LONDON RESEARCH INTERNATIONAL

GEOTHERMAL ENERGY DEVELOPMENT IN INDONESIA: AN INVESTOR'S GUIDE

CONTENTS

1. Summary of Renewable Energy Sector in Indonesia

For many years, Indonesia has been experiencing a severe power shortage, as the power demand continues to grow. The country is highly dependent on fossil fuels as a source of energy including electricity, while its proven reserves of fossil fuels are declining. It has already become a net importer of crude oil. In recent years, growing attention has been directed to the abundant renewable energy (RE) sources the country has including geothermal energy.

The share of renewable electricity in the country's electricity production remains small at about 13 per cent including large hydro. One of the main reasons is that oil and gas are highly subsidized, which makes it difficult for RE to compete with them. The lack of conducive investment climates also hinders the progress of RE deployment, although the government is trying to increase the use of RE. In the short term, RE is expected to contribute to fulfilling the needs of electricity in rural and remote areas. (The government has a target of increasing the household electrification rate to 90% by 2020.[1]) In the longer term, RE is expected to displace part of petroleum fuels and constitute a significant share of Indonesia's primary energy supply.[2]

For the last two decades, Indonesia's power demand steadily increased. The electricity consumption grew at an average annual rate of 13% between 1990 and 1997.[3] This high rate of growth was driven by rapid economic expansion and extensions of grid into rural and remote areas. Until 1997, when Asian financial crisis occurred, investment in new generation capacity kept pace with the growth in demand. The crisis, however, brought a situation where supply capacity far exceeded shrinking demand, and thus severe financial strains on the state-owned electricity company, Perusahaan Listrik Negara (PLN), which is a sole purchaser of power in Indonesia. The crisis made it extremely difficult for PLN to pay for all of the power for which it had signed contracts with Independent Power Producers (IPPs), because the power demand declined sharply. To everyone's relief, the power demand recovered relatively quickly. Between 1997 and 2005, the growth rate of electricity consumption averaged 7% annually, and, in 2006, reportedly grew by 9%.[4]

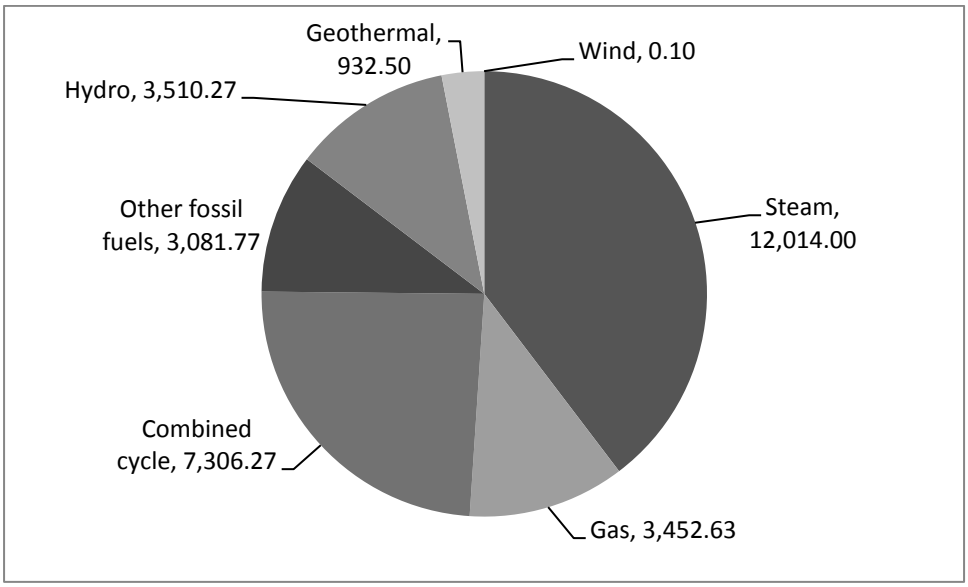
According to PLN projection, Indonesia will have a peak power demand of 57,442 MW by 2018, with PLN planning to supply 35,274 MW and the rest coming from IPPs. As of 2009, Indonesia has an estimated total installed capacity of 29,885 MW with 87.0 percent thermal (oil, gas, and coal), 10.5 percent hydropower, and 2.5 percent geothermal.[5] PLN has a capacity of 24,924 MW, and 16 IPPs have 4,045 MW. In addition there is captive power of 916 MW in total.[6] In 2009,

[1] Rural Electrification In Indonesia:Progress And Challenges, 2007. <www.iec.ch/affiliates/gm_workshop_pdf/2007_indonesia_rural_elec.pdf, 29 March 2010>.
[2] Energy Policy Review of Indonesia, 'Part 6: Renewable Energy', 2007. < www.iea.org/>.
[3] Indonesia Electricity – consumption, 2007. <www.indexmundi.com/indonesia/electricity_consumption.html>.
[4] Energy in Indonesia, January 2002. < www.eia.doe.gov/emeu/cabs/indonesia.html>.
[5] Geothermal energy in Indonesia, 2008. 29 March 2010 <www.ics.trieste.it/media/140968/df6054.pdf>
[6] PLN Plans to Spend $7.8b Next Year as 10,000 MW Program Gathers Steam, December 2009. < thejakartaglobe.com/business/>

PLN posted a profit of Eur 528 million, after suffering a record loss of Eur 98.4 million in 2008,[7] mainly due to higher foreign exchange gains and improved efficiency, and lower costs for fuel purchases.

Figures 1 and 2 exhibit the generating capacity mix and the electricity generation mix in 2008. The shares of geothermal power in those two are respectively 3.1% and 5.6%.

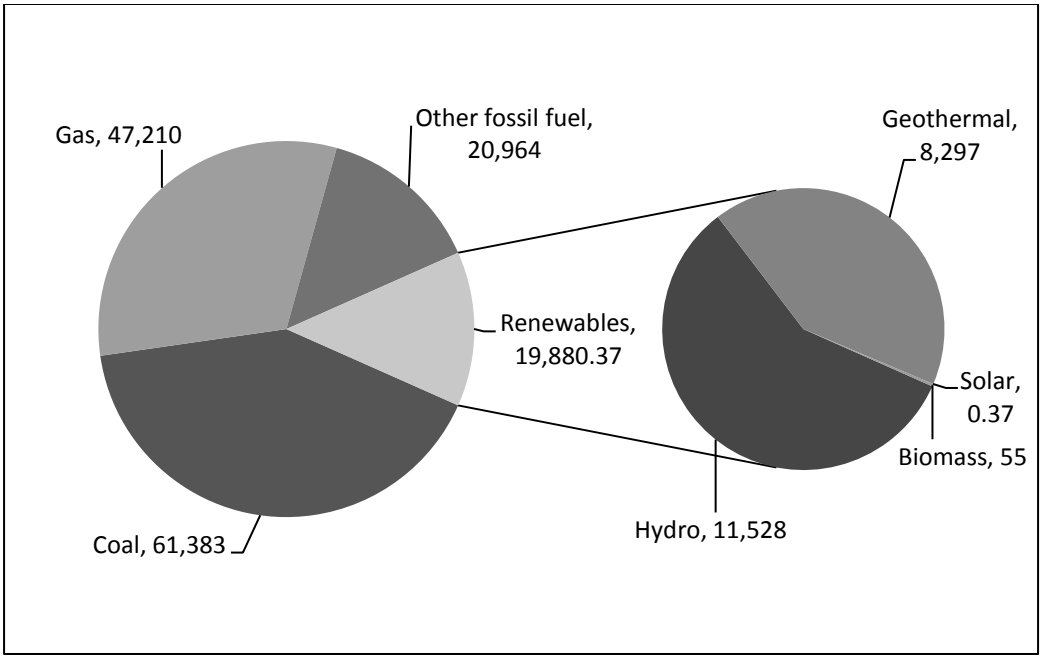
Figure 1: Generating Capacity Mix in Indonesia in 2008 (MW): Total 30,297.54 MW



Note: Biomass capacity is included under steam capacity.
Source: Ministry of Energy and Mineral Resources, Handbook of Energy and Economic Statistics 2008, June 2009. Available at <www.esdm.go.id/publikasi/statistik.html>.

[7] PLN's Surprise Profit Boosts Performance of SOEs in a Tough Year <www.thejakartaglobe.com/business/plns-surprise-profit-boosts-performance-of-soes-in-a-tough-year/357492>.

Figure 2: Electricity Generation Mix in Indonesia in 2008 (GWh): Total 149,437.37 GWh



Source: Ministry of Energy and Mineral Resources, Handbook of Energy and Economic Statistics 2008, June 2009. Available at <www.esdm.go.id/publikasi/statistik.html>.

2. Geothermal Power in Indonesia

Indonesia has the world largest reserves of geothermal energy—approximately 40 percent of the world's reserves[8]. According to the Ministry of Energy and Mineral Resources (MEMR), as of March 2010, Indonesia's geothermal potential was estimated at 28,100 MW, up from 27,000 MW in 2004 (see Appendix 1 for detailed figures in 2004). This potential is equivalent to 12 billion barrels of oil, which is nearly twice as large as the country's 6.4 billion barrels of oil reserves.[9] Almost a third (about 8,000 MW) of the potential is located in Java and Bali, the most densely inhabited islands with the highest demand for electricity.[10]

Although Indonesia is among only a handful of countries to utilise geothermal energy, the use has progressed very slowly. Over a span of 20 years, only 3 % of total estimated geothermal potential has been developed.[11]

[8] Indonesia's geothermal development,2009. <http://www.thejakartapost.com/news/2009/11/30/indonesia%E2%80%99s-geothermal-development.html>.
[9] Indonesia's Geothermal Potential Even Bigger Than Previously Estimated, March 2010. <http://www.energyboom.com/geothermal/indonesias-geothermal-potential-even-bigger-previously-estimated>.
[10] Overview of Policy Instruments for the Promotion of Renewable Energy and Energy Efficiency in Indonesia <www.serd.ait.ac.th/cogen/62/reports/countries/indonesia.pdf, March 2010>
[11] Ministry of Energy and Mineral Resources website < http://portal.djmbp.esdm.go.id/dbb2>.

2.1 Existing Geothermal Power Plants

As shown in Table 1, there are seven geothermal power plants (PLTP[12]) in operation in Indonesia today. The total installed capacity of those plants is 1,189 MW, including 420 MW operated by PLN and 749 MW by PT Pertamina (National Oil Company) and its partners under joint operation contracts (JOCs). (The JOC scheme is not used for new projects after 2003, as noted later in this report.) Owning to these power stations, Indonesia saves the equivalent of somewhere around 4 million barrels of oil every year.[13]

Table 1: Existing Geothermal Power Plants (2010)

Plant Name	First Year of Commercial Production	Capacity (MW)			Production (GWh/year)	Field Operator (Joint Operation Partner)
		PLN	JOC	Total		
PLTP Sibayak	2000	-	10 (2 units)	10	40	PT Dizamatara Powerindo
PLTP Salak	1994	180 (3 units)	195 (3 units)	375	2,948	Chevron Geothermal Indonesia Ltd.
PLTP Kamojang	1982	140 (3 units)	60 (1 unit)	200	1,100	PT. Indonesia Power
PLTP Darajat	1994	55 (1 unit)	204 (2 units)	259	1,987	Chevron Geothermal Indonesia Ltd.
PLTP Wayang Windu	2000	-	220 (2 units)	220	932	Magma Nusantara Ltd; PT. Star Energy
PLTP Dieng	1998		60 (1 unit)		300	PT. Geodipa
PLTP Lahendong	2001	60 (2 units)	-	60	146	PT Pertamina Geothermal Energy

Notes: PLTP – Pembangkit Listrik Tenaga Panas Bumi (Geothermal Power Plant)
JOC – Joint Operation Contract
Source: Prepared by LRI based on the data in Ministry of Energy and Mineral Resources website <portal.djmbp.esdm.go.id/dbb2>.

2.2 Geothermal Law and Business Structure

Geothermal energy business in Indonesia is governed by the following law and regulations:

(1) Law No. 27/2003 on Geothermal

(2) Government Regulation No. 59/2007 on Geothermal Business Activities

(3) Ministerial Regulations

[12] PLTP – Pembangkit Listrik Tenaga Panas Bumi (Geothermal Power Plant)
[13] Pertemuan Badan Geologi Tentang Panas Bumi, 2008, March 2010. < http://portal.djmbp.esdm.go.id/dbb2/>.

- MEMR Regulation No. 11/2008 on Mechanism for Determining Geothermal Working Area
- MEMR Regulation No. 02/2009 on The Guidelines for Geothermal Pre-Survey Assignment
- MEMR Regulation No. 05/2009 on The Guidelines for Electricity Purchasing Price by PT. PLN from Cooperation and Other Business Entities
- MEMR Regulation No. 11/2009 on The Guidelines for Geothermal Enterprises

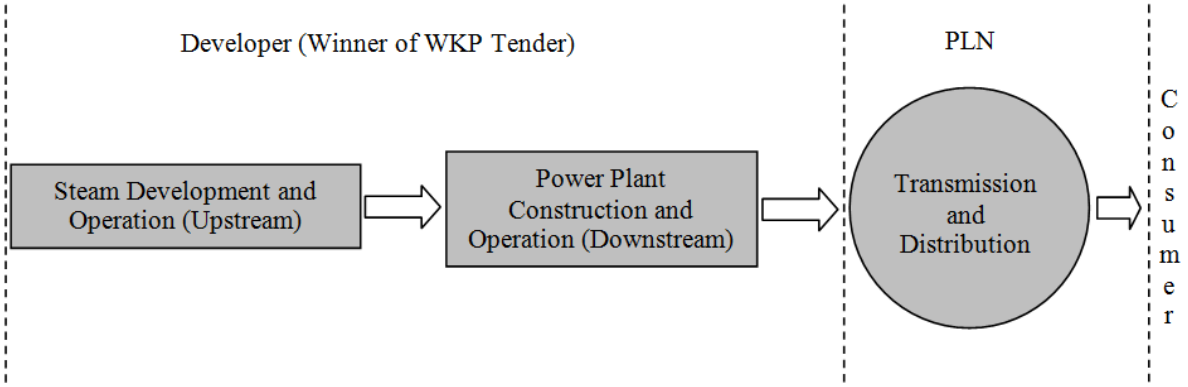
The main objective of the Law No. 27/2003 on Geothermal is to promote the utilisation of geothermal energy in order to support sustainable development and contribute to national energy mix. The law also aims to increase government revenue and provide business opportunities for IPPs.

Before the law was enacted, the contractual arrangements of geothermal power plants were based on Presidential Decree No. 45/1991. Under this decree, PT Pertamina was involved in every geothermal power project, and its business partner, who was named joint operator, was selected for each so-called Geothermal Working Area (Wilayah Kerja Pengusahaan – WKP) or simply a project. For some projects, PT Pertamina and its partner developed the resources to produce and sell only steam to PLN (under a Steam Sales Contract (SSC)), whereas in other projects, they own and operate a power plant and sell the electricity produced to PLN (under an Energy Sales Contract (ESC)).[14]

With the enactment of the law, PT. Pertamina lost the privilege to be involved in any geothermal development project. Now, for every new WKP, a tender is held, which is open to any company including PT. Pertamina. The winner of the tender becomes the developer of the WKP, who produces electricity. Those plants built prior to the enactment of the law are still operated under their original contracts in accordance with Presidential Decree No. 45/1991. Figure 3 exhibits the principle of current geothermal business in Indonesia.

[14] Energy in "Energy Sales Contract" refers to electricity.

Figure 3: Geothermal Business Structure in Indonesia



Source: Prepared by LRI based on an interview with an official of the Agency for Assessment and Application of Technology (Badan Pengkajian dan Penerapan Teknologi - BPPT).

Among the existing seven plants, two are based on the dry steam technology, and the remaining the flash steam technology. Suppliers of equipment include Mitsubishi Heavy Industries (Japan), Mitsubishi Electric (Japan), Fuji Electric (Japan), Ansaldo Energia (Italy), General Electric (USA) and Ormat (Germany).[15]

Electricity sales price is agreed between PLN and the developer of the geothermal power plant. The benchmark electricity selling price set for any WKP auction is regulated at a maximum of 0.097 USD/KWh by MEMR Regulation No. 05/2009 on the Guidelines for Electricity Purchasing Price by PT. PLN.[16] Table 2 shows the initial or benchmark price agreed (at auction) between the developer and PLN,[17] and the technology used at different plants.

[15] *Indonesia - Time to tap the ring of fire*. <http://www.frost.com/prod/servlet/market-insight-top.pag?Src=RSS&docid=173797191, 26 March 2010>
[16] *Indonesia to set geothermal electricity price at 9.7 US cents/ kWh, December 2009.* <http://thinkgeoenergy.com/archives/3136, 24 March 2010>
[17] *Indonesia's Geothermal Development, 2002*. <jakarta.usembassy.gov/download/geo2002.pdf 26 March 2010>

Table 2: Energy and Steam Sales Prices and Technologies in Use

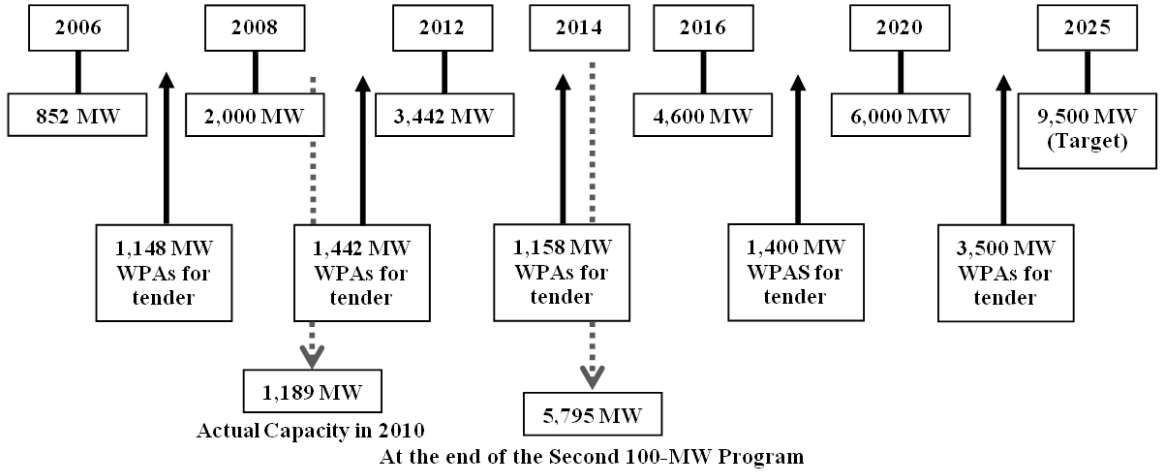
Plant Names	Electricity Price (ESC) (US$/KWh)	Steam Price (SSC) (US$/KWh)	Technology
PLTP Sibayak	0.071	0.0535	-Flash Steam Plant -China National Electric Wire and Cable Imp/Exp Corporation
PLTP Salak	0.074	0.0535	-Flash Steam Plant -Ansaldo Energia
PLTP Kamojang	0.0703	0.0657	-Dry Steam Plant -Suppliers data available in Appendix 2.
PLTP Darajat	0.0695	0.0425	-Dry steam plant
PLTP Wayang Windu	0.0724	0.0546	-Flash steam plant -Fuji Electric (steam turbine) and Mitsubishi
PLTP Dieng	0.0445	0.0486	-Flash steam plant
PLTP Lahendong	Not applicable	0.0182	-Flash steam plant -EGS France

Note: ESC (Energy Sales Contract) and SSC (Steam Sales Contract) with PLN.
Sources: Prepared by LRI based on the data available at Ministry of Energy and Mineral Resources website <http://portal.djmbp.esdm.go.id/dbb2 March 2010>; Indonesia's Geothermal Development, 2002.<jakarta.usembassy.gov/download/geo2002.pdf>

2.3 Future Prospects

The government prepared a plan called "the road map of geothermal development from 2006 to 2025," in which the MEMR envisioned to increase geothermal power to 9,500 MW by 2025, meeting 5% of the national electricity demand.[18] In the plan, additional locations for potential WKPs were proposed (see Figure 4).

Figure 4: The Road Map of Geothermal Power Development, 2006 – 2025



Note: The Second Program refers to the Second 10,000-MW Fast Track Power Development Program.
Source: "Geothermal Development in Indonesia". Prepared by Directorate General Of Mineral, Coal And Geothermal. <apecenergy.tier.org.tw/1_Geothermal_Development_in_Indonesia.pp>

[18] Pemanfaatan Panas Bumi Ditargetkan Mencapai 9,500 MW, November 2009 <www.tambangnews.com/berita/utama/385-2025-pemanfaatan-panas-bumi-ditargetkan-mencapai-9500-mw.html>.

In April 2009, the government approved the Second 10,000-MW Fast Track Power Development Program. While this program includes both conventional and renewable power developments, geothermal power alone accounts for nearly half-- 4,733 MW.[19] It is expected that PLN will build 21 plants with total generating capacity of 5,118 MW, consisting of 10 geothermal plants, 9 coal-fired plants, one combined cycle plant and one hydro plant. IPPs are expected to build 72 plants with total capacity of 5,035 MW, consisting of 33 geothermal plants, 34 coal plants, 2 combined cycle plants and 2 hydro plants.[20] The construction of all the power plants is scheduled to be completed by 2014.[21]

The Director of the Electricity Sector Development, Emi Perdana Hari, stated that the total cost of the program was projected at USD 15.960 billion, and that PLN was expected to contribute USD 5,903 billion of it while the rest was open for investment by IPPs.[22]

On 25th March 2010, PLN announced that they had secured necessary funding. Main funding sources are domestic banks such as the Bank Mandiri, BNI, BRI and BCA, as well as international banks such as Japan International Cooperation Agency (JICA), the Japan Bank for International Company (JBIC), Asian Development Bank (ADB), and the German Development Bank (KFW).[23]

According to the Coordinating Minister for Economic Affairs, the Government will encourage the private sector involvement, namely, IPPs in the execution of the program.[24] As the President Director of PT PLN has stated that PLN are ready to purchase the electricity produced by IPPs.[25]

On 27th January 2010, the Government enacted Ministry of Energy and Mineral Resources (MEMR) Regulation No. 02/2010, which includes the list of power plants (renewables, coal and gas) that are envisioned in the program.[26] Table 3 exhibits only the geothermal plants included in the list.

[19,22] PLN ready to start 2nd 10,000 MW program, August 2009<thejakartapost.com/news/2009/08/20/pln-ready-start-2nd-10000-mw-program.html>.
[20] PLN to Seal Deal With Independent Power Firm as 2nd Fast Track Unfolds, February 2010. <www.thejakartaglobe.com/business/pln-to-seal-deal-with-independent-power-firm-as-2nd-fast-track-unfolds/358334>.

[22] Proyek 10.000 MW tahap II Butuh Dana US$15.960 miliar <ekonomi.tvone.co.id/10/proyek_10000_mw_tahap_ii_butuh_dana_us15960_miliar/, March 2010>.
[23] Dana Aman, April PLN Buka Tender, March 2010 <http://www.kontan.co.id/index.php/bisnis/news/32758/Dana-Aman-April-PLN-Buka-Tender>.
[24]PLN Ngebet Beli Listrik Swasta, December 2009 <www.tempointeraktif.com/hg/bisnis/2009/12/08/brk,20091208-212595,id.html, March 2010>.
[26] PLN Ngebet Beli Listrik Swasta, December 2009 <www.tempointeraktif.com/hg/bisnis/2009/12/08/brk,20091208-212595,id.html, March 2010>.
[26] Pemerintah Siap Bangun 93 Pembangkit Listrik Baru, February 2010. <esdm.go.id>.

Table 3: Geothermal Power Plants Listed in the Second 1,000-MW Fast Track Power Development Program

No.	Plant Name	Province	Planned Capacity (MW)	Status (As of end of March 2010)
By PLN				
1	PLTP Tangkuban Perahu I	West Java	2x55	Waiting for bids
2	PLTP Kamojang 5 dan 6	West Java	1x40 ;1x60	Completing EIA Process
3	PLTP Ijen	East Java	2x55	Waiting for bids
4	PLTP Lyang Argopuro	East Java	1x55	Waiting for bids
5	PLTP Wilis/Ngebel	East Java	3x55	Waiting for bids
6	PLTP Sungai Penuh	Jambi	2x55	Completing EIA Process
7	PLTP Kotamobagu 1 and 2	North Sulawesi	2x20	Completing EIA Process
8	PLTP Kotamobagu 3 dan 4	North Sulawesi	2x20	Completing EIA Process
9	PLTP Sembalun	West Nusa Tenggara	2x10	Waiting for bids
10	PLTP Tulehu	Maluku	2x10	Waiting for bids
By IPPs				
11	PLTP Rawa Dano	Banten	1x110	Waiting for bids
12	PLTP Cibuni	West Java	1x10	Waiting for bids
13	PLTP Cisolok-Cisukarame	West Java	1x50	Waiting for bids
14	PLTP Drajat	West Java	2x55	Waiting for bids
15	PLTP Karaha Bodas	West Java	1x30 ; 2x55	Plant Construction
16	PLTP Patuha	West Java	3x60	Waiting for bids
17	PLTP Salak	West Java	1x40	Waiting for bids
18	PLTP Tampomas	West Java	1x45	Waiting for bids
19	PLTP Tangkuban Perahu II	West Java	2x30	Waiting for bids
20	PLTP Wayang Windu III	West Java	2x120	Drilling stage
21	PLTP Baturaden	Central Java	2x110	Waiting for bids
22	PLTP Dieng	Central Java	1x55 ; 1x60	Waiting for bids
23	PLTP Guci	Central Java	1x55	Waiting for bids
24	PLTP Ungaran	Central Java	1x55	Waiting for bids
25	PLTP Seulawah Agam	NAD (Aceh)	1x55	Waiting for bids
26	PLTP Jaboi	NAD (Aceh)	1x7	Waiting for bids
27	PLTP Sarulla 1	North Sumatera	3x110	Infrastructure Preparation
28	PLTP Sarulla 2	North Sumatera	2x55	Infrastructure Preparation
29	PLTP Sorik Merapi	North Sumatera	1x55	Waiting for bids
30	PLTP Muaralaboh	West Sumatera	2x110	Waiting for bids
31	PLTP Lumut Balai	South Sumatera	4x55	Drilling stage
32	PLTP Rantau Dadap	South Sumatera	2x110	Waiting for bids
33	PLTP Rajabasa	Lampung	2x110	Waiting for bids
34	PLTP Ulubelu 3 dan 4	Lampung	2x55	Completing drilling process
35	PLTP Lahendong 5 dan 6	Sulawesi Utara	2x20	Plant Construction
36	PLTP Bora	Sulawesi Tengah	1x5	Waiting for bids
37	PLTP Merana/Masaingi	Sulawesi Tengah	2x10	Waiting for bids
38	PLTP Mangolo	Sulawesi Tenggara	2x5	Waiting for bids
39	PLTP Huu	West Nusa Tenggara	2x10	Waiting for bids
40	PLTP Atadei	East Nusa Tenggara	2x2,5	Waiting for bids
41	PLTP Sukoria	East Nusa Tenggara	2x2,5	Waiting for bids
42	PLTP Jailolo	North Maluku	2x5	Waiting for bids
43	PLTP Songa Wayaua	North Maluku	1x5	Waiting for bids
44	PLTP Hululais	Bengkulu	2x55	Drilling Preparation

Source: Pemerintah Siap Bangun 93 Pembangkit Listrik Baru, February 2010. <esdm.go.id>

3. Geothermal Development Process in Indonesia

The government facilitates private sector investment in geothermal energy development by further improving the legal and regulatory setting for such investment. It also accepts geothermal CDM proposals.

3.1 Geothermal Development Process

The development process of geothermal energy is stipulated in the Geothermal Law no.27/2003 and the Government Regulation No.59/2007 on Geothermal Business. The sequence of development is basically as follows: (See also Figure 5.)

1. The Ministry of Energy and Mineral Resources (MEMR) of the government conducts an advanced study to determine the WKP, which includes not only the area of exploration/exploitation but also the expected volume and exact locations of reserve.

2. The WKP is auctioned to enterprises and cooperatives of both private and public sectors by the local authority or the government depending on the geographical scale of the WKP. For the WKP located within a district boundary, the power to approve the project lies with the district regent. If the WKP crosses a district boundary, approval will be required by the provincial governor. Similarly, if the WKP crosses a provincial boundary, approval will be required by the MEMR.

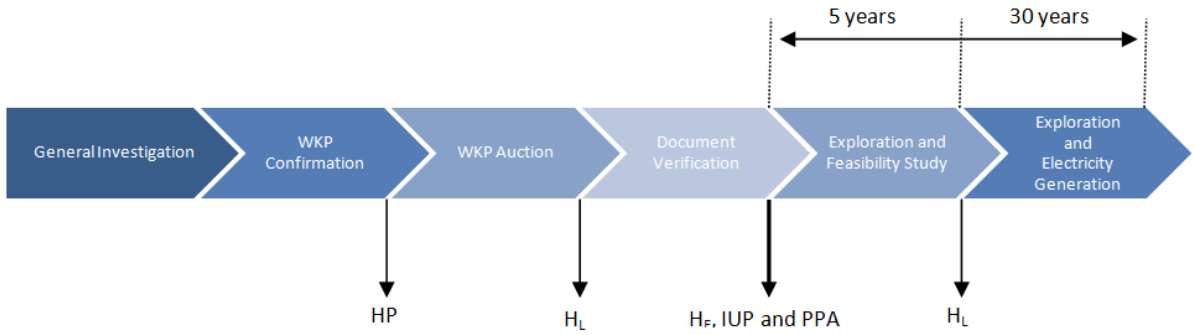
3. The winner of the WKP tender is the bidder who offers the lowest selling price for the electricity produced in the WKP concerned. The benchmark price is regulated at a maximum of 0.097 USD/kWh by MEMR Regulation NO.32/2009 on the Benchmark of Geothermal Electricity Price.

4. The winner of the WKP tender will obtain the Permit for Geothermal Business (Ijin Usaha Panasbumi - IUP) consisting of a three-year Exploration Permit given by the MEMR (which can be extended) and an Exploitation Permit, which is valid for 30 years after the exploration.

5. After acquiring an IUP or business license mentioned above, the winner company must undertake exploration, feasibility studies for a geothermal plant, exploitation (construction) and operation.

6. The company will sign an Energy (Electricity) Sales Contract with PLN, the sole purchaser of all the electricity produced at the WKPs. The price agreed upon during the WKP auction is set as the point of reference for the price in the official contract. The duration of the contract will be 25 to 30 years.

Figure 5: Geothermal Development Process



HP	Electricity benchmark price by the minister
HL	Price offered by bidders
HF	Final electricity selling price (bidder verification result)
PPA	Energy sales contract between the developers and PLN
IUP	Izin Usaha Panasbumi (Geothermal Business Permit)
IUKU	Izin Usaha Ketenagalistrikan Untuk Kepentingam Umum (Business Permit for Electricity for Public Use)

Source: Pertemuan Badang Geologi tentang Panas Bumi. Available at <portal.djmbp.esdm.go.id/dbb2>, 26 March 2010

Some tax facilities are provided in accordance with the Tax Regulations: Government Regulation No. 62/2008 No. 1/2007 on Income Tax Facilities for Investment in Certain Business Fields and/or Certain Regions. They include the following:

- A 30 percent net tax deduction of the total Investment, charged for 6 years for 5 percent annually.
- Income tax of 10 percent imposed on dividend of foreign tax subject or even lower rate of tax based on tax treaty to avoid double taxation.

3.2 CDM Projects

With utilization of geothermal power instead of coal-fired power, Indonesia could reduce GHG emissions by about 4.8 billion tons of carbon dioxide equivalent (tCO2-e) per year at a cost as low as 1 USD/tCO2-e (depending on the project's financial arrangement).[27] Indonesia has much to gain from developing geothermal CDM (Clean Development Mechanism) projects. Also, the financial benefit derived from the CDM may enable geothermal energy to compete with other energy sources domestically.

[27] Indonesia's Geothermal Development, 2002.<jakarta.usembassy.gov/download/geo2002.pdf>

The Designated National Authority (DNA) for CDM for Indonesia is the National Commission for Clean Development Mechanism (NC-CDM).[28] Indonesia's National Commission for UNFCCC (United Nations Framework Convention on Climate Change) has been actively promoting geothermal energy as a means to reduce GHG emissions.[29]

CDM projects in Indonesia are mostly small-scale projects, ranging from biogas production from industrial waste, to small hydropower in rural areas[30]. For geothermal, as shown in Table 4, there are several proposed CDM projects that have been approved by the DNA and are currently awaiting issuance of CERs (Certified Emission Reductions), which are carbon credits generated by CDM registered projects.

Table 4: Geothermal CDM Projects in Indonesia (2010)

Project Proponent	Project Name	Status
Chevron Geothermal Indonesia Ltd.	Darajat Unit III Geothermal Project	CER Issuance
PLN (Perusahaan Listrik Negara)	Lahendong II-20 MW Geothermal Project	DNA Approved
PT Perusahaan Listrik Negara (PLN) PT PERTAMINA	Kamojang Geothermal	DNA Approved
PT Dizamatara Powerindo	Sibayak Geothermal Power Plant	DNA Approved
Perusahaan Listrik Negara (PLN)	Lahendong III – 20 MW Geothermal Power Plant Project	DNA Approved
PT. Magma Nusantara Limited Sindicatum Carbon Capital Ltd.	Wayang Windu Phase 2 Geothermal Power Project	-

Source: national commission for clean development mechanism, list of CDM potential & projects. Available at <dna-cdm.menlh.go.id/en/projects/>.

3.3 Sustainable Development Criteria

According to the NC-CDM, the sustainable development criteria and indicators for assessing a proposed CDM project are categorized into four groups: environmental, economic, social and technological sustainability. The first three types of criteria concern local impacts of the proposed CDM project; therefore, the evaluation boundary is local. Specifically, the evaluation for environmental sustainability covers the area that has direct ecological impacts from the project. The evaluation for economic and social sustainability covers the administrative border of regency.[31] If the impacts cross boundaries, the scope of evaluation includes all impacted regencies. However, the scope of evaluation for technological sustainability is national.

To be approved, a proposed project must pass all individual indicators that are applicable. The evaluation of CDM projects is made based on a checklist. Project proponent has to provide

[28] National commission for clean development mechanism | About NC-CDM <http://dna-cdm.menlh.go.id/en/about/>
[29] Potential and obstacles of using the CDM to promote geothermal energy, 2001. < www.hm-treasury.gov.uk/d/Michaelowa(2001f)2.pdf, 30 March 2010>
[30] Why are there so many small-scale CDM projects?, 2008. <www.carbon-financeonline.com/index.cfm?section=CDMJIanalysis&action=view&id=11262>
[31] The regency is an administrative unit in Indonesia and is usually larger than city.

explanation and justification that the proposed project fulfils the requirement of all the indicators. Wherever possible, the explanation in the application form should include comparison of the condition with and without the proposed project. The supporting data for justification can be qualitative or quantitative. The explanation may also refer to the current regulation related to the indicators or any supporting documents attached to the application. The technical team and expert advisor(s) must tick each indicator with "yes", "no", or "not applicable." The proposed project will pass the sustainability criteria if "no" is never ticked.

Environmental Sustainability Criteria

- Environmental sustainability by implementing natural resource conservation or diversification, with the following indicators:
  - The sustainability of local ecological functions is maintained.
  - The threshold of existing national and local environmental standards is not exceeded (not causing air, water or soil pollution).
  - The biodiversity of genetic, species, and ecosystem is maintained and no genetic contamination occurs.
  - Compliance with existing land use planning.
- Local community health and safety, with the following indicators:
  - No health risk is imposed.
  - Compliance with work safety regulations.
  - Documented procedures that describe adequate actions to prevent and manage possible accidents, exist.

Economical Sustainability Criterion

- Local community welfare, with the following indicators:
  - Not lowering local community's income.
  - An agreement between the parties concerned regarding "termination of employment" problems in accordance with applicable law, exists.
  - Not lowering local public services.
  - Adequate measures to overcome the possible impact of a decline in income of local community members, exist.

Social Sustainability Criteria

- Local community participation in the project, with the following indicators:
  - Consultation process to local communities has been fulfilled.
  - Comments and complaints from local communities are taken into consideration and responded to.
- Local community social integrity, with the following indicator:
  - No conflicts among local communities are triggered.

Technological Sustainability Criterion

- Technology transfer, with the following indicators:
  - Dependencies on foreign parties in knowledge and appliance operation (transfer of know-how) are avoided.
  - Experimental or obsolete technologies are not used.
  - The capacity and utilization of local technology is enhanced.

3.4 Procedures of CDM Project Approval[32]

The approval procedures for CDM projects by the National Commission (NC-CDM) in Indonesia are as follows: (See also Figure 6. The numbers below correspond to the numbers in the figure.)

1. Project proponent (together with consultant) prepares application documents consisting of the following:
   - the National Approval Application Form, which includes explanation that the proposed project meets all the criteria of Sustainable Development;
   - Project Design Document;
   - Environmental Impact Analysis (AMDAL) report (where required);
   - notes of public consultation;

[32] National commission for clean development mechanism | project approval procedure <dna-cdm.menlh.go.id/en/approval, March 30 2010>

- a recommendation letter from Ministry of Forestry (only for forestry CDM project proposals); and
- other supporting documents to justify the project.

2. The application documents are submitted to the NC-CDM Secretariat to be processed. Project Proponent must prepare 25 copies of the application documents and 1 electronic document (soft copy). The secretariat has to make sure that the application documents are complete. Executive Secretary posts the project proposal at the National Commission website to invite comments from public and stakeholders. Each comment will be posted at the National Commission website.

3. Executive Secretary submits and presents the project proposal that has been received to the National Commission in the Internal Coordination Meeting. The Internal Coordination Meeting lasts one day.

3a. If required by the National Commission, Executive Secretary will assign experts to perform additional evaluation to the project proposal as second opinion. Experts should evaluate within 5 days.

4. The National Commission assigns members of the technical team to evaluate the project proposal based on sustainable development criteria and indicators.

4a. If required, Technical Team member of the same sector as the proposed project may take the application document to the Sectoral Technical Team meeting that has been previously established in the relevant ministries.

4b. If required by Technical Team, with the approval from the National commission, Executive Secretary will assign experts to assist the Technical Team. The whole process of (4), (4a) and (4b) completes within 21 days.

5. If Technical Team or experts suppose that the data given are not complete, they will write a note on the data needed to be completed and attach it to the evaluation report to be submitted to the National Commission. Technical Team submits the evaluation report of the project proposal to the Secretariat to be passed on to the National commission. The Technical Team's evaluation report will be posted at the National Commission website.

6. The National Commission receives Secretariat's report on the results of the project proposal evaluation and stakeholders' comments that are communicated through the National Commission website or sent directly to the Secretariat.

   After considering all inputs, the National Commission makes a decision whether the project proposal will be given approval or rejection. The National Commission Decision-making Meeting lasts one day.

6a. If there is any essential difference of opinion between the stakeholders who are in favor of and those who are against the project proposal, the National Commission may hold a Stakeholder Forum Special Meeting through a CDM national meeting held specifically for that purpose.

At the Stakeholder Forum Special Meeting, the National Commission conveys the controversial project proposal and compiles aspiration, supports and critics from participants of the Stakeholder Forum Special Meeting. The Stakeholder Forum Special Meeting lasts one day.

7. If the National Commission cannot give the approval letter because of incomplete data in the project proposal, according to the note made by Technical Team and experts, project proponent is given 3 months time to make up and resubmit the revised project proposal to the Secretariat.

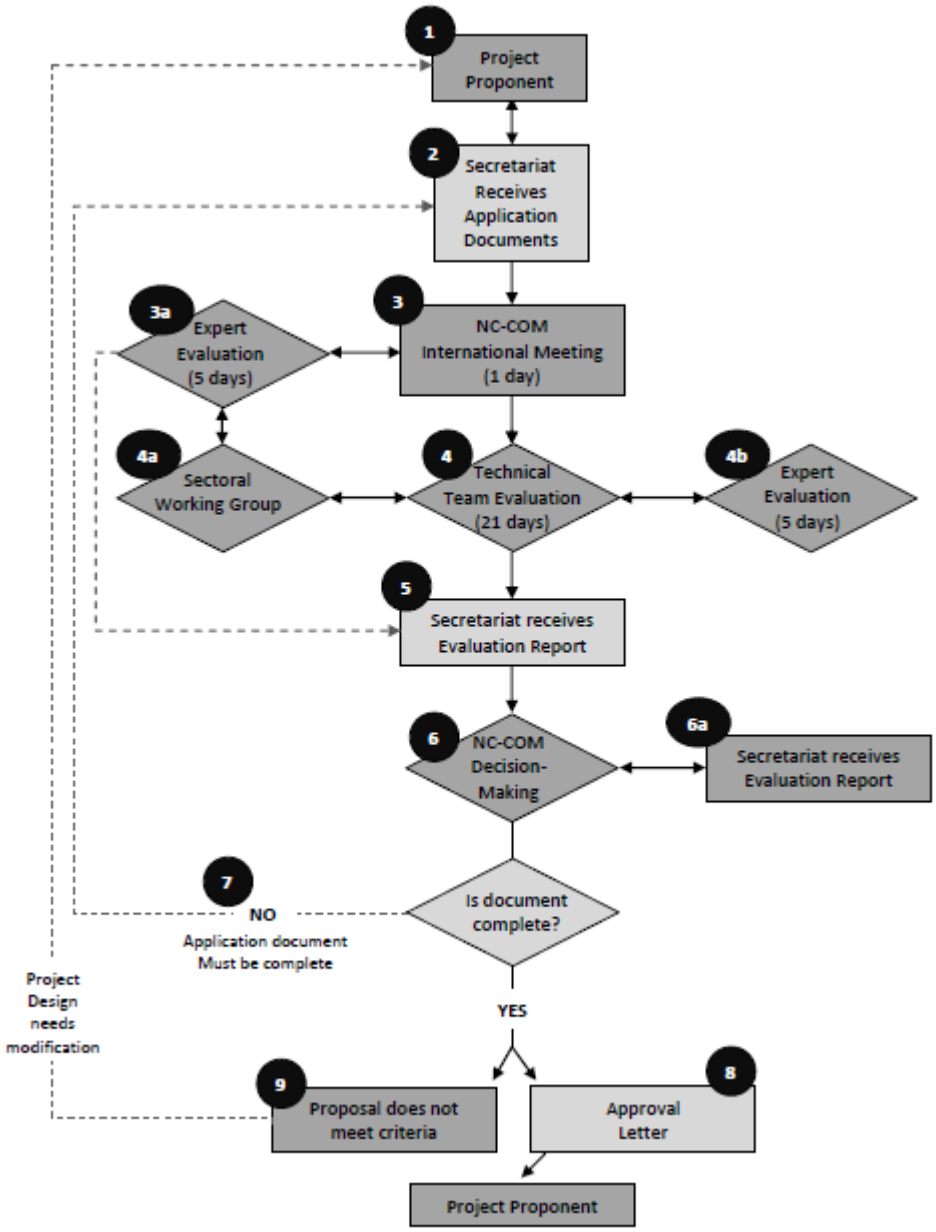
The Secretariat will process the revised project proposal documents with the same procedures for new project proposal. However, Technical Team or experts will re-evaluate only part of the proposal with the new additional data.

The process of returning project proposal by Technical Team or expert group to be revised by project proponent may only be done once for every proposal.

8. Secretariat submits National Commission Approval to project proponent.

9. If the proposed project does not meet the criteria, it may be re-submitted for national approval after modifying the project design.

Figure 6: CDM Project Approval Procedures in Indonesia



Source: National commission for clean development mechanism website| project approval procedures. Available at <dna-cdm.menlh.go.id/en/approval>.

4. Conclusion

Indonesia has approximately 28 GW of geothermal power potential, and only 1,189 MW (at seven power plants) has been developed. Most of the potential is located on the Islands of Java and Bali, the most densely populated islands with the highest demand for electricity.

With the issuance of Law No. 27 of 2003 on Geothermal and Government Regulation No 59 of 2007 on Geothermal Business Activities, legal certainty and thus a clear understanding and transparent view into the geothermal energy sector is provided to investors.

Opportunities to invest in geothermal energy have been widened after the government's approval of the Second 10,000-MW Fast Track Power Development Program, which includes 4,733 MW of geothermal power. Whether the program can be accomplished or not depends largely on participation by IPPs, who are expected to build 33 geothermal power plants under the program. PLN has already secured necessary funds to fulfill their investment requirements and they are assuring that the electricity produced by IPPs will be purchased by them. The ceiling price to sell geothermal power to PLN is currently set at 97 USD/MWh.

The government has been accepting CDM project proposals. Several geothermal power projects have been approved by the National Commission for CDM. The CDM can be a catalyst to further accelerate the development of geothermal energy.

Appendix 1: Geothermal Potential in Indonesia

No	Province	Number of Locations	Potential (MW)					
			Resources		Reserves			Total
			Speculative	Hypothetical	Probable	Possible	Proven	
1	Aceh	17	630	398	282			1310
2	North Sumatra	16	1500	170	1627		329	3626
3	West Sumatra	16	825	73	758			1656
4	Bengkulu	5	450	223	600			1273
5	Bangka-Belitung	3	75					75
6	Jambi	8	375	259	358	15	40	1047
7	Riau	1	25					25
8	South Sumatra	5	725	392	794			1911
9	Lampung	13	925	838	1072		20	2855
10	Banten	7	450	100	285			835
11	West Java	38	1500	784	1297	488	1557	5626
12	Central Java	14	275	342	614	115	280	1626
13	Yogyakarta	1			10			10
14	East Java	11	137.5	295	774			1206.5
15	Bali	5	75		226			301
16	NTB	3		6	108			114
17	NTT	19	290	353	609		14	1266
18	West Kalimantan	3	50					50
19	North Sulawesi	5	25	125	540	110	65	865
20	Gorontalo	2	25		15			40
21	Central Sulawesi	14	275		106			381
22	Southeast Sulawesi	13	250		51			301
23	South Sulawesi	16	325		49			374
24	North Maluku	9	150	117	42			309
25	Maluku	6	125		100			225
26	Irian Jaya	2	50					50
	Total	252	9,532.5	4475	10,317	728	2305	27357.5
			14,007.5		13,350			

Note: Figures are for 2004.
Source: *Potensi Dan Wilayah Kerja Pertambangan Panas Bumi Di Indonesia, 2005*. Available at <www.dim.esdm.go.id/index.php?option=com_content&view=article&id=21&Itemid=54>.

Appendix 2: Technology Specification for Kamojang Geothermal Power Plant

1. Turbines
Manufacturer: Mitsubishi Heavy Industries LTD.
Type: Double Flow. 5 (five) level condensing turbine
Capacity: Unit I = 30 MW (terminal G)
Unit II / III = 55 MW (terminal G)
Inbound steam pressure: 6.5 bar abs (inbound MSV)
Outbound steam pressure: 0.1 bar abs
Inbound steam temperature: 161.9^{o} Celsius
Rotation: 3,000 rpm
Steam consumption: Unit I = 250 ton/hour
Unit II/III = 388.9 ton/hour

2. Generator
Manufacturer: Mitsubishi Electric Corp.
Phase: 3 (three)
Frequency: 50 Hz
Terminal Voltage: 11,800 Volt
Rotation: 3,000 rpm
Capacity: Unit I = 37,000 kva
Unit II/III = 68,750 kVA
Nominal current at MCR: Unit I = 1.835 A
Unit II/III = 3.364 A
Power factor: 0.8

3. Exciter
Manufacturer: Mitsubishi Electric Corp.
Type: Brushless
Voltage: Unit I = 200 Volt
Unit II/III = 190 Volt
Current: Unit I = 370 A
Unit II/III = 845 A
Capacity: Unit I = 128 kva
Unit II/III = 278 kVA
Power factor: 0. 9
Frequency: 200 Hz
Rotation: 3,000 rpm

4. Trafo Generator
Manufacturer: Unit I = Asea
Unit II/III = Fuji Electric Corp.LTD
Type: ONAN
Primary Voltage: 11. 8 kV
Secondary Voltage: 150 kV
Frequency: 50 Hz
Phase: 3 (three)
Rotation: 3.000 rpm

5. Condenser
Manufacturer: Mitsubishi Heavy Industries LTD.
Type: Direct Contact. Spray/Tray jet.
Design Vacuum: Unit I = 0. 13 bar abs
Unit II/III = 0. 10 bar abs
Water cooling temperature: Unit I = 29^{o} Celsius
Unit II/III = 27^{o} Celsius
Hot water temperature: Unit I = 49.6^{o} Celsius
Unit II/III = 45.8^{o} Celsius
Cooling Capacity: 19.5 M^3

6. Demister
Manufacturer: Unit I = Mitsubishi Heavy Industries LTD.
Unit II/III = Mitsubishi Electric Corp.
Type: Vertical Drum
Steam flow: Unit I = 250 ton/hour
Unit II/III = 400 ton/hour
Operation pressure: 6. 5 bar abs
Operation Temperature: 161 9 Celsius
Design Pressure: 11 bar abs
Capacity: 19. 5 M^3

7. Cooling tower
Manufacturer: Unit I = Ishikawajima Harima Industries
Unit II/III = Mitsubishi Heavy Industries LTD.
Inbound water temperature Unit I = 51^{o} C
Unit II/III = 43^{o} C
Outbound water temperature: Unit I = 29^{o} C
Unit II/III = 27^{o} C
Fan Rotation: Unit I = 113 rpm

Unit II/III = 129 rpm
Motor Rotation: Unit I = 935/400 rpm
Unit II/III = 1000/750 rpm
Power: Unit I = 100 KW/cell
Unit II/III = 120 KW/cell
Cell amount: Unit I = 3
Unit II/III = 5

8. Final Separator
Manufacturer: Unit I = Mitsubishi Heavy Industries LTD
Unit II/III = Burgess-Miura Co. LTD.
Type: Static Cyclone
Design Pressure: 10 bar abs
Design Temperature: Unit I = 169^{o} C
Unit II/III = 205^{o} C

9. 11.8/6.3 V Trafo Units
Manufacturer: Unit I = Meiden
Unit II/III = Fuji Electric Corp.LTD
Type: ONAN
Primary Voltage: 11.8 kV
Voltage secondary: 6.3 kV
Frequency: 50 Hz
Phase: 3 (three)
Capacity: 4.000 kVA

10. 6.300/400 V Trafo Unit
Manufacturer: Unit I = Meiden
Unit II/III = Fuji Electric Corp. LTD
Type: ANAN
Primary Voltage: Unit I = 6,300 V
Unit II/III = 6,000 V
Voltage secondary: Unit I = 380 V
Unit II/III = 400 V
Off load tap range: ± 5%
Frequency: 50 Hz
Phase: 3 (three)
Capacity: Unit I = 1,250 kVA
Unit II/III = 1,750 kVA

11. 6.300/380 V T5-T6 Trafo Unit (Station Service)
Manufacturer: Fuji Electric Corp.
Type: ONAN
Voltage: 6000/400 V
Frequency: 50 Hz
Phase: 3 (three)
Capacity: 2.5 MVA
Current: 241/3608 A
Impedance: 9%
Temperature increase:
Coil = 65^{o} C
Oil = 60^{o} C
Connection Symbol: Dyn 11
Total weight: 6,600 kg
Weight without tank: 4,800 kg
Total isolation tank capacity: 1,950 liter
Production year: November 1986

12 150/6.3 kV Trafo Unit (T8)
Manufacturer: Fuji Electric Corp.
Type: ONAN
Primary Voltage: 150 kV
Voltage secondary: 6.3 kV
Frequency: 50 Hz
Phase: 3 (three)
Capacity: 7 MVA
Current identifier: 26.9/642 A
Impedance: 10.78%
Temperature increase: coil = 65^{o} C
Oil = 60^{o} C
Connection Symbol: YYN6
Total weight: 21,900 kg
Weight without tank: 10,500 kg
Modifier: 550 liter
Year of Production: November 1986
Standard: IEC-76 (1986)
Total isolation oil capacity: 5,050 liter

13. 150/20 kV Trafo Unit (T7)
Manufacturer: Fuji Electric Corp.LTD
Type: ONAN
Voltage identifier: 150/20 kV
Frequency: 50 Hz
Phase: 3 (three)
Capacity: 15 MVA
Current identifier: 57.7/433 A
Impedance: 10.21 %
Temperature increase: coil = 65^{o} C
Oil = 60^{o} C
Connection Symbol: Ynd5

Total weight: 35,000 kg
Weight without tank: 17,900 kg
Year of Production: November 1986
Total isolation oil: 7,050 liter

14. Main Water Cooling Pump
Manufacturer: Yoshiruka Kogya Corp. LTD.
Type: Double sucking centrifugal
Unit amount: 2
Capacity: Unit I = 3,700 m^3/hour
Unit II/III = 6,400 m^3/hour
Total head: Unit I = 28.5 m
Unit II/III = 33 m
Rotation: Unit I = 735 rpm
Unit II/III = 600 rpm
Power: Unit I = 400 KW
Unit II/III = 773 KW

15. Primary Intercooler Pump
Manufacturer: Yoshikura Kogyo Corp. LTD
Type: Double sucking centrifugal
Unit amount: 2
Capacity: Unit I = 560 m^3/hour
Unit II/III = 760 m^3/hour
Total head: Unit I = 20 m
Unit II/III = 30 m
Rotation: Unit I = 1,460 rpm
Unit II/III = 740 rpm
Power: Unit I = 48 KW
Unit II/III = 85 KW

16. Secondary Intercooler Pump
Manufacturer: Yoshikura Kogyo Corp. LTD
Type: Double sucking centrifugal
Unit amount: 2
Capacity: 350 m^3/hour
Total head: 35 m
Rotation: 1,460 rpm
Power: Unit I = 55KW
Unit II/III = 49 KW

17. Steam releaser valve
Manufacturer: Nippon Fisher
Type: Vee Ball
Amount: 6
Size: 4x16" and 2x10"
Release capacity: 1,264 ton/hour

18. Gas Ejector
Manufacturer: Mitsubishi Heavy Industries LTD.
Type: Unit I = Double storey single element
Unit II/III = Double element burst
Geothermal: Unit I = 2,350 kg/hour
Unit II/III = 1,885 kg/hour
Air: Unit I = 150 kg/hour
Unit II/III = 290 kg/hour
Steam (vapor): Unit I = 580 kg/hour
Unit II/III = 736 kg/hour
Temperature gas: Unit I = 32^o C
Unit II/III = 29^o C
Set capacity: Unit I = 4.510 m^3
Unit II/III = 23,900 m^3
Amount of set per unit: 1

