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COMPETENT NATIONAL EPC COMPANY IN THE FIELD OF GEOTHERMAL INDUSTRY TO SUPPORT THE DEVELOPMENT OF INDONESIA

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ABSTRACT

Development of geothermal industry as one of renewable energy has been launched by Government in its policies to meet the needs of energy demand in national development. Government through Presidential Regulation No. 5 Year 2006 has set a target of renewable energy in the national mix energy minimal at 17%. Geothermal energy itself as part of government's renewable energy has been projected in 2025 with the target of supply 4.4% of the national energy demand of 2,785 million Barrel Oil Equivalent (BOE). This target is expected to be more realistic because there are many obstacles found in upstream and downstream of geothermal development.

Until now, geothermal power plants as existing downstream area and built already produce 1,341 MW. Geothermal power is generated from the transformation of geothermal projects worth as the effort of competent Engineering, Procurement & Construction (EPC) companies are to meet the project completion time that has been targeted, the reliability of plant built, meets the required performance and the health conditions of assured Safety environment. Many things can be obtained by the construction of Geothermal Power Plant (GPP) by a competent EPC company that is in addition to improving Nett Present Value (NPV) of Wilayah Kerja Pertambangan (WKP) owner in this case as project owner, the other impact is the fulfillment of energy demand in each sector is increasingly increased in accordance with the national economic growth while reducing fossil fuel certainly.

Development of geothermal industry is expected to reach a total installed capacity of 6,141 MW by 2025, so there is 4,800 MW of capacity that needs to be established by the competent EPC companies for 12 years. So, it is clear that the EPC sector will continue to be very dominant in the value chain of the geothermal industry development. With the increasing need for accelerating infrastructure development to encourage economic growth in Indonesia, there is no doubt that the EPC sector is in a favorable position. Capability of EPC companies shall enhanced in order to face the multiple executions of EPC projects. How to align and set-up different deliverable of EPC projects in terms of scope, schedule, cost, quality and Health, Safety & Environment (HSE) as the main purpose. How to survive in any stage of EPC development is more important than constrains itself. EPC companies must find its own strategic, various ways to solve their specific problems in geothermal multi-project scenario.

I. BACKGROUND

National economic growth in recent years reached more than 6%, this resulted in increased national energy demand. To meet the increasing energy demand, the government is looking for alternative energy other than fossil that dwindling. Fulfillment of the energy contained in the government's incentive to develop a national energy policy stipulated in Presidential Regulation No. 5 Year 2006. In this regulation, the development of new

and renewable energy is expected to be achieved by 17% in 2025 which is 5% share of geothermal energy. Based on geothermal development roadmap drawn up in 2006, targets to be achieved by year 2025 amounted to 9,500 MW.

Installed capacity of electric power per October 2012 reached 31,930 MW which is from 4,991 power plant units[1]. Throughout 2012, the achievements that have been successfully obtained new renewable energy sector and energy conservation is the development of new renewable energy-based generation of 304.68 MW from geothermal (115 MW), micro-hydro (163.68 MW), solar power (5 MW), 3 MW connected (on the grid), bioenergy (21 MW) [2]. Additional capacity of geothermal power plant (GPP) is still far below the government's target in 2012 was 2,590 MW according to road map. Total GPP capacity that have been installed in 2012 can be seen in Table 1 below reached 1,341 MW and potential in the WKP.

Many things that cause the growth of geothermal energy supply especially GPP does not in accordance with the road map that have been set, in addition to licensing of forest land that overlaps with many areas including the development of geothermal developers unprepared to execute this project, both technically and financially. These constraints are very likely resolved in various WKP of geothermal simultaneously so that developers need competent partners from the upstream and downstream sides. On the downstream side, developers will be more in touch with EPC companies and Operation & Maintenance (O&M) to build geothermal power plants and operate them within the investment for 25 to 30 years. The geothermal power plant construction should be done by a competent EPC company that developer's target in investing can be achieved. If geothermal development scenario occurs particularly in the downstream side would need EPC company that is able to simultaneously build geothermal power plants but still ensure the quality of the desired plant. Especially if nationalized geothermal development will greatly benefit Indonesia seeing potential of Indonesian national capacity to process this energy increases through its industrial development. Government support for the nationalization that had been stipulated in the ministerial regulations industry must be improved so that the geothermal industry is being developed to have many impact not only meet energy needs but also develop supporting industries for the success of national development.

II. DEVELOPMENT OF GEOTHERMAL POWER PLANT IN INDONESIA

Up to 2012, there is few additional geothermal power plants can be built to generate electricity. During 2012 there were only 115 MW capacity comprising of 110 MW Ulubelu and 5 MW geothermal power plants geothermal Ulumbu. Of the five WKP expected to begin construction in 2012, geothermal power plants totaling 305 MW, none have been realized. The main obstacle is the fifth WKP can not be further developed as the unavailability of steam, another thing because injection wells can not be made as well as the limited capacity of the reservoir so it must be sought again reservoirs that can provide geothermal energy exploitation. From the five WKP, there is only one WKP that is ready to tender its EPC is Kamojang unit 5 with 30 MW capacity plan. Along the way, the capacity amend to 35 MW and this capacity is to be constructed by the EPC contractor in mid-2013 so that the Commercial Operation Date (COD) is expected to be achieved by mid-2015.

Table 1: WKP list that has already installed GPP, totaling 1,341 MW per year 2012.

No.	WKP Panas Bumi	Lapangan PLTP	Potensi (MW)	Kap. Terpasang (MW)
1	Sibayak-Sinabung	Sibayak	124	12
2	Cibeureum - Parabakti (Gn. Salak)	Gn. Salak	952	377
3	Pengalengan	Wayang Windu	400	227
		Patuha	706	-
4	Kamojang-Darajat	Kamojang	855	200
		Darajat	610	270
5	Dieng	Dieng	780	60
6	Lahendong-Tompaso	Lahendong	358	80
7	Ulubelu	Ulubelu	556	110
8	Ulumbu	Ulumbu	199	5
Total			**5.540**	**1.341**

III. COMPETENCE OF EPC COMPANY TO TRANSFORMS GEOTHERMAL UPSTREAM PROJECT INTO ELECTRICITY ENERGY

Start from 2013 as can be seen in Table 2, there will be 9 GPP can be built to continue the process of exploration that has been done before. The Ninth of estimated geothermal does not have any significant obstacles due to the conditions on the ground have a lot to deal with technical issues such as the availability of steam, the availability of injection wells, or even addition of steam only.

3.1. Geothermal Upstream Project

As part of geothermal development process, the upstream will determine whether fast or not the development could be done. The upstream process in general consists of:

1. WKP tender
2. Infrastructure preparation
3. Exploration and reserve confirmation
4. Feasibility study
5. Exploitation / production drilling

From the nine field is expected to be built in 2013 - 2014, only two field that are ready to build and can be tender or the appointment of its EPC contractor are Kamojang unit 5 and Cibuni. Kamojang field among the other geothermal fields have the most good steam quality with dryness levels approaching 100%. This will affect the design and construction of its GPP would be simpler and cheaper when compared with GPP that has fluid with lower steam quality.

3.2. GPP EPC Projects as Downstream of Geothermal Project

Continuing the process of geothermal development, EPC construction of geothermal power plants become a part that is not less important in this process considering the steam that has been obtained from the drilling of production wells will be converted into electrical energy for distribution to consumers.

Some construction EPC scheme depends on the upstream development scheme, if before the Law No. 27 Year 2003 issued by the EPC construction schemes that are shared among many Re-injection Fluid Collection System (FCRS) or Steam Above Ground System (SAGS) with its own GPP unit. This is due to the scheme are still a lot of development in the upstream that use Steam Sales Contract (SSC), in contrast to the scheme after geothermal Law issued where the developer is responsible from upstream to downstream so that the EPC construction scheme in the form of total geothermal project combines FCRS construction up to the plant.

Although in the downstream area has a higher certainty than in the upstream area, EPC construction of GPP work plays important role, especially from the performance of the plant. Steam consumption efficiency is important to note that the process upstream has done at great expense need to be converted into useful energy. This is where the importance of a competent EPC companies involved in GPP so that the performance of GPP built in good quality.

3.3. Competence of EPC Company in GPP Project

To build a GPP, the project owner chose a trusted EPC company. Selection of EPC companies need to pay attention to its competence, it can be known from the track record and their experience. A company's track record of EPC, project owners need to be referenced in order to be selected to build GPP on target. There are four parameters that can be used as a company's EPC competence in particular for the GPP construction:

1. GPP construction completion in a timely manner according to the contract agreed.
2. Its construction based on costs that have been agreed upon in the contract
3. GPP has reliability according to the contract
4. Maintaining the Health, Safety and Environment (HSE) in the construction execution

3.3.1. Project completion on time

GPP development project completion time varies depending on the capacity to generate. In Indonesia, the largest unit capacity of GPP ever built is 117 MW. Range of GPP plants are being built in Indonesia between 20 MW to 110 MW, the unit is relatively large between 20 MW to 60 MW. The time required to complete a GPP project ranged from 24 months to 36 months. GPP EPC completion of processing time is determined by the supply of the main equipment especially Steam Turbine Generator which can reach about 16-18 months exwork factory for 1 unit. Remaining eight

months are used to transport equipment up to installation and commissioning. Competent EPC company will maintain and manage the project deadline-time EPC (milestones), particularly for long lead items. Ability to maintain project milestones are not owned by other EPC companies, because many factors can affect to these capabilities.

3.3.2. Project completion on budget

Cost factor to be one of the parameters that need to be taken into account in completing the construction of GPP as it relates to the economic feasibility of the GPP. In the GPP upstream area, the feasibility has been studied in such a way to have considered the estimated investment cost of GPP construction. This Cost is used as a basis for determining the GPP construction budget by the owners of the project, so that when the execution of the construction of GPP by EPC companies must not exceed a predetermined budget.

Competence of EPC company in building GPP on budget is one of the important parameters to be considered by the project owner. Competent EPC company must able to manage project financial when built a GPP by taking into account technical specifications as agreed in the contract with project owner according to the scope of works. Many things that have the potential to exceed the set budget, such as the purchase of materials and equipment, the largest segment in the implementation of the project. Technical specifications under the contract are not allowed, but if it turns out far exceeds the contract will result in the purchase price of the equipment to be very expensive. The same thing could potentially exceed the budget if engineer's ability to negotiate is poor. Cash flow monitoring is also important for the execution of the project so that the project can continue to operate until it can be completed according to the contract.

3.3.3. Power Plant Reliability

In building a GPP, knowledge on geothermal thorough will provide more benefits so that the execution of its projects more smoothly. A competent EPC company will be able to estimate a GPP EPC work from the outset to determine the characteristics of the geothermal field to be built a GPP. Some characteristics of the geothermal field which affects the technical design and specification of equipment a GPP project including:

1. Type of reservoir (steam domination, water domination or hot water)
2. Wellhead pressure
3. Number of geothermal fluid flow
4. Turbine inlet pressure
5. Number of Non Condensable Gases (NCG)

A competent EPC company will be able to optimize the data field to be designed as a GPP with a good performance can be seen from the generated electricity output and steam consumption efficiency to be converted into electricity. In addition, ease of operation and maintenance of the current period to be one of the considerations a competent EPC company in implementing the GPP EPC project.

Sometimes, GPP development in Indonesia is differ compare with almost GPP overseas that could be done in a remote and challenging field. It is related to the geography and geology of Indonesia, especially with regard to areas that have geothermal potential is located in the mountains called the ring of fire. Areas of ravines and steep cliffs to be one challenge in building GPP especially the SAGS/FCRS. Under these conditions, the EPC contractor must be able to ensure that the design can still be implemented.

3.3.4. Maintaining the Health, Safety and Environment

Construction of a GPP project as well as in other areas should pay attention to aspects of HSE. Although geothermal energy is environmentally friendly energy, but the duration of the construction period is the most vulnerable to disturbing aspects of HSE. Health of workers and communities need to be considered when implementing GPP construction. Safety became a critical note considering the construction of GPP activity can be done in dangerous fields such as ravines and steep cliffs. During the installation of heavy equipment, safety equipment and material from the note sent up to field to be installed. Environmental aspects to be crucial in the execution of GPP project as most WKP geothermal in Indonesia is in the protected forest and nature reserve. In addition, the relationship with the surrounding community so it should be because the smooth execution of the project on the ground directly under the influence of society. If the relationship with the community was well even have the support, then the smooth

execution of the project will be very smooth. Aspects of the HSE will be a big stumbling block if not well handled. Although budgeted costs is quite large, but good handling in the HSE field will keep EPC contractor even the project owner of the greater losses. Anticipatory nature of the HSE is more to reduce the risk that may occur particularly during the construction period.

Competent EPC company already understand of this HSE implementation because of the awareness, project execution risks will be reduced if the HSE aspects of well applied in the field.

3.4. Competency requirements in GPP EPC Company

Construction a GPP project by a competent EPC company will provide security for the project owner because the project will be in accordance with the set targets. In the field of GPP EPC, not many companies that can meet the competency requirements to be met. The minimum requirements that must be met by a competent EPC company are:

1. Resources, engineer is trained so as to have minimum 6 years experience
2. Wide Network and Supply Chain Management (SCM)
3. Stakeholders (Association to increase the Local Content level/LCL)
4. Management support
5. The use and mastery of engineering technology and construction methods

3.4.1. Resources with sufficient experience

The ability of the engineer who owned will determine the successful completion of a GPP was because the engineers who create technical designs and specifications based on basic design of GPP in a particular field. Technical design and specifications are made can be optimized so as to meet the execution aspects of GPP project competency commonly known as Cost Performance Index (CPI), Schedule Performance Index (SPI), HSE, and also the performance of GPP are built. To meet engineer capabilities like this, it takes at least sufficient experience and continuous training concept. The length of time required in order to meet the competency engineer an EPC company in GPP at least 6 (six) years working experience in the field of GPP.

3.4.2. Wide Network and Supply Chain Management

Competence of an EPC company in GPP need to be met with wide network and SCM due to numerous parties involved but have chosen to remain eligible project owners. In Ulubelu GPP projects 1 & 2, there are at least 635 suppliers involved in the execution. [(3)]It is believed, supplier as part of the SCM will be greater than the number that a company already has a competent EPC data. Therefore, the execution of its GPP EPC projects will be guaranteed given knowledge and data suppliers who are familiar with GPP projects already well controlled. Relationship with suppliers is managed properly so that when a GPP project to be executed, competent EPC contractor is ready to coordinate with the suppliers.

3.4.3. Stakeholders (Association to meet the Local Content Level)

Execution procedures of GPP projects in Indonesia has been set by government regulation through Industrial Ministry regulations (Permenperin) Number: 54/M-IND/PER/3/2012 on the use of domestic products for the construction of electricity infrastructure. Competent EPC company must have the ability to meet the Local Content (LC) value set by the government. LC value varies depending on the capacity of GPP are built, the value is in the range between 28.95% to 42%.

3.4.4. Management Support

GPP project execution is slightly different from the other projects, one of the difference is that the value of GPP projects are considered relatively small when compared with other projects both in the field of oil and gas projects or even in other power projects such as Coal power plants, or hydroelectric power plant. Therefore, a competent EPC company in GPP are in need of a total management support so that the execution of the project continue to operate smoothly and normally like other project execution. In a variant of a certain value, the execution of the project is not much different than a project with a small value compared to the execution of the project with a great value. Man power needs of the project was not much different, it is the primary concern of the total management support on GPP project.

3.4.5. Usage and mastery of engineering technology and construction methods

Competency requirements an EPC company in GPP that are directly related to the execution of the project is the mastery of engineering technology and construction methods. It is absolute and is essential for the smooth execution of the project as well as the quality of the project construction. Various design and engineering technology need to be mastered to be used optimally in GPP project execution so that it can effectively and efficiently and meet contract specifications.

Construction method is also important given in the field with varying terrain and in Indonesia tend challenging because the project site is located in the mountains, certainly need a method that sophisticated, effective and efficient to install equipment and materials safely so it continues to function in accordance designs. This construction method is obtained in addition to upgrading technology also with increased skills from experience.

3.5. EPC Company Competency Benefits on Projects GPP

GPP project execution is carried out by a competent EPC company has benefit that can be felt by many stakeholder. The direct benefit of a GPP EPC project success can certainly felt by the project owner itself, the surrounding communities and government.

3.5.1. Benefit to the project owner

Benefit is received by the project owner of EPC GPP project execution. As explained in the previous section that the project owner has a set budget targets and revenue from the sale of electricity. With the completion of the EPC GPP project on budget defined by the scope of work, project owners do not need to seek funding to increase the budget. Environmental Maintaining and safety during the certainly of execution will minimize unnecessary additional expenditure by the project owner. Timely completion of contractual impact on revenue flows to the owner of the project as a result of electric power sales to buyers in Indonesia is particularly Perusahaan Listrik Negara (PLN). Reliable performance of GPP is also beneficial to maximize the income generated by sales of electricity to supply steam as efficiently as possible.

3.5.2. Benefit to the community

Frequent working on GPP EPC projects, a competent EPC company will provide a positive benefit to the surrounding community. Synergy with the community is very important feeling for smooth project execution process so arranged as much as possible so that the existence of the project provide benefits to the community. One of the benefits that can be felt by the surrounding community is employs local communities and their involvement in executions. High communication skills are required at all when dealing with the public as to achieve the same understanding between GPP EPC contractors with the surrounding community due to it is not easy. Appropriate approaches, how to communicate well and fit as well as other social skills are keys to success giving effect to the community.

3.5.3. Benefit to the government

Certainly the GPP project will give large benefit to the government. One of these benefits, include:

1. Tax
2. Government budget savings with energy substitution of fossil fuel by geothermal energy at 20.5 million barrels of oil per year by GPP capacity currently at 1,341 MW (1 MW ~ 42 barrels per day) [(4)]
3. Promote the development of surrounding community which is the main task of the government to build the community.
4. Fulfillment of energy needs for the purposes of people either in the field of lighting or industry which is a government program
5. Achieve of program development with the development of the surrounding community and other communities with growing industry
6. Maintaining the environment especially in the international agreement regarding the development of environmentally friendly energy
7. Promote domestic industry to continue to implement the spirit of Local Content usage.

These impacts are sustainable and synergies will help promote national economic growth despite the implementation needs to continue to receive support from the government itself. As a country that has the largest geothermal potential in the world, Indonesia deserve became the most

advanced country in the field of geothermal industry since the process of development has been provided in its nature as a giant laboratory.

IV. GPP EPC MULTI-PROJECT EXECUTION

Based on the competency and qualified managerial skills, GPP EPC multi-project execution is not impossible to do. In some cases, the execution of some projects has been met by a GPP EPC company with satisfactory results. This capability can be enhanced to execute GPP EPC multiple projects in parallel are expected the next few years will be a lot of GPP EPC project to be executed simultaneously.

4.1. GPP EPC Projects Prospective in Indonesia

Current conditions, there are some WKP that is expected to begin its GPP EPC construction in 2013 or 2014. WKP include:

1. Kamojang unit 5 1x35 MW capacity, estimates started to be built in mid-2013
2. Karaha Bodas 1x30 MW capacity, estimates started to be built in end-2013 or beginning of 2014.
3. Ulubelu 3 & 4 2x55 MW capacity, estimates started to be built in beginning or mid-2014
4. Lahendong 5 & 6 2x20 MW capacity, estimates started to be built in beginning or mid-2014
5. Lumut Balai 2x55 MW capacity, estimates started to be built in mid or end-2014
6. Muara Laboh 2x110 MW capacity, estimates started to be built in mid or end of 2014
7. Sibual – buali (Sarula) 2x110 MW capacity, estimates started to be built in mid or end of 2014
8. Suoh Sekincau 2x110 MW capacity, estimates started to be built in mid or end of 2014
9. Cibuni 1x3 MW capacity, estimates started to be built in end of 2013 or beginning of 2014.

Complete list of estimates GPP EPC construction can be seen in Table 2. Under these conditions, it is estimated there will be a GPP capacity additions in 2017 amounted to 828 MW hence GPP total capacity to be 2,169 MW. Based on the road map that has been revised by the Ministry of Energy and Mineral Resources (ESDM), Directorate of New and Renewable Energy and Energy Conservation (EBTKE), geothermal development in 2025 is projected to reach 6.141 MW so there is 4.800 MW capacity GPP needs to be built from now. (5)

Table 2: List of estimation of GPP capacity addition in some WKP, GPP EPC construction estimation ranging 2013 – 2014

No.	Geothermal Concession Area	Geothermal Field	Installed Cap. (MW)	Addition est. (MW)	Est. / Actual To start for Development
1	Sibayak-Sinabung	Sibayak	12		
2	Cibeureum - Parabakti (Gn. Salak)	Gn. Salak	377		-
3	Pangalengan	Wayang Windu	227		
		Patuha	-	60	2012 (Actual)
4	Kamojang-Darajat	Kamojang	200	35	Unit 5 35 MW/2013
		Darajat	270		-
5	Dieng	Dieng	60		
6	Lahendong-Tompaso	Lahendong	80	40	Unit 5&6 40 MW/2014
7	Sibual-Buali	Sarulla	-	220	Unit 1&2,220 MW/2014
8	Lumut Balai	Lumut Balai	-	110	Unit 1&2 110 MW/2014
9	Ulubelu	Ulubelu	110	110	Unit 3&4 110 MW / 2013-14
10	Karaha-Cakrabuana	Karaha Bodas	-	30	Unit 1 30 MW / 2013 - 14
11	Ulumbu	Ulumbu	5		
12	Cibuni	Cibuni	-	3	Unit 1 3 MW / 2014
13	Muara Laboh	Muara Laboh	-	110	Unit 1,2 110 MW /2014
14	Suoh Sekincau	Suoh Sekincau	-	110	Unit 1&2, 110 MW / 2014
Total			**1.341**	**828**	**2.169**

4.2. GPP EPC Multi-Project

From Table 2 can be seen there are 9 locations GPP can be built that is expected to begin in 2013 and 2014, but the sites were spread across the island of Sumatra, Java and Sulawesi. Here are details of the location of prospective GPP project:

1. West Java (Kamojang 5, Cibuni, Cisolok and Karaha Bodas)
2. West Sumatera (Muara Laboh)
3. South Sumatera (Lumut Balai)
4. Lampung (Ulubelu 3 & 4)
5. North Sulawesi (Lahendong 5 & 6)

With the distribution of GPP location, is wide open construct by a competent EPC company. There is no doubt at all in the execution of GPP EPC projects that will be simultaneously soon if and only if it is done by a competent EPC company.

4.3. Lesson Learned From Excution of GPP Multiple Projects Simultaneously

PT. Rekayasa Industri (Rekind) is a national EPC company that has long been building a GPP projects in Indonesia. Started in 1991, various GPP

projects have been successfully well completed. Beginning in 2006, Rekind has several GPP capable of working on several projects simultaneously with excellent results. Several things that are owned and performed by Rekind for GPP EPC projects in parallel, are:

1. Having SBU Geothermal with engineers and Project Managers who have had lesson learned and experienced in various GPP projects
2. Already have wide network and fostering good relationships especially with propireatry equipment and GPP material suppliers
3. Play an active role in the association in relation to meet the requirements of government regulations in the field of Local Content
4. Rekind's Top Management is very concerned at the geothermal field and has has the ability for reliable project portfolio management for the implementation of GPP EPC projects in parallel
5. Has applied advanced technology facilities in the execution of EPC projects, one of which is 3D software and the experts to design GPP in three dimensions. Product of this technology could facilitate engineering and construction team in project implementation
6. Has the powerful ability in developing relationships with any society around the GPP constructions.

Here's an example of technology products in the GPP design that has been completed by Rekind with very satisfactory results:

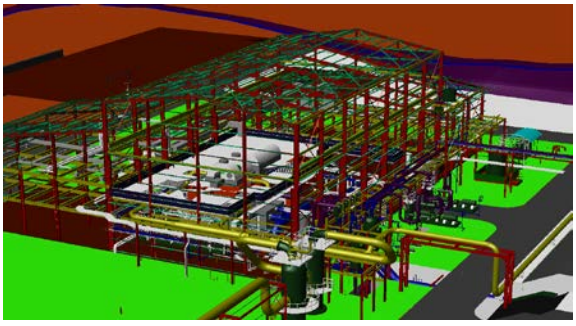

Figure 1: Three-D Model of the GPP Kamojang unit 4 design

Start in 2006, there were a few projects have been successfully carried out in parallel by the Rekind:

1. Period of 2006, Rekind performs Lahendong 2 GPP project in North Sulawesi and Kamojang unit 4 in West Java
2. Period of 2008, GPP Lahendong 3 project in North Sulawesi and Wayang Windu 2 in West Java
3. Period of 2010-2011, the project is done parallel is GPP Lahendong 4 project in North Sulawesi and GPP Ulubelu 1 & 2 in Lampung.

Special cases of some of projects undertaken above are as follows:

1. GPP Project Kamojang 4 is 100% designed by local engineers as well as the highest Local Content.
2. Wayang Windu project has challenging terrain with steep precipices and deep ravines. Wayang Windu project in time of its commissioning has set a record as the world's largest GPP capacity.
3. Lahendong 4 project has been done with very quickly and so far into the project with the world's fastest construction for a capacity of 20 MW.

Until now, Rekind is a national EPC company that able to build a GPP in Indonesia and has been involved in the construction of GPP so that it can reach the capacity of 692 MW, according to table 3.

In addition to GPP EPC project execution, Rekind also active in the development of the geothermal industry clusters in Indonesia for:

1. Develop clusters of new and sustainable energy industry with a competitive advantage to make a major contribution in developing geothermal business improvement.
2. With encouragement and support from the Government of Indonesia, the development of the geothermal industry could solve the fuel energy crisis in the future and the use of geothermal energy as the primary energy not only as an alternative energy
3. Manage sustainable energy competitiveness and CAPEX per MW which has been competitive

4. Configuration design of geothermal power plants that maximize output and minimize waste

Cooperation among cluster elements in the form of such schemes below:

- Availability and interactions between cluster components:
  - Industry (plant owner/Developer)
  - Resources
  - Institutions (ITB, UI, API, etc.)
  - Government Supports (regulation and policy)
- Partnership:
  - Inter-companies
  - Firm and supporting operations
  - Private and public sector

Table 3: List of GPP capacity built by and involving Rekind

No.	NAME OF PROJECT	OWNER	PERIOD	Cap. (MW)
1	Gunung Salak Geothermal Power Plant Project	UNOCAL Geothermal of Indonesia Ltd	1993	55
2	Geothermal Power Plant Gunung Salak Unit I/II Project	PT. PLN (Persero)	1994	55
3	Sarulla Unocal Project North Sumatera	PERTAMINA (UNOCAL Geothermal of Indonesia)	1994-1995	
4	Lahendong Geothermal Pipe Line Project 85 in Km 10", 18", 22" & 24"	BUD Engineering Pte. Ltd.	1998 - 1999	20
5	Wayang Windu Geothermal Pipeline Project 790 in. Km Dia. 18", 24", 30", 36" & 42"	PT. Mandala Nusantara Ltd. & Sumitomo Corporation	1997 - 2000	110
6	Dieng 1 Geothermal Power Plant Project 1 x 60 MW	Himpurna California Energy Ltd. Patuha Power Ltd.	2002	60
7	Lahendong II Geothermal 1 x 20 MW	PT. PLN (Persero)	2005 - 2007	20
8	Total Project Kamojang - 4 1 x 60 MW Geothermal Power Plant	PT. PERTAMINA DIT HULU	2006 - 2008	60
9	Lahendong III Geothermal Power Plant Project 1 x 20 MW	PT. PLN (Persero)	2007 - 2009	20
10	Wayang Windu Phase 2 Geothermal Power Plant Project, 1 x 110 MW	PT. Star Energy Holding Limited	2007 - 2008	117
11	Lahendong 4 Geothermal Power Plant Project 1 x 20 MW	PT. PLN (Persero)	2009 - 2011	20
12	Ulubelu 1 & 2 Geothermal Power Plant Project (2 x 55 MW)	PT. PLN (Persero)	2010 - 2012	110
13	Operator of Cisolok-Cisukarame Geothermal Field	PT. Rekayasa Industri	2008-current	45
	TOTAL			692

V. CONCLUSION

1. Government encourages fulfillment energy needs in order to redress economic growth for national development.
2. Renewable energy continues to be developed to meet the energy needs and save the budget, one of the developments is geothermal energy.
3. GPP EPC projects will start to accumulate to be done in 2014 so its need for competent GPP EPC company.
4. Competence of an EPC company is very important to continue to be supported in order its ability to work on projects in parallel is able to meet the challenges of working on multiple GPP EPC projects.
5. GPP EPC multi-project execution is possible to be done by a competent EPC company with the trust of the project owner and the support of various parties.

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