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Managing Multiple Projects: The Story from Indonesia

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ABSTRACT

Geothermal projects are exposed to various risks of varying degrees throughout all its phases and stages of development. Managing projects in a multiple-project environment involves planning and controlling project schedules and resources when the same resources are assigned to several different projects. A methodical, process-driven approach to managing multiple projects improves the ability to perform an array of projects, while juggling priorities and managing other daily responsibilities. The majority of project managers find that what most significantly influences the success of their projects is not their ability to properly sequence and execute the individual tasks on a given project, but rather the competition for resources and attention between projects in a multiple-project environment. For these and other reasons, it is critical that organizations recognize the need for a disciplined, process-oriented approach to managing multiple projects.

PT Pertamina Geothermal Energy (PGE) is a leading geothermal developer and a fully owned subsidiary of the state-owned oil and gas company, Pertamina. It has experience in managing several geothermal projects simultaneously for nearly 13 years. Six geothermal power plants were successfully commercialized from 2015 – 2018 with the total capacity of 215 MW. All of them are geothermal power plants built, owned and operated by PGE with one planned to be commercialized on Q2 – 2019. Those achievements would make PGE a global leader in geothermal development.

1. INTRODUCTION

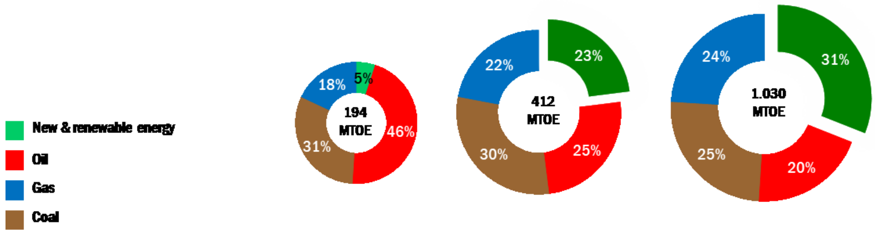
The government of Indonesia (GoI) implemented a Fast-Track Program designed to rapidly develop 10,000 MW of generation capacity equivalent to about one third of the PLN's total existing system capacity in 2006. These new power plants, located throughout the country, would utilize coal resources. It was intended to increase supply at an affordable price to the economy and household by displacing high cost oil-fired generation units. The second 10,000 MW Fast-Track Program was launched in late 2008, the sources of energy used are specific renewable energy types, gas and coal, with geothermal making up 40% of the target in order to ensure a more environmentally sustainable development of the sector.

Geothermal power is one of the best option to diversify Indonesia's energy mix as the country is blessed with abundant geothermal resources. Located in the Pacific Ring of Fire, Indonesia has the largest geothermal potential in the world with 40% of the world's geothermal resources. It has the total potential of about 27 -29 GWe. There is no country with more potential for geothermal power than Indonesia (DiPippo, 2016). However, the development of the energy is amounted to only 5.8% of the total potential (Fan et al, 2018).

In early 2014, the GoI issued a new National Energy Policy (NEP) following to the Energy Law No. 30 in 2007 in order to enable the coordination and synergy of all stakeholders in the energy sector. It revised its renewable energy targets (RET) to 23% by 2025 and 31% by 2050 from a base of only 6% of the current energy mix. It requires an estimated investment of IDR 1,600 trillion or around USD 120 billion (Maulidia et al., 2019).

As a subsidiary of PT Pertamina (Persero), which is mandated by the government as the motor for the development of geothermal energy in Indonesia, PT Pertamina Geothermal Energy (PGE) is fully committed to continue the expansion of installed capacity of geothermal power. As of June 2019, the company has managed five geothermal areas, three development projects, and three geothermal fields in exploration stage in parallel. In order to develop all commercialized and ongoing projects, PGE needs more than USD 2 billion to date. In addition, investments in the geothermal sector also have a high risk and return on investment of more than 20 years.

This paper presents how PGE's, as a project-based organization, manages its projects in a multiple-project environment and the governance of its projects to generate value. It also identifies the need to employ such structure to deliver its multiple projects.



	existing	2025	2050
Total electricity capacity	51 GW	137 GW	448 GW
NRE power plant	9.6 GW (19%)	46 GW (34%)	172 GW (38%)

	2015	2016	2017	2018	2019	2020	2025	2030	2040	2050
Geothermal	1.438,5	1.653,5	1.908,5	2.133,5	2.493,5	3.109,5	7.241,5	9.300	13.423	17.546
Hydro & micro hydro	5.024	5.119	5.236	5.491	7.008	7.889	20.960	25.844	35.611	45.379
Bioenergy	1.740	1.886	2.093	2.359	2.674	3.024	5.532	9.651	17.887	26.123
Solar	79	229	429	679	979	1.379	6.379	14.103	29.551	45.000
Wind	7	57	107	207	307	507	1.807	7.167	17.887	28.607
Others	372	1.860	1.860	1.860	1.861	1.863	3.128	3.779	5.081	6.383
Total	8.660	10.804	11.728	12.939	15.807	18.475	45.044	69.843	119.440	169.038

Figure 1: National Energy Policy based on PP No 79/2014 (EBTKE – MEMR, 2019). The energy mix profile (upper) and the breakdown of the energy mix (lower).

2. THE NATURE OF MULTIPLE PROJECT MANAGEMENT

Projects are considered as means to a business success (Pinto, 2002). Often, these projects are implemented in a Multiple Project Management (MPM) environment. MPM has been applied in organizations as they seek to improve management and efficiency, coordinate interrelated projects to cut cycle time, and transfer technology between projects to outperform the competition. MPM can be perceived as an organizational-level environment in which multiple projects are managed concurrently. In it, projects are grouped together to facilitate effective management to meet strategic business objectives. They are diverse in size and importance, may be at any point in their life cycle, and may not necessarily be interdependent or directly related. Some of the projects in the MPM environment are sufficiently large and strategic in nature to have a full-time project manager. The project manager leads a single project at a time. At a higher level, an aggregation of all projects in a multiple-project management environment of one specific organization is often recognized as a portfolio of projects and is managed by a so called portfolio manager (Pennypacker & Dye, 2002).

As a result of the MPM environment, the interproject interactions become an issue, which leads multiple- project managers to focus on interdependence among projects in order to maximize the objective of group success as opposed to individual project success. The concept of portfolio management should be applied to an operational level so that functional managers, multiple project managers, and team members can couple the planning and control cycles for single projects and the portfolio of projects. The purpose of it is to manage all projects as a collection, by adjusting and linking their schedules to match available resources (Adler et al., 1996). In these settings, concurrent projects are often intertwined due to interdependencies between inputs and outputs and sharing of specialized resources (Fricke and Shenhar, 2000). The disruptions in one project due to an unexpected event can ripple through the performance of concurrent projects (Pavlak, 2004).

The challenge of MPM is project speed that leads to schedule pressure. Schedule pressure here is a consequence of a schedule-driven project management policy to finish projects deemed business-critical on the planned completion date even if they started late and there is no free resource capacity.

A project is said to have performed well if it has satisfied its scope while keeping within the scheduled timeframe and budgeted cost, and met desired quality and stakeholders' satisfaction. Thus, a project can be defined as a success if it achieves its business objectives and the management of the project can be defined as a success if the project is finished on time, meeting cost, quality or performance targets (Shenhar et al., 1997). The performance targets can be summarized with four dimensions:

1. Efficiency.
   It applies during and immediately following project execution
2. Impact on customer
   It applies immediately following project to a few months after delivery to customer

3. Business success
   It applies 1 – 2 years following project execution
4. Future potential
   It applies 3-5 years following project execution

Two levels of project success are defined by Turner and Zolin (2012) as follow:

1. Level 1
   It is defined as the achievement of targeted outcome and benefit.
2. Level 2
3.

It is defined as the achievement of targeted goals, public or business need, impact, or government or corporate strategy.

The inability of projects to meet these goals and objectives is project failure. A project is defined as a failure when it fails to meet the tripartite criteria of time, budget and quality, even though recent studies have added such criteria as sustainability, stakeholder management, communication, and risk management issues. In terms of multiple-project success factors, Fricke and Shenhar (2000) found that management support is one of the key success factors. This support can be seen in terms of implementing the reasonable number of projects, allocating resources appropriately, setting clear goals and project priority, and assigning project manager properly.

2.1 The Nature of Geothermal Projects

Most renewable energy sources have very different cost structures compared to the conventional energy generating technologies, with high upfront costs, long lead times, long payback periods and low operating costs. Geothermal energy also possesses these characteristics: it has high exploration and drilling costs and risk in addition to capital plant expenses (Noorollahi et al., 2009). A complex infrastructure project such as construction of a geothermal power plant, involves many stakeholders, their complex organizational structures, the use of numerous multistage contracting systems, and a multitude of inter-related activities in different phases of the project life-cycle. These factors produce significant risk exposure, uncertainty, vagueness, and vulnerability throughout a project's life-cycle (Sovacool et al, 2014). Thermal power plant projects have a high cost overrun risk, with the sensitivity analysis showing that construction delay, inadequate soil investigation, change orders, inflation, and changes in design specifications are the most sensitive risks involved (Islam et al, 2019).

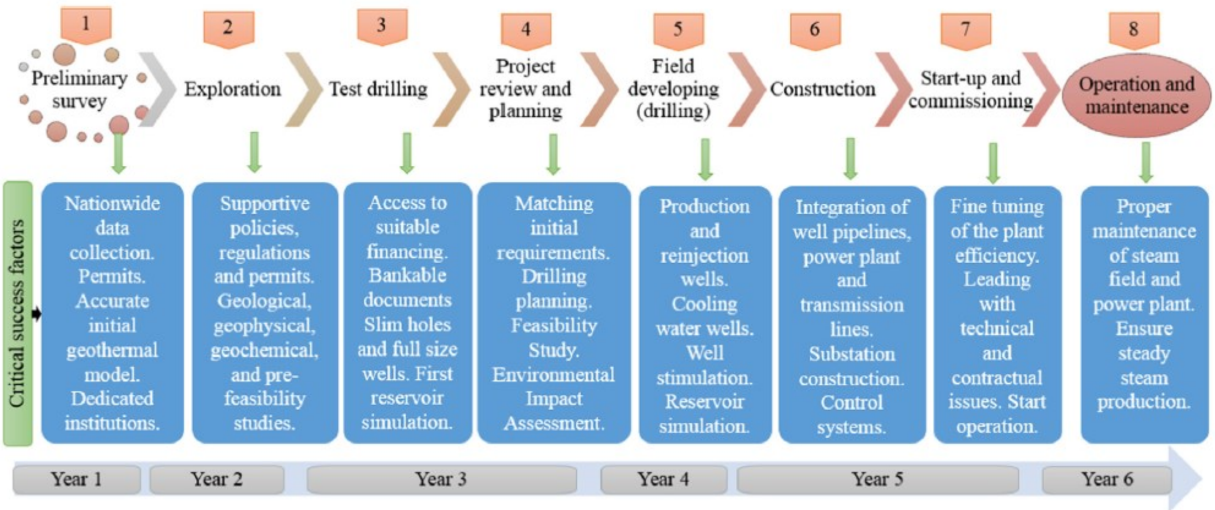


Figure 2: Critical success factors in the development phase of a geothermal project. Achieving the economic viability of a geothermal project requires rigorous control of costs of each development phase (Moya et al, 2018)

A geothermal project with a 30 MW condensing type power capacity could require 7 – 12 years of development with investment of USD 65 – 80 Million (Monterossa, 2009). It can be divided into a series of development phases before the actual operation and maintenance phase commence: preliminary survey, exploration, test drilling, project review and planning, field development/full-scale drilling, construction, and start-up and commissioning (Gehringer & Loksha, 2012). It is also a fairly sensitive project and could be influenced by many external factors, including electricity demand, environmental requirements, local policy, national policy or company policy. That is a reason why the project does not always run with the maximal flow. The speed of the project is adjusted to how promising the project is at the current time. Therefore, it is compulsory to have a good practice of project management to deliver a successful project.

2.2 Geothermal Projects Conducted by Pertamina Geothermal Energy

To accelerate geothermal development and encourage energy diversity in the country, the government issued new policies with the presidential decree No.16 in 1974 appointing the state-owned oil company Pertamina to explore and develop geothermal energy in conjunction with domestic and international partners. As a consequence of implementing the Government RegulationNo.31/2003 and implementation of the new Oil and Gas Law No. 22/2001, Pertamina has to transfer activities on the commercialization of geothermal to its subsidiary, PT. Pertamina Geothermal Energy (PT. PGE), which was established on 2006 as its subsidiary company (Darma et al, 2010).

Table 1: PGE's projects.

No	Name of Project	Units	Supply to 3rd party	Remark
1	Kamojang Unit V	35 MW	Electricity	Operation
2	Lahendong 5&6	2x20 MW	Electricity	Operation
3	Ulubelu Unit 1&2	2x55 MW	Steam	Operation
4	Ulubelu Unit 3&4	2x55 MW	Electricity	Operation
5	Karaha Unit 1	30 MW	Eletricity	Operation
6	Lumut Balai 1&2	2x55 MW	Eletricity	Development
7	Hululais Unit 1&2	2x55 MW	Steam	Development
8	Sungai Penuh Unit 1	55 MW	Steam	Development

PGE currently holds 34.4% of the total government of Indonesia (GoI) installed capacity from geothermal energy at 1948.5 MW, making it the second largest firm in Indonesia. Currently, PGE functions mainly as: (i) a constructor and developer of geothermal investments under the oversight of Pertamina; (ii) an operator of steamfields and power plants that Pertamina owns; and, (iii) management of Joint Operation Contracts (JOCs) where for some contracts it oversees the revenues from PLN for existing private geothermal developers. The size and scope of PGE's activities has been relatively contained, given that Pertamina currently has fully developed operations only in a small number of fields with a total capacity equivalent to 617 MW. As a result, it has a lean corporate structure, with permanent staff limited to what is necessary to oversee the contract workers who perform the construction and, in some cases, operational tasks.

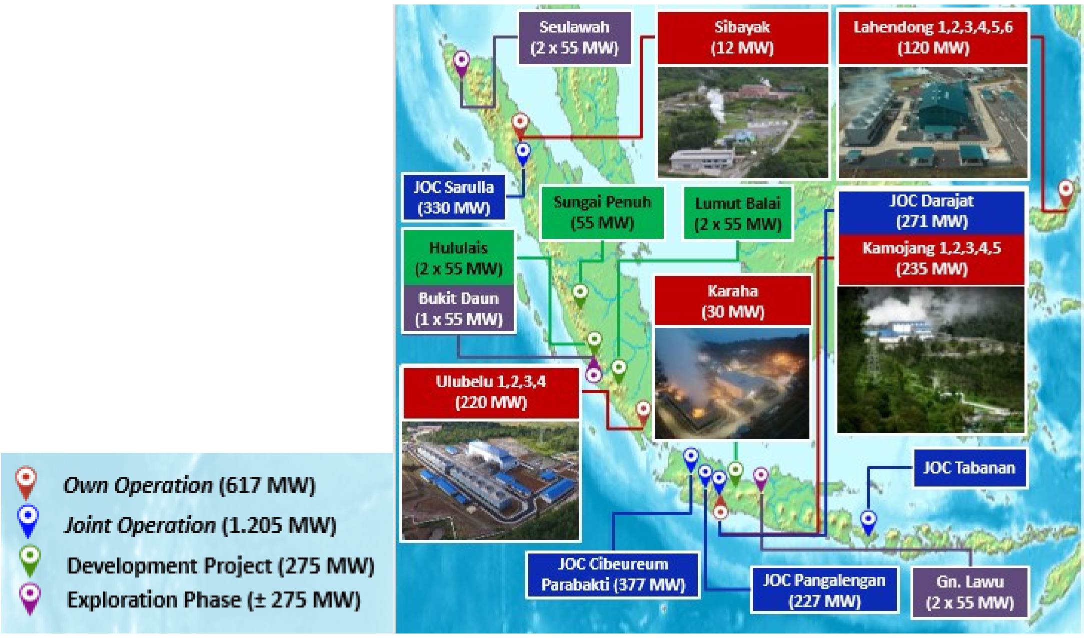


Figure 3: PGE Geothermal Working Areas (GWA).

The details of projects performed by PGE since second Fast Tracked program can be seen as follow :

2.2.1 Kamojang

The Kamojang geothermal field is located in Garut, West Java. The plant was first operated in 1982 with a capacity of 30 MWe. Two more units started generating 55 MW in 1988. In August 2008, unit IV of the Kamojang operation had a capacity of 60 MW. New exploration activities identified sufficient resources to increase the existing plant by an additional 35 MWe with Unit V in 2015. Unit V is constructed, owned and operated by PGE under the scheme of Total Project.

2.2.2 Lahendong

The Lahendong geothermal field is located in Tomohon, North Sulawesi. The Lahendong plant has a total production capacity of 120 MW from Units 1–6. The first unit started in 200, unit-2 started in 2007 followed by Unit-3 and unit-4 in 2009. New capacity from unit-5 and 6 were inaugurated last December 2017 with capacity of 2 × 20 MW. Both Unit 5 and 6 are constructed, owned and operated by PGE under the scheme of Total Project

2.2.3 Ulubelu

The Ulubelu geothermal field I administratively located in Tanggamus, Lampung. The power plant began its operation in 2012, it is operated by PLN (Indonesia Electricity Company) whilst the steam is produced by PGE. Unit 3 started its operation in 2016 while Unit 4 started its operation 9 months after.

2.2.4 Karaha

The Karaha geothermal field is located in Tasikmalaya, West Java. PGE started to maintain some wells which were drilled by KBC. In order to support a 30-MW plant, PGE drilled additional 5 development wells and performed workover on 3 wells. The plant has been operated since April 2018.

2.2.5 Lumut Balai

The Lumut Balai geothermal field is located in Muara Enin, South Sumatra, associated with the Sumatra volcanic belt. PGE drilled 24 wells, three of which were drilled before 2009, to support 220 MW of electric capacity. The first unit of 55 MW was proposed to start operating in 2017. But due to various obstacles, the commissioning has been delayed until 2016. The next unit of a 55 MW power plant is also undergoing construction that should commence operation by 2017.

2.2.6 Hululais

The Hululais geothermal field is situated about 80 km north of Bengkulu City in Sumatra Island. It is owned by PT Pertamina Geothermal Energy (PGE), the first stage development scenario was 110 MW in total from 2 X 55 MW under the scheme of steamfield project. Exploration drilling has been conducted since 2010.

2.2.7 Sungai Penuh

Located in Kerinci Regency in Jambi. The project is estimated to have a potential 80 MW in capacity. PGE prepared the exploration drilling in 2010. The first exploration well has been completed in June 2013 in order to support a first 55-MW unit. The drilling activities took six months due to a technical problem. To date, five wells have been drilled. The main barrier in preparing such activities is a very limited infrastructure at Sungai Penuh and its location in the National Park of Kerinci Seblat (Darma, 2016).

3. MANAGING MULTIPLE PROJECTS

In highly competitive and turbulent atmosphere, every company experiences an increasing pressure to deliver more, better and quicker output. Thus, it leaves some paradox in managing projects: the persistent need for quick results and value creation as prime focus of project output. The main concern now is no longer the capital asset, system or facility etc., but increasingly the challenge of linking business strategy to projects, maximizing revenue generation, and managing the delivery of benefits in relation to different stakeholder groups (Winter et al, 2006).

In a multi-project environment with no or little free resource capacity nor with capacity increases in prospect, project performance is affected by interdependencies with other concurrent projects as well as by residual effects from prior projects. In order to accelerate one particular project, top management has no alternative but to capture resources from projects that were scheduled to unfold simultaneously.

When the start of project 1 is delayed, this project becomes a priority and pulls additional resources during the early stages. As project 1 nears completion, its priority status changes, and it starts releasing resources. In the meantime, because project 2 lost resources mid-course due to project 1, it has become a priority relative to the other concurrent project and it will also capture some resources from that project; likewise, project 3 receives additional resources at a later stage once the priority status of project 2 changes again. Hence, project 1 captures resources in one period to release them later in two periods; project 2 captures resources in two periods to release them later in three periods; and project 3 even releases resources between periods during which it captures resources because of intense fluctuation of its relative priority.

As top management puts pressure on a project team to complete a particular project on time, the delays in the elapsed durations of subsequent projects added together tend to exponentially increase due combination of several factors: schedule pressure after a time delay, increment oscillation in project priorities; and productivity decreases since the team's size fluctuate. This dynamic approach eventually could lead in generating a persistent steady state that degrades the organization's long-term performance in terms of its capability to deliver projects efficiently.

Addressing this issue, the design of the organization is a very important point as a project-based organization. Miterev et al. (2016) presented a model to represent the factors influencing the design of the project-based organization. The concept of their model is based on some key points: the decision to be project-oriented is a strategic decision that influences the overall strategy of the organization whilst that decision says that the project-based working are the main business process that will be adopted by the organization. To create a fit between the processes adopted and the decision to be project-oriented, between processes in the line and on projects different functions, processes adopted and the context needs an organization structure. Project cultures are needed to promote behaviors in the organization to reflect project-based working. Project-based organization requires to adopt human resource management approaches that reflect that churn.

3.1 Multiple Projects Conducted by Pertamina Geothermal Energy

The project cycle for the geothermal projects as implemented by PGE comprises three phases: exploration, exploitation and operation phases (Figure 4). The exploration phase is further subdivided to four development steps: preparation and permit to conduct survey of G&G, constructing infrastructure, exploration drilling and production test of the exploration wells. The exploitation phase is divided into preparation & permit, constructing infrastructure, development drilling, production test of the development wells, FEED and EPCC. EPCC is intended for the construction of the steam gathering pipe network, power plant and transmission line construction (if any).

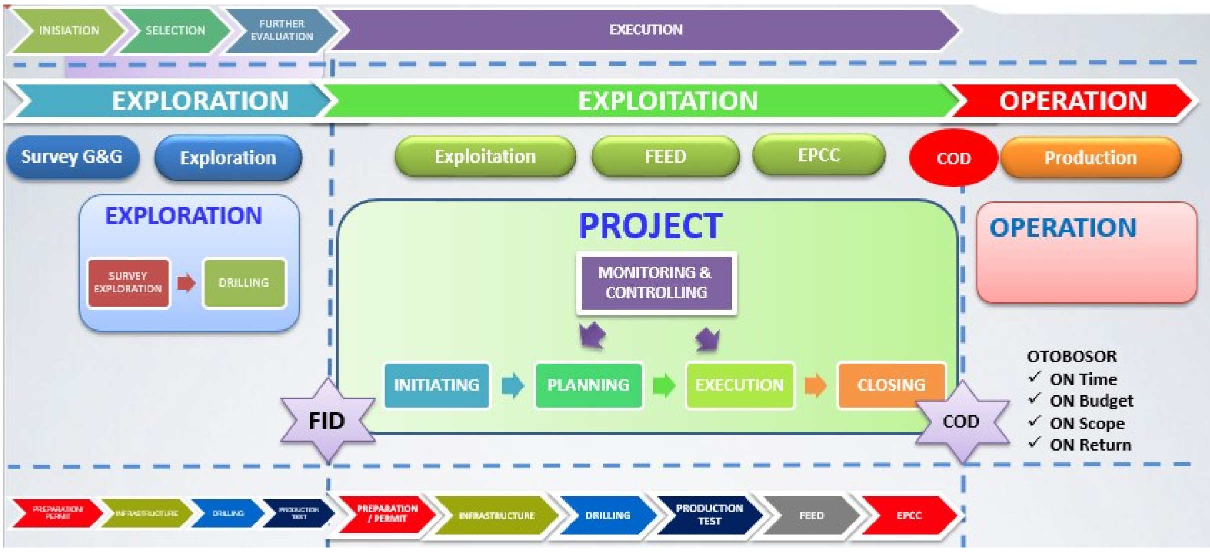


Figure 4 : PGE's project life cycle.

PGE relies on 14 geothermal working areas to push ahead its ambitious geothermal energy development plans to support GoI's target to develop renewable energy. Additionally, from 2008 to date, in parallel PGE is conducting geothermal development projects with a total capacity of 600 MW. Five projects have been completed and three more projects are still under development. In addition to that, three other projects are still under exploration phase. Despite that the organization operates the project in parallel, the activities in each project are also performed concurrently (Figure 5).

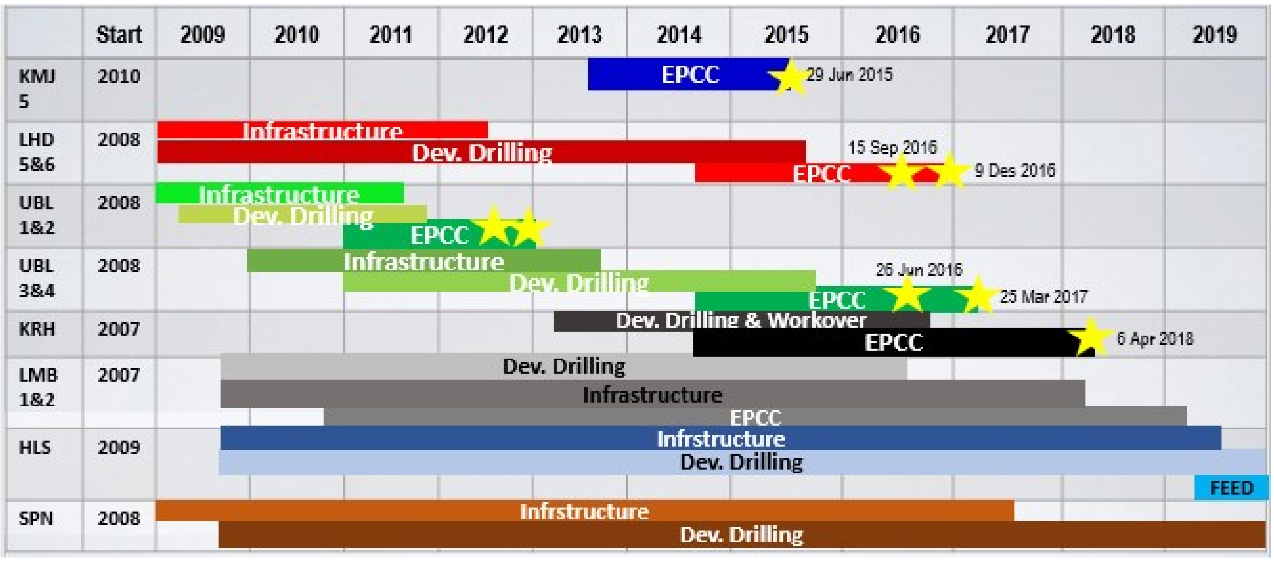


Figure 5: PGE's multiple projects.

3.2 PGE's Organizational Design for Managing Multiple Projects

As project-based organization, design of the PGE's organization views various organizational arrangements as complementarities and conceptualize projects as temporary organizations nested in the parent organization. PGE develops its organizational structures to create a fit between the processes adopted and organization strategy; between the processes adopted in the line and on projects, between the processes adopted in different functions, and the processes adopted and the external context (Figure 6). In particular, the processes adopted in parts of the organization that are still functional, such as the Human Resource Management and Finance Departments should reflect project-based working.

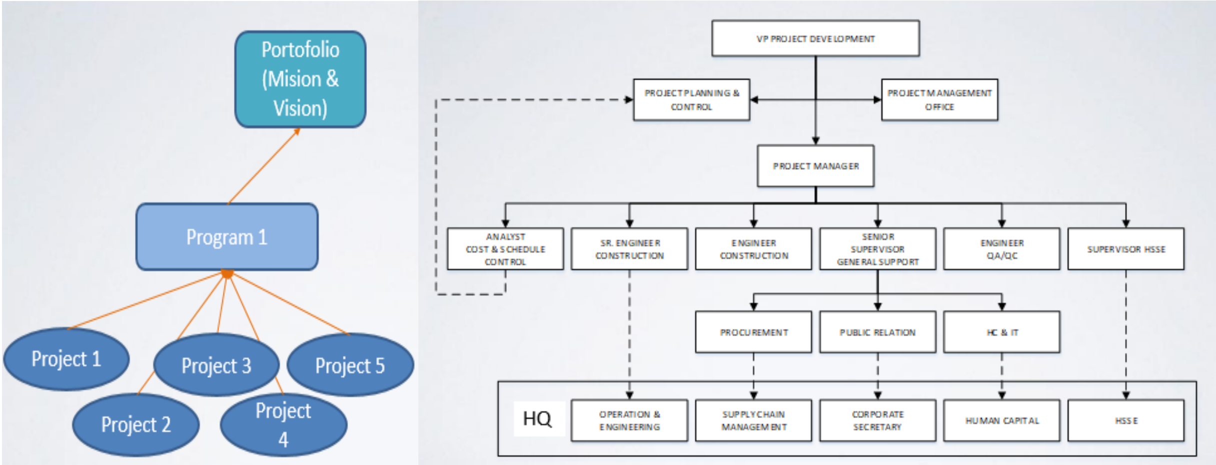


Figure 6: PGE's organizational structure.

In order to manage its multiple projects, PGE created a department called Project Development. It facilitates the control and management of all the projects operates by the company. The multiple-project manager or Program Manager in the context of PGE is known as Vice President of Project Development. Two managers – Project Management Office Manager and Project Planning Manager based in Head Quarter assist the Vice President on performing his duties whilts each project at site has one project manager dedicated full time to a project. The project manager is responsible for overlooking all activities in his project. The project structure itself adopts a matrix organization in order to align its portofolio, program and project.

There are two types of project organizations in PGE, namely:

1. Greenfield Project Organization, where the organization of project consist of 11 personnel including the Project Manager while the Engineering function is a matrix organization which is assisted by Operation & Engineering Function from the Head Office.
2. Brownfield Project Organization, where the project organization consists of personnel from area geothermal who are given assignments through Instruction Letter issued by President Director. However, the organization could also get the assistance from Operation & Engineering Function from the Head Office

In addition to above mentioned structure, PGE employs a full team of Project Management Consultants (PMC) to assist PGE's project team during the EPCC stage. As this is a critical point for a project to deliver its value and it has also lessened the interdependencies with other concurrent projects, especially with the Operation and Engineering Function.

To maintain the project goals and schedules, a project coordination meeting will be held regularly.

1. Weekly meetings with project members and Project Manager as well with PMO & PPC Manager through video conference.
2. War rooms are held every two weeks with the presence of Board of Directors.
3. Monthly meetings with the Implementing Coordinator and Project Controller are held at the latest H + 8 from the end of each month with a progress improvement agenda, the plan for the coming month and concern for project items.

By having this organization structure, PGE has been able to deliver six geothermal power plants, successfully commercialized from 2015 – 2018 with the total capacity of 215 MW. All of them are geothermal power plant built, owned and operated by PGE with one ongoing to be commercialized in Q2 – 2019. Another project was successfully commercialized to supply steam to a power plant owned by PLN with the capacity of 110 MW.

4. CONCLUSIONS

Project-based organizations should carefully decide its strategic decisions to be project-oriented and adopt projects, programs and project portfolios to perform its work, especially in multiple-project environment. The project-based organizations should develop organizational structures to create a fit between the processes adopted and organization strategy and needs to adopt a project-oriented culture, where everybody working in the organization recognizes that is the organization's way of doing business and adopts appropriate behavior.

In order to manage its multiple projects, PGE has a department called Project Development to overlook and generate value by linking between its projects and their permanent organization. It has considered a temporary team called PMC to assist its permanent team. Sharing of responsibility between the permanent team and temporary team as a primary reason why a novel form of organization is required. Having this organization structure has allowed PGE to deliver its project completion successfully. A competition for resources and attention between projects could be minimized by the company.

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