salak (**Unit 4,5,6), West Java Unocal Nusamba	165	11/94 8.47	247.5	Operating (1997) Reached long-term agreement
7	**Bedugul** (Unit 1,2,3,4), Bali PT. Pandanwangi Sekartaji California Energy Mawatindo	220	11/95 7.15	264	Unit 1,2: Reviewed Unit 3,4: Postponed Claimed termination to Pertamina
8	**Karaha Bodas** (Unit 1,2,3,4) West Java Karaha Bodas Co. LLC. Caithness (40.5%) Florida Power Light (40.5%) Tomen (9%) Sumarah Daya Sakti (10%)	220	12/94 Years 1-14: 8.46 Years 15-22: 6.58 Years 22-30: 5.64	264	Postponed In process of int. arbitration

9	**Sibayak,** North Sumatra PT. Dizamatra Powerindo Enserch	120	1/96 7.10	144	Postponed In the re-negotiation process
10	**Cibuni**, West Java PT. Yala Tekno Geothermal	10	11/95 6.90	12	Postponed In the re-negotiation process
11	**Kamojang (**Unit 4,5), West Java PT. Latoka Trimas Bina Energy Asia Power	2X30	12/94 7.03	72	Under review In the re-negotiation process
12	**Lumut Balai,** S. Sumatra Unocal PT. Daya Bumi Lumut Balai	150	N/A	331	Negotiated 2004
13	**Ulubelu,** Lampung/S. Sumatra PT. Darmasatrya Arthasentosa Calpine	110	N/A	191	Negotiated 1999/2000
14	**Tompaso,** North Sulawesi: PT. Wahana Kumunikatama, Kanematsu Corp. Oxbow International Power	60	N/A	197	Negotiated

Appendix 5: Key contacts for geothermal development

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INAGA or Asosiasi Panasbumi Indonesia (API) was established in 1991 as a National Organization of Indonesian Geothermal Professional Society. INAGA or API has held an Annual Scientific Conference & Exhibition every year since November 1996 as a means to encourage the development and promotion of Indonesian geothermal energy.