

## **Analyzing the Value Chain to Increase the Competitive Advantage of Geothermal Energy Businesses (a case study PT Sorik Marapi Geothermal Power)**

Syaiful Bahri Lubis<sup>1</sup>

<sup>1,2</sup>Universitas Muhammadiyah Sumatera Utara

<sup>1</sup>[Syiaful.otp@gmail.com](mailto:Syaiful.otp@gmail.com)

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### **ABSTRAK**

PT Sorik Marapi Geothermal Power adalah perusahaan energi panas bumi, analisis rantai nilai adalah salah satu alat yang dibutuhkan oleh semua perusahaan untuk mencapai keunggulan kompetitif terutama dalam pengembangan panas bumi. Penerapan rantai nilai adalah sebagai strategi bagaimana suatu perusahaan akan dapat mengetahui semua kegiatan bisnis untuk mencapai keunggulan kompetitif dan menghasilkan produk yang berkelanjutan. PT Sorik Marapi Geothermal Power menerapkan teknologi & inovasi terbaik untuk mengembangkan energi panas bumi dengan lebih hemat biaya. Penelitian ini menggunakan penelitian kualitatif dengan studi kasus dengan melakukan observasi & wawancara di lapangan. Hasil penelitian ini didukung oleh data primer dari informan & data sekunder dari tinjauan pustaka & penelitian sebelumnya. Tercapainya keunggulan kompetitif dalam pengembangan energi panas bumi dengan rantai nilai dengan menerapkan sistem pembangkit listrik siklus biner, pengeboran efektif, dan sistem konstruksi knock-down. Keunggulan kompetitif harus didukung oleh tenaga kerja yang tepat dan memiliki peran penting untuk mencapai target perusahaan. PT Sorik Marapi Geothermal Power dapat mencapai keunggulan kompetitif dengan memiliki strategi biaya yang efisien karena perusahaan dapat menghasilkan energi 1 unit / tahun & sudah dihasilkan dengan kapasitas energi 140MW ke PT PLN melalui saluran transmisi 150 KV. Dalam proses bisnis PT Sorik Marapi Geothermal mendapatkan keuntungan 2,2 energi dibandingkan dengan teknologi konvensional & memiliki perjanjian energi listrik lebih murah dibandingkan BPP bagian Sumatera dengan harga 8,1 sen.

### **ABSTRACT**

PT Sorik Marapi Geothermal Power is a geothermal energy company, value chain analysis is one of the tools that is needed by all companies to achieve the competitive advantage especially in geothermal development. The implementation of a value chain is as strategies how a company will be able to know all the activities of business to achieve competitive advantage and produce sustainable products. PT Sorik Marapi Geothermal Power applies the best technology & innovation to develop geothermal energy with more cost-efficiency. This research used qualitative research with case study by doing observation & interview in the field. The result of this research was supported by the primary data from informant & secondary data from literature review & the previous research. The achievement of competitive advantage in developing geothermal energy with value chain by applying binary cycle power plant system, drilling effectively, and knock-down construction system. The competitive advantage should be supported by the right manpower have the significant role to achieve on company's target. PT Sorik Marapi Geothermal Power could achieve the competitive advantage by having the efficient cost strategy because company could produce energy 1 unit/year & already generated with 140MW capacity of energy to PT PLN through 150 KV transmission line. In process business of PT Sorik Marapi Geothermal gets the profit 2.2 energy compared with conventional technology & has the agreement of electricity energy is cheaper than BPP of Sumatera section with the price 8.1 cent.

## **INTRODUCTION**

At present Indonesia relies on fossil energy relatively high, more than 90% the usage of national energy resources from fossil energy. According to the Indonesia National Energy Council (DEN) 2017, Indonesia depends on fossil as primary energy with the total 194 million tonnes of oil equivalent (Mtoe). The energy consumption is 43% by fossil fuel, 18% natural gas, and 31% coal. Fossil energy is not as renewable energy. They are formed over thousands of years. So that it will be faster forming than resources. The usage of fossil energy will have a negative impact on the environment & mortals that cause energy fossils to have a high carbon dioxide emission & affect the greatest global warming. By

having the highest consumption of fossil energy, it will make insufficient the existence of oil & gas so that the Government of Indonesia should use the National Government Budget (APBN) to buy fossil fuel from abroad to supply energy for the community (Setyaningsih, 2011). Finally, it will increase the foreign exchange even affect the rupiah weakened beyond USD.

As stated above, the value chain has the significant role to establish geothermal as sustainable energy to increase efficiency & effectiveness to achieve the competitive advantage. By having that strategy the company will have Power Purchase Agreement (PJBL) to supply sufficient energy to the community either for household & business activities. The implementation of a value chain is a strategy to describe all activities of the company to achieve the competitive advantage and the ways to create & production. Value chain can describe some activities of the company and know the cost leadership & differentiation strategy that already applied & the existing potential of a product (Porter, 1985). As a business environment developed and made a change of business environment rapidly. In this case each company needs to have the improvement of competitiveness to survive in the global business, in this case the challenges will increase the demand of the company to get a better performance.

Value chain is a tool to understand the competitive advantage by identifying all activities of a company that can reduce cost and relationship between company & suppliers, & customers in industry will be better. It formulates some activities in organization that consist of primary & support activity. By having this strategy, the company could get the efficient cost for each activity either primary or support activity to avoid expenses no need to be spent. So, in this the correlation between management accountancy is how the company can achieve the differentiation & low-cost strategy (Periansya, 2011). Geothermal is a reliable energy friendly environment for the future as reliable energy that can supply sufficient electricity. In conclusion, geothermal energy is primer energy. As the Chairman of Indonesian Geothermal Association said (API) transition to clean energy is a great potential.

KS Orka Renewables Pte Ltd is one of the largest developing geothermal projects in 4 continents. KS Orka Renewables is the majority owner of two geothermal developers, PT Sorik Marapi Geothermal Power that is located in Mandailing Natal Regency, North Sumatera Province that has 240 MW resources of geothermal energy. This company has achieved Commercial Operation Date (COD) until unit 3 with the installed capacity of 140 MW that has already been transmitted to the State Electricity Company (PLN). Here is the process until Commercial Operating Date (COD) unit-1 45 MW 05 October 2019, unit-2 45 MW 07 July 2021, and unit-3 50 MW 07 October 2022. For Sokoria Geothermal Indonesia in Ende, East Nusa Tenggara with capacity 30 MW has already achieved Commercial Operating Date (COD) unit-1 28 March 2022. Currently the government of Indonesia gives a recommendation to KS Orka Renewables to develop other geothermal potentials; those are 6 in the island of North Sumatera & 1 in the island of East Java.

PT Sorik Marapi Geothermal Power can have this by using Kaishan's technology with Epander & Organic Rankine Cycle (ORC). By using this technology, the generation of production can be converted to 2.2 energy compared with conventional. PT Sorik Marapi Geothermal Power uses this technology in geothermal development and will be efficient in cost if compared with other geothermal developers. Because expander & ORC can produce energy with various well characteristics with different pressures and enthalpies can still be used to generate electricity. If the well test finished company will get generation also the process of construction is faster because it uses a knock-down method. This method can construct unit with some modulars (ORC & expander) It will reduce cost or be more efficient in geothermal development. In this research the Commissioning Operating Date (COD) unit 3 was late, it should be in May 2022 it was in October 2022. It will be further research.

According to background the aims of this research as follow;

1. How the value chain in PT Sorik Marapi Geothermal.
2. How the competitive advantage in PT Sorik Marapi Geothermal Power by having performance of value chain.
3. Are there any disadvantages that caused by the late Commercial Operating Date (COD) unit-3?

## RESEARCH METHODS

### Conceptual Framework

Value chain is defined as describing all activities of a company that need to produce goods and services beginning from design, raw materials, and production process to customer and maintain the good relationship after market. Porter said, value chain analysis is a strategy tool to identify the

competitive advantage of a company. The identification of their value customers can be improved and can reduce cost and understand good relations between companies with suppliers, customers, and other companies. Value chain is a strategy of a company to describe primary & support activity. Value chain can be depended on the kinds of the industry & there is difference for manufacture, Services Company, and organization is not as profit-motive (Porter, 1980 dalam Pawarrangan, 2012).

Value chain analysis is as one the product of value chain is the activities begin from raw material until get the marketing & sales. It occurs with supplier linkages & relation with consumer linkages. These activities are divided into different activities but those are linked to support each other (Porter, 2001 dalam Wibowo, 2014). Value chain is very useful to identify related activities as strategy. They consist of five main activities (inbound logistic, operation, outbound logistic, marketing & sales, services) and four support activities (Firm infrastructure, human resources management, technology development, procurement) that can be created value & cost in a business.

Support activities that consist of procurement, technology development, human resources management, firm infrastructure, company should put the right one to manage this strategy. By having cost leadership, the company will get more profit even though there are some challenges from competitors. Hansen & Mowen (2004:489). The competitive advantage is one of the greatest strategies of the company facing a rival. The company designs a strategy to get competitive, competitive, sustainable so that the company can be a market leader. (Prakoso, 2005:53). Researched by Usvita (2014), Djodjobo & Tawas (2014), Mulyana (2014), Agha et al. (2012), Wanget al. (2011), Li et al. (2006), Bharadwaj et al. (1993) dan Miller (1988). Stated that competitive advantage gives positive impact & significant to company performance.

## Literature review

This research uses the previous research done by Ayuningtyas, Harianto, Arief Safari (2018) with the title “Pengembangan Strategi pada Aktivitas Rantai Nilai Panas Bumi” pada sebuah perusahaan pengembang energi panas bumi (PT Geo Dipa Energi)”. This company is as geothermal developer and it is same with PT Sorik Marapi Geothermal Power. Here are the activities of value chain as table below;

Table 1. Literature Review of the previous research

Author	Title	Value Chain Activity
Ayuningtyas, Harianto, Arief Safari (2018)	“Pengembangan Strategi pada Aktivitas Rantai Nilai Panas Bumi (Studi Pada PT Geo Dipa Energi (Persero))” “Strategy Development of Value Chain in Geothermal Energy (study in Geo Dipa Ltd (Persero))”	a. Main activity -inbound logistic, need supplier either goods or services for operational activity of geothermal - operation Operation activity PT Geo Dipa does the operation in the existing area (Dieng & Patuha) that has already generated and exploration in new potential areas. Also does some activities in exploration phase area likes (Candradimuka, Arjuno Welirang, & Candi Umbul Telomoyo) This company does the activities in the first area are establish production wells, injection wells,
Author	Title	Value Chain Activity
Ayuningtyas, Harianto, Arief Safari (2018)	“Pengembangan Strategi pada Aktivitas Rantai Nilai Panas Bumi (Studi Pada PT Geo Dipa Energi (Persero))”	brine, make up well, injection condensate wells, monitoring reservoir & underground

Author	Title	Value Chain Activity
Ayuningtyas, Harianto, Arief Safari (2018)	<p>“Pengembangan Strategi pada Aktivitas Rantai Nilai Panas Bumi (Studi Pada PT Geo Dipa Energi (Persero))”</p> <p>“Strategy Development of Value Chain in Geothermal Energy (study in Geo Dipa Ltd (Persero))”</p>	<p>facility, operation, and maintenance (O&amp;M) steam field, and operation and maintenance (O&amp;M) power plant</p> <ul style="list-style-type: none"> <li>- Outbound logistic</li> </ul> <p>Outbound logistic in geothermal company is electricity power that bought by State Electricity Company (PT PLN)</p> <ul style="list-style-type: none"> <li>- Marketing &amp; sales</li> </ul> <p>In Geothermal Company the marketing &amp; sales is not assigned to the special person because the electricity power that produced is bought by State Electricity Company (PLN) as a single buyer. It is as electricity transmitter in Indonesia</p> <ul style="list-style-type: none"> <li>- Services</li> </ul> <p>Activity in services as consumer is PLN, both of companies do the matching of Kwh meter has the same total of electricity power that transformed to transmission of State Electricity Company (PLN)</p>
		<ul style="list-style-type: none"> <li>- <b>Support activity</b></li> <li>- Infrastructure</li> </ul> <p>Activities of this section include as follows; general management, public affair, planning, financial accounting, law, and Government relation to support the performance of all value chain</p> <ul style="list-style-type: none"> <li>- Human Resources Management</li> </ul> <p>Human Resources Management functions have the best way to get targets of production. In this case Human Resources Management of Geo Dipa do the recruitment, employee placement, reward &amp; punishment, training &amp; development, retirement &amp; payroll</p> <ul style="list-style-type: none"> <li>- Technology Development</li> </ul>

Author	Title	Companies always do the best strategy for technology development likes; exploration techniques to have the greatest geothermal resources & spend with efficient cost.
		Value Chain Activity
		<ul style="list-style-type: none"> <li>- Procurement In this activity, Company does the procurement to support operational activity to make sure the materials needed is always available on time &amp; spend with low-cost</li> <li>- Method The research uses the descriptive method based on case study.</li> <li>-Data &amp; data sources Primary &amp; secondary data sources either from quantitative or qualitative methods. Primary data can be found by doing observation, interview, and questioner &amp; secondary data by literature review &amp; related documents.</li> <li>-Data analysis technique This section uses the PESTEL analysis (asses political, economic, social, technological, environmental, and legal factors) this analysis method to measure the weakness &amp; strengthen.</li> </ul>

As the above statement the conceptual can be written as follow;

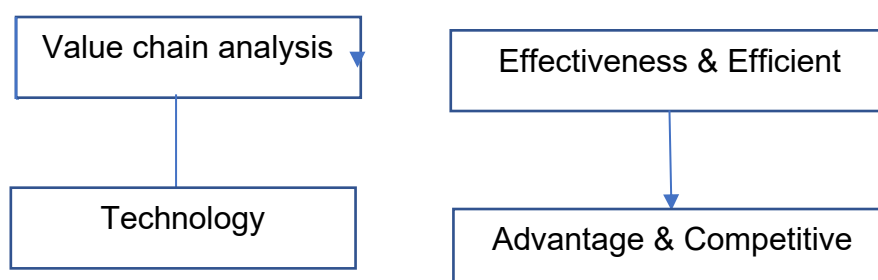


Figure. 1. Conceptual Framework

Methodology approach

This research used a qualitative approach with a case study & descriptive. According to Denzin & Lincoln, qualitative research is research that uses nature settings that have the purpose of describing phenomena happening and doing it with some methods. Qualitative approach is the most important strategy to understand the social phenomenon & individual perspective that is researched. Qualitative research has the procedure of research with the result of the research being expressed in words either verbal or written to the analysed person. This research used a case study as Suharsimi Arikunto stated, case study is approaching research done by intensive, detailed, & depth study of complexity issues. This research is done in PT Sorik Marapi Geothermal Power as a geothermal developer located in Mandailing Natal Regency, North Sumatera Province, Indonesia. In this research how to get the maximal result of the advantage competitive trough value chain analysis in geothermal business. Collecting the data can be collected by doing observation, interview & documentation to the field then analysed the data research related to value chain activity in the company either primary activity or support activity. Here are the steps to collecting the data;

1. Preparation (creating questions, literature review)
2. Setting the time (make sure the informant can be interviewed to get the data)
3. Transcript the data by tabulation
4. Observation & interview
5. Analysis the data
6. Compare the data

Table 2. The questionnaire of this research is written down as table below;

Research Focus	Needed result	Informant	Data collecting technique
Identify the value chain activities that applied in company	The application of value chain including primary & support activity	-Terry Satria Indra - Ali Sahid (WKTPB) -SCM Department -Richard Alexander (Head of Operation)	Observation, interview, documentation
Low-cost strategy & differentiation strategy to have the competitive advantage	Strategy of company to get the competitive advantage in geothermal business	-Terry Satria Indra (KTPB) Susan (Finance & Accounting Manager)	Observation, interview, documentation
Technology used by company to get the competitive advantage	The competitive with other competitor how to have lower COGS compared with other company specially in geothermal business	Ali Sahid (WKTPB) Terry Satria Indra (KTPB) -Richard Alexander (Head of Operation)	Observation, interview

As the above table, the research will be taken by doing observation, interview as primary data starting from main activities & support activities. Interview done directly to informants and zoom online (FGD) to compare the data that was tabulated in the table. Data analysis technique of the research can be described as below;

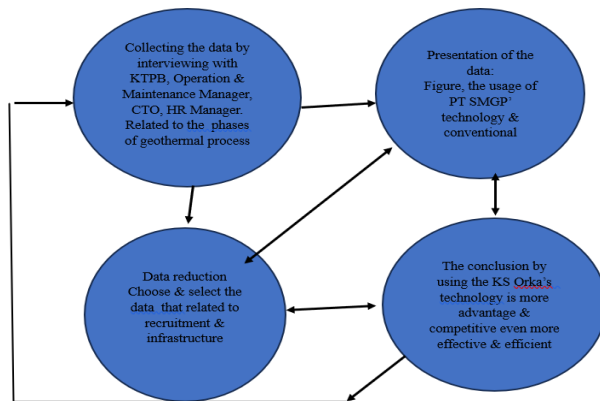


Figure 2. Data analysis technique

## RESULT AND DISCUSSION

This research took place in KS Orka Renewables Pte Ltd KS Orka Renewables Pte Ltd is one of the largest developing geothermal projects in 4 continents. KS Orka Renewables is the majority owner of two geothermal developers, PT Sorik Marapi Geothermal Power that is located in Mandailing Natal Regency, North Sumatra Province that has 240 MW resources of geothermal energy. This company has achieved Commercial Operation Date (COD) until unit 3 with the installed capacity of 140 MW that has already been transmitted to the State Electricity Company (PLN). Here is the process until Commercial Operating Date (COD) unit-1 45 MW 05 October 2019, unit-2 45 MW 07 July 2021, and unit-3 50 MW 07 October 2022. For Sokoria Geothermal Indonesia in Ende, East Nusa Tenggara with capacity 30 MW has already achieved Commercial Operating Date (COD) unit-1 28 March 2022.

### Value Chain PT Sorik Marapi Geothermal Power

Value chain is a strategy that is applied to identify a company in creating products or services that have sustainable relation between internal & external for cost-leadership & differentiation strategy to get the competitive advantage of how the company can always compete with others. Here are the value chain analysis in PT Sorik Marapi Geothermal Power as table below;

Table 3. The result of observation for primary activities of value chain

The observed activity	The result of observation & interview
Inbound logistic	Company does purchase some materials (consumable parts & special material e.g. compressor, control valve, generator, motor & pump) that will be used to
The observed activity	The result of observation
	establish electricity, in this case company selected the best clients with Comparison of the price to find the best quality & price. Especially for spare parts that will be used for power plant establishment, they are supplied by Zhejiang Kaishan Compressor Co., Ltd. Some materials that bought already manufactured before sending to the project. So this strategy can build power plants faster. Company assigns special employee to have good governance as internal control

Operation	The research takes place in a company that produces electricity power and sell it to The State Electricity Company (PLN). Since the company has transformed energy when the company acquired a 100% stake OTP Geothermal in 2016. The activity began with land clearing, land acquisition, drilling & built power plants. Currently, the company has already produced 140 MW capacity energy. the Company also does operation & maintenance (O&M) to make sure the product is always available.
Outbound logistic	The result produced by the company is electricity energy sold to PLN, PLN is a single buyer as well as the single seller of electricity in Indonesia. The result of electricity is assembled in 66kv transmission. Both companies have two Kwh meters consisting of the main kwh meter & comparison kwh meter.
Marketing & sales	Marketing & sales in PT Sorik Marapi Geothermal Power is not handled by a special person, because it is a single buyer by PLN and as a contributor in Indonesia.
Services	For service activity, the company makes efforts to make sure resources of energy are sufficient according to yearly planning operation (ROT) and it is discussed &
The observed activity	The result of observation
	monitored in plan allocation for energy (RAE) with PLN. It is done to make sure the electricity power that is transformed to PLN as target and also efforts to improve power plants operate can be discussed at the meeting. To make sure the accuracy of kwh meter, company always calibrates & validation by PLN as buyer

Table 4. The result of observation for support activities of value chain

The observed activity	The result of observation & interview
Infrastructure	Construct power plant & other facilities that have been done by company related to power purchase agreement (PPA) and The Stated Electricity Company (PLN) always discusses operations that are needed (SLS, SLO, URC & COD). Check kwh meter is also done at the same time while unit rated capacity (URC) & commercial operation date (COD) is declared.
Human Resource Management	Human Resources Management  Human Resources Management functions have the best way to get targets of production. In this case



	Human Resources Management of the company does the recruitment, employee placement, reward & punishment, training & development, retirement & payroll.
Technology development	As a geothermal developer of electricity energy does not use conventional technology but the company uses Kaishan's technology by using some modular (ORC & expander) with binary cycle power plant system, by having this technology the waste heat from expander can be used.
The observed activity	The result of observation & interview
	As a geothermal developer of technology but company uses Kaishan's technology by using some modular (ORC & expander) with binary cycle power plant systems. By having this technology the waste heat from expander can be used again with the binary system even brine. Brine before transforming to ORC (Organic Rankine Cycles) it will be transformed firstly to low pressure separator for flash then producing brine that can be used to get energy.
Procurement	PT Sorik Marapi Geothermal Power applies the strategy of procurement process. If a company needs materials urgently, it will be purchased & supplied by local vendors but if the materials that will be used for power plant or main equipment supplied by Kaishan as project owner as import by having master list from aboard as import duty exemption.

#### 1.1.2. Competitive advantage in Geothermal Business

The competitive advantage that applied by PT Sorik Marapi Geothermal Power according to observation, interview in the field by researcher. the result is written down as table below;

Table 5. The result of the competitive advantage PT Sorik Marapi Geothermal Power

Questions	Respond
1. What strategy does PT Sorik Marapi Geothermal Power do to get the competitive advantage?	Besides the company business, PT Sorik Marapi Geothermal Power always improves the geothermal utilization continuously. In this case, as geothermal developer technology is also improved. Company develops exploration strategies to get the best sources with spending efficient cost through drilling with safety, effectiveness, and efficiency. Besides drilling technique, the company also develops power plant construction so that can maximize power plant capacity & generation. The business company uses technology combination power plant

Questions	Respond
	expander & ORC (Organic Rankine Cycle-binary). technology can use the steam & brine. It still can be used the waste brine form expander as generation or binary power plant
2. What does the company do to keep the energy sources available?	After generating energy until unit -3 with 140MW capacity, the company still improves exploration to get sufficient sources of energy with spending efficient cost by using drilling method by safety, effective, and efficient. Besides drilling improvement company also develops power plant construction with technology so that can maximize the capacity of the power plant and increase reliable operation. In this case, to make sure the production of electricity is always available PT Sorik Marapi Geothermal Power does maintenance & operation (O&M).
3. Does PT Sorik Marapi Geothermal Power get the competitive advantage with the strategy that is applied by the company?	Yes, it does. Because the company applies low-cost strategy & differentiation strategy for it's geothermal business it can be seen with 140 MW capacity also with power plant modular expander & ORC (organic rankine-cycle). By using this technology, it can utilize steam & brine with utilization waste steam from expander still used for power plant binary system it is same with brine

as the above statement, value chain analysis is how the company identifies all activities of the company beginning from raw-materials until producing goods/ service, this activity will give the competitive advantage. PT Sorik Marapi Geothermal is able to generate 140MW capacity & strategies to make the company can develop geothermal energy with efficient cost and drilling method safely, efficiently & effectively. So, the researcher writes down as figure below;

<b>Firm infrastructure</b> Construct all support families of the company, company asset, risk management, plan budget, strategy, community development & community relation (CDCR) & good corporate governance (GCG)
<b>Human Resource Management</b> Recruitment, assignment, reward, punishment, training, and development
<b>Technology development</b> Technology development, improve drilling method, use binary cycle system and construct power plant that already manufactured from Shanghai (Kaishan's technology)
<b>Procurement</b> Purchasing material, select vendor with the best price, order goods or services, and evaluate supplier

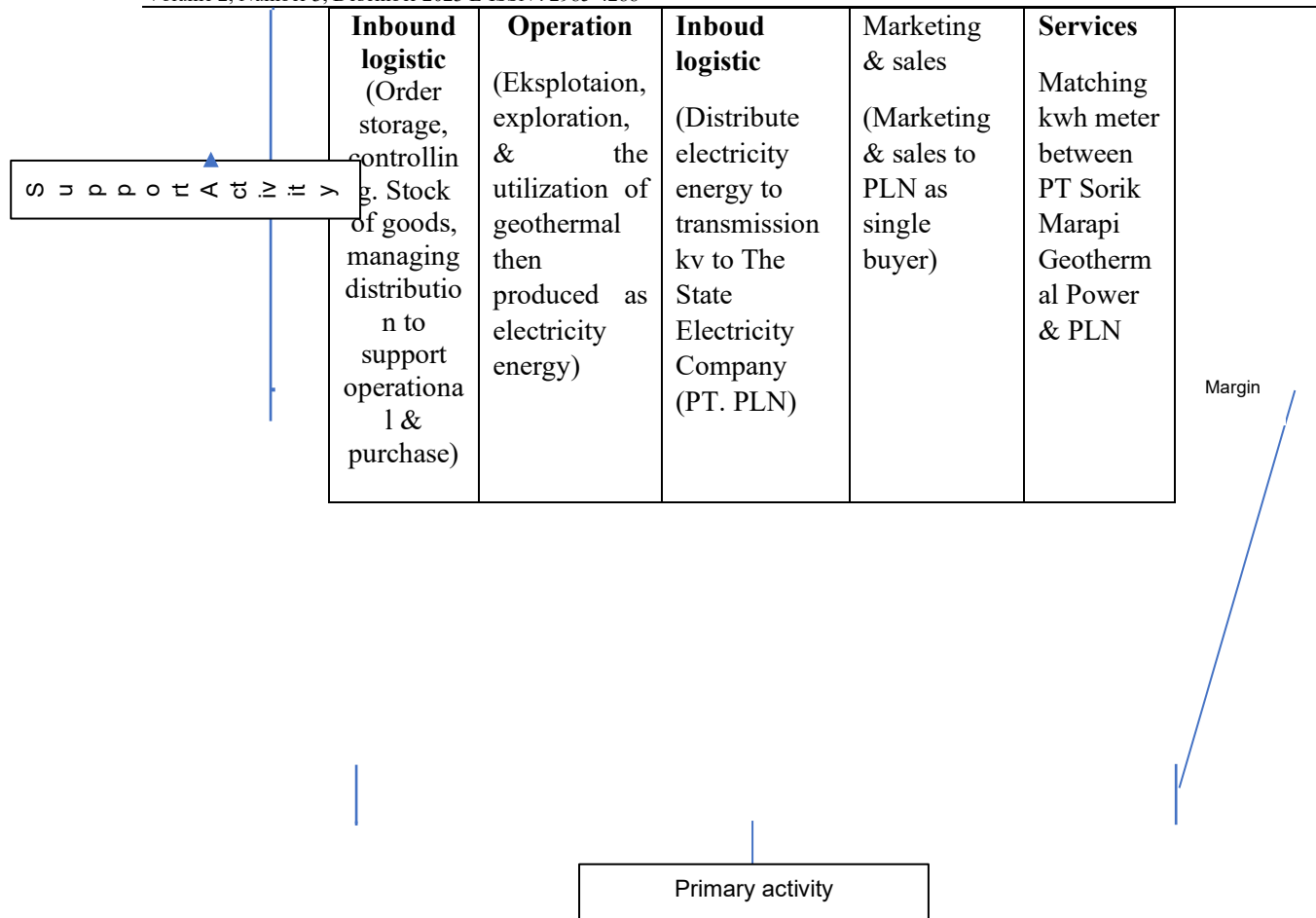


Figure 3. Value chain activity PT Sorik Marapi Geothermal Power

#### Commercial Operating Date (COD) PT Sorik Marapi Geothermal

PT Sorik Marapi Geothermal Power has been generating electricity energy 140MW started operating in late year 2019. Here is the process until Commercial Operating Date (COD) unit-1 45 MW 05 October 2019, unit-2 45 MW 07 July 2021, and unit-3 50 MW 07 October 2022. The research found the late Commercial Operation Date (COD) unit-3, it should be generated in May 2022 but it can be generated in October 2023. This finding is classified to inbound logistic & outbound logistic in value chain analysis.

#### Discussion

##### Value Chain PT Sorik Marapi Geothermal Power

After getting the data on the field, the researcher did verification to informants of the company. They are experienced people in the same company before. The data will be analysed by comparing between theoretical, previous research, and informant statements.

##### Inbound logistic

Inbound logistic Is activities of the company includes receive, store, raw material contribution, until the raw materials can be used for production process. as raw materials to suppliers (Friska S. (2010), Periansya. (2011), Luhung, Damar Afrian. 2019). According to previous research & data from informants inbound logistic is activity that purchase materials, storage then contributing for internal support operational. Because as raw material in geothermal is sources that are drilled from underground (steam & brine). This is same with previous research by Safari Ayuningtyas, Harianto, Arief Safari (2018). Terry Satria Indra stated as below;

“The activity of geothermal developer for renewable energy needs sufficient supply chain goods and services can be supplied continuously. So that Power Purchase Agreement (PPA) could be transformed to PLN on time. Inbound logistic in geothermal activity is as materials support operational”

#### Operation

According to theoretical, operation is (Friska S. (2010), Periansya. (2011), Luhung, Damar Afrian. (2019) Activities required to transform inputs into outputs (product or services), packaging, maintenance to equipment, insurance, printing & other operational facilities. In this case, as data research from previous research by Ayuningtyas, Harianto, Arief Safari (2018) is same with activity in PT Sorik Marapi Geothermal Power. Terry Satria Indra & Ali Sahid stated as below;

“PT Sorik Marapi Geothermal Power is as an electricity company that sold & transmitted to The State Electricity Company (PLN) company has already constructed to develop unit-1, unit-2, & unit-3 with 140 MW capacity trough 150KV transmission. This successful is achieved by company since acquired 100% share of OTP Geothermal. Starting from 2016 by doing land acquisition, constructed production wells, injection wells, condensate, make up wells, operation & maintenance (O&M) steam field & power plant. Company applies the best strategy either management or monitoring to keep the energy can be maintained to transmit”

#### Outbound logistic

Outbound logistic in Geothermal company, the result is electricity energy. Thus, energy is transmitted to PLN then PLN contributes to community. It will be as outbound logistic (outputs) IF company transmits the energy to PLN trough 150 kv transmission. Electricity that produced from power plant will be flowed by transformer to switchyard. If we see from theoretical, outbound logistic is activity for storing, collection of goods, and distribution to buyer (customer) (Siddique and Arif 2021) . It has suitability between theoretical, previous research by Ayuningtyas, Harianto, Arief Safari (2018) & PT Sorik Marai Geothermal Power.for this activity Terry Satria Indra & Ali Sahid stated as below;

“Outbound logistics in Geothermal company produces electricity energy that transmits to PLN transmission as a single buyer for electricity then distributes it to the community. the company does storage of the energy by using 66kv transmission then transmitting to the company's substation. Outbound logistics (product) activity if the company has already transmitted energy to PLN by using 150 kv transmission. Electricity that produced from power plant will be flowed by the transformer to the switchyard. Company has two switch yards (PT Sorik Marapi Geothermal Power & PLN) as controller to know the total of energy transmitted to PLN”

#### - Marketing & sales

Marketing & sales is as information facilities, how the customer can reach product and how to make the customers interested in advertisement, promotion, and pricing. This activity needed to keep good relation & customers and decide price, (Friska S. (2010), Periansya. (2011), Luhung, Damar Afrian. (2019). This difference with geothermal company as previous research by Ayuningtyas, Harianto, Arief Safari (2018). Marketing & sales as data that found in field Terry Satria Indra & Ali Sahid stated as below;

“Geothermal business does not assign especially to the person (employee) to do marketing & sales. Because in this case The State Electricity Company Pte Ltd (PT PLN) is a single buyer. Energy that produced by company will be bought by PLN with contract of Power Purchase Agreement (PJBL) during 30 years to provide national energy, utilization of renewable energy & friendly energy according to the law of Indonesia (Permen ESDM No. 17 Tahun 2014) about Power Purchase Agreement of geothermal energy by State-Owned Company (PLN)”

#### Services

Based on theory, services are related to add extra services to keep product value (Friska S. (2010), Periansya. (2011), Luhung, Damar Afrian. (2019). But in geothermal company according to previous

research by Ayuningtyas, Harianto, Arief Safari (2018) services activity is as a controller the transmitted energy to PLN, namely matching kwh meter. This is an application to know energy transactions. For this case, the company always does calibration regularly & validated by PLN. Terry Indra & Ali Sahid stated as below;

“Services in PT Sorik Marapi Geothermal Power, company does the matching kwh meter that used for energy transaction based on Power Purchase Agreement (PJBL) by calibrating regularly and validating with PLN to control energy that transmitted to transmission or energy that transmitted from transmission to power plant of the company”

#### Firm infrastructure

Value chain activity for firm infrastructure based on theoretical is infrastructure consist of construct facilities, management, financial, accounting, law, government governance, and quality management (Friska S. (2010), Periansya. (2011), Luhung, Damar Afrian. (2019) according to previous research & data research on the field have the similarity stated by Terry Satria Indra & Ali Sahid as below;

“Activity of company for infrastructure is construction for all facilities & business development in achieving company target. Those include general management, public affairs, management, financial, accounting, law, government, governance that can support all activities of a company. With this strategy company can identify opportunity & threat with efficient & consistent, identify sources & capability”

#### Human Resource Management

Human Resource Management activity includes recruitment, training, development & competency for all employees in the company, Friska S. (2010), Periansya. (2011), Luhung, Damar Afrian. (2019). This is the same based on previous research & data research. For this activity Human Resource Management, Terry Indra & Ali Sahid stated as below;

“Human Resources Management functions have the best way to get the target of production. In this case Human Resources Management of the company do the recruitment, employee placement, reward & punishment, training & development, retirement & payroll”

#### Technology development

Technology development is activity done by the company to get the technology development for product and processing, either procedure knowledge or technology of process equipment (Friska S. (2010), Periansya. (2011), Luhung, Damar Afrian. 2019). The result of the data research this same with geothermal business as stated by Terry Satria Indra & Ali Sahid as below;

“In geothermal business needs to improve technology. Because geothermal developer should get the best strategy to get the commercial with efficiency & effective. PT Sorik Marapi Geothermal Power improves technology either power plant system, construction or drilling method. this company uses binary cycle power plant as Kaishan’s technology. PT Sorik Marapi Geothermal Power uses modular power plant concept with technology from Kaishan Manufacture which is their sponsor. The modulars is ORC (Organic Rankine cycle) & expander, this technology exploits steam & brine. this technology can use the waste brine from expander can be used for power plant binary system to get electricity energy for this technology, company gets the energy 2.2 compared with other (conventional system). The utilization of the technology also gives the complete advantage because it can reduce the cost. Currently, company has already generated 140MW capacity with phase 1 unit/year”

#### Procurement

Procurement is activity of procurement that has purchasing function that needed for support company business (Friska S. (2010), Periansya. (2011), Luhung, Damar Afrian. 2019). PT Sorik Marapi Geothermal Power on this section as the result of the data research, company does procurement for goods/services for support operational supplied on time by supplier.

“Company does procurement to prepare materials support operations and always be on time with efficient cost & best quality. For every purchase, the company has the requirement that all vendors if purchasing doesn’t match & low-quality company will return or reject and ask to get the new one. It will be considered for the next procurement. Thus, company does the selection for bidding to get the best supplier with company needs”

According to data research, only a few different value chain activities refer to theoretical & geothermal business if we analyze from each activity but have the same result. The comparison can be shown as table below;

Table.6. Analyse the result of the data research for value chain

Value Chain Activity	Theoretical	Previous Research	Observation
Inbound logistic	activities of the company include receive, store, raw material contribution, until the raw materials can be used for production process. as raw materials to suppliers (Friska S. (2010), Periansya. (2011), Afrian. 2019), Luhung, Damar Afrian. 201	need supplier either goods or services for operational activity of geothermal Ayuningtyas, Harianto, Arief Safari (2018)	activity that purchases materials, storage then contributes for internal support operational. Because as raw material in geothermal is sources that drilled from underground (steam & brine)
Value Chain Activity	Theoretical	Previous Research	Observation
Operation	ctivities required to transform inputs into outputs (product or services), packaging,	PT Geo Dipa does the operation in the existing area (Dieng & Patuha) that already	PT Sorik Marapi Geothermal Power is as an electricity company that sold & transmitted to
	maintenance to equipment, insurance, printing & other operational facilities (Friska S. (2010), Periansya. (2011), Afrian. 2019), Luhung, Damar Afrian. 2019)	generated and exploration in new potential areas. Also does some activities in exploration phase area likes (Candradimuka, Arjuno Welirang, & Candi Umbul Telomoyo) This company does the activities in the first area are establish production wells, injection wells brine, make up well, injection condensate wells, monitoring reservoir &	The State Electricity Company (PLN) company has already constructed to develop unit-1, unit-2, & unit-3 with 140MW capacity trough 150KV transmission. This successful is achieved by company since acquired 100% share of OTP Geothermal. Starting from 2016 by doing land acquisition, constructed production wells, injection wells, condensate, make up wells, operation & maintenance (O&M)

		underground facility, operation, and maintenance (O&M) steam field, and operation and maintenance (O&M) power plant Ayuningtyas, Harianto, Arief Safari (2018)	steam field & power plant. Company applies the best strategy either management or monitoring to keep the energy can be maintained to transmit
Value Chain Activity	Theoretical	Previous Research	Observation
Outbound logistic	Outbound logistic is activity for storing, collection of goods, and distribution to buyer (customer) (Siddique and Arif 2021)	Outbound logistic in geothermal company is electricity power that bought by State Electricity company (PT PLN) (O&M) power plant Ayuningtyas, Harianto, Arief Safari (2018)	Outbound logistic in Geothermal company produces electricity energy that transmits to PLN transmission
Value Chain Activity	Theoretical	Previous Research	a single buyer for electricity then distributes it to the community. the company does storage of the energy by using 66kv transmission then transmitting to the company's substation. Outbound logistics (product) activity if the company has already transmitted energy to PLN by using 150kv transmission. Electricity that produced from power plant will be flowed by the transformer to the switchyard. Company has two switch yards (PT Sorik Marapi Geothermal Power
			& PLN) as controller to know the total of energy transmitted to PLN

Marketing & sales	Marketing & sales is as information facilities, how the costumer can reach product and how to make the costumers are interested in advertisement, promotion, and pricing. This activity needed to keep good relation & customer and decide price (Friska S. (2010), Periansya. (2011), Afrian. 2019), Luhung, Damar Afrian. (2019)	Marketing & sales In Geothermal Company the marketing & sales is not assigned the special person because the electricity power that produced is bought by State Electricity Company (PLN) as single buyer. It is as electricity transmitter in Indonesia Ayuningtyas, Harianto, Arief Safari (2018)	“Geothermal business does not assign especially to the person (employee) to do marketing & sales. Because in this case The State Electricity Company Pte Ltd (PT PLN) as single buyer Energy produced by the company will be bought by PLN with contract of Power Purchase Agreement (PJBL) for 30 years. in order to provide national energy, utilization of renewable energy & friendly energy according to the law of Indonesia (Permen ESDM No. 17 Tahun 2014) about Power Purchase
Value Chain Activity	Theoretical	Previous Research	Observation
Services	based on theoretical, services is related to add extra services to keep product value (Friska S. (2010), Periansya. (2011), Afrian. 2019), Luhung, Damar Afrian. 2019	as consumer is PLN, both of companies do the matching of Kwh meter has the same total of electricity power that transformed to transmission of State Electricity Company (PLN) Ayuningtyas, Harianto, Arief Safari (2018)	Services in PT Sorik Marapi Geothermal Power, company does the matching kwh meter that used for energy transaction based on Power Purchase Agreement (PJBL) by calibrating regularly and validating with PLN to control energy that transmitted to transmission or energy that transmitted from transmission to power plant of the company
Firm Infrastructure	Value chain activity for firm infrastructure based on theoretical is infrastructure consist of	Activities of this section include as follows; general management, public	Activity of company for infrastructure is construction for all facilities & business



	construct facilities, management, financial, accounting, law, government governance, and quality management (Friska S. (2010), Periansya. (2011), Luhung, Damar Afrian. (2019)	affair, planning, financial accounting, law, and Government relation to support the performance of all value chain Ayuningtyas, Harianto, Arief Safari (2018)	development in achieving company target. Those include general management, public affairs, management, financial, accounting, law, government governance that can support all activities of a
Value Chain Activity	Theoretical	Previous Research	Observation
			company. With this strategy company can identify opportunity & threat with efficient & consistent, identify sources & capability
Human Resource Management	Human Resource Management is activity includes recruitment, training, development & competency for all employees in company, Friska S. (2010), Periansya. (2011), Luhung, Damar Afrian. (2019)	Human Resources Management functions have the best way to get targets of production. In this case Human Resources Management of the company does the recruitment,	Human Resources Management functions have the best way to get targets of production. In this case Human Resources Management of Geo Dipa do the recruitment, employee placement, Training, development, retirement, payroll
Technology Development	Technology development is activity that done by company to get the technology development for product and processing, either procedure knowledge or technology of process equipment (Friska S. (2010), Periansya. (2011), Luhung, Damar Afrian. 2019)	Technology Development Company always does the best strategy for technology development likes; exploration techniques to have the greatest geothermal resources & spend with efficient cost. Ayuningtyas, Harianto, Arief Safari (2018)	Geothermal business needs to improve technology. Because geothermal developer should get best strategy to get the commercial with efficiency & effectiveness. PT Sorik Marapi Geothermal Power improves technology either power plant system, construction, &
Value Chain Activity	Theoretical	Previous Research	Observation
			drilling method, in this company uses binary cycle power plant as

			Kaishan's technology. PT Sorik Marapi Geothermal Power uses modular power plant concept with technology from Kaishan Manufacture which is their sponsor. The modulars is ORC (Organic Rankine cycle) & expander, this technology exploits steam & brine. this technology can use the waste brine from expander can be used for power plant binary system to get electricity energy for this technology, company gets the energy 2.2 compared with other (conventional system). The utilization of the technology also gives the competitive advantage
Value Chain Activity	Theoretical	Previous Research	Observation
			because it can reduce the cost. Currently, company has already generated 140MW capacity with phase 1 unit/year
Procurement	Procurement is activity of procurement that has purchasing function that needed for support company business (Friska S. (2010), Periansya. (2011), Luhung, Damar Afrian. 2019)	In this activity, Company does the procurement to support operational activity to make sure the materials needed is always available on time & spend with low-cost Ayuningtyas, Harianto, Arief Safari (2018)	Company does procurement to prepare materials to support operations and always be on time with efficient cost & best quality. For every purchasing, company has the requirement all vendors if purchasing does it match & low-quality company will return or reject and ask to get the new one. It will be as consideration
			for the next procurement. Thus,

			company does the selection for bidding to get the best supplier with company needs
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#### Competitive Advantage PT Sorik Marapi Geothermal Power

The competitive advantage of a company is if the company can apply low-cost strategy & differentiation strategy. Differentiation is a method of producing high quality products to customers and increasing receiving by customers. It means the company should have differentiation. Company creates goods/services that given unique to customers. The competitive advantage of a company is how to create something for customers that is not given by competitors. PT Sorik Marapi Geothermal has the efficient cost & differentiation strategy in business to develop geothermal. It can be seen as table below;

Table.6. Comparison of Competitive Advantage

No	Theoretical	Previous Research	Observation
1.	Competitive advantage is a valued strategy of the company to have customers to compete more effective & in the market. The strategy is designed to aim gaining sustainable competitive advantage so that company can be as market leader (Prakoso, 2005:53)	Company always does the best strategy for technology development likes; exploration techniques to have the greatest geothermal resources & spend with efficient cost. Ayuningtyas, Harianto, Arief Safari (2018)	Company improves technology either power plant system, construction, & drilling method. This company uses binary cycle power plant as Kaishan's technology. PT Sorik Marapi Geothermal Power uses modular power plant concept with technology from Kaishan Manufacture which is their sponsor. The modulars are ORC (Organic Rankine cycle) & expander, this technology exploits steam & brine. this technology can use the waste brine from expander can be used for power plant binary system to get electricity energy for this technology, company gets the energy 2.2 compared with other (conventional system). The utilization of the technology also gives the competitive advantage because it can reduce the
	Theoretical	Previous Research	Observation
			the cost. currently company has already generated 140MW capacity with phase 1 unit/year

2.	<p><b>Competitive advantage strategy</b></p> <p>-Low-cost strategy Puts emphasis on organizational to sell lower price compared than competitor so that the costumers get interested or gives the same value or more to customers with low cost / efficient cost than competitor.</p> <p>-Differentiation strategy refers to the development of a unique product or services. These products are seen as such when compared with competing products. Porter (1985)</p>	<p>The previous research stated the binary cycle power plant, this technology is combined with system flash to utilize the waste brine from flash system on project area that dominated by brine. they stated this technology Ayuningtyas, Harianto, Arief Safari (2018)</p>	<p>In geothermal business needs to develop technology so that can maximize the capacity of power plant &amp; increase the reliable operation. In this case, company uses the combined power plant with binary cycle ORC (Organic Rankine Cycle) &amp; expander by utilizing steam &amp; brine. by using this technology, company can get generation more 2.2 than conventional technology It also can reduce the cost &amp; more efficient for maintenance. The company can give price under the basic cost of supply (BPP) 8.1 cent/ Kwh</p>
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as the above table, if the company wants to get the competitive advantage, the company should have the different price with an efficient cost & difference strategy than others. PT Sorik Marapi Geothermal Power has the competitive advantage by using the technology & drilling strategy, and construction. it is shown with grace of period is faster 1 unit/year. By using technology there will be no wasted well drilling, in contrast to a turbine which requires equal steam pressure from all production wells. Meanwhile, with an expander, various well characteristics with different pressures and enthalpies can still be used to generate electricity

#### Commercial Operating Date (COD) PT Sorik Marapi Geothermal Power

PT Sorik Marapi Geothermal Power is as geothermal developer faster than others geothermal developer generated 140MW capacity until 2022. The successful of generation of the company can be seen as the table below;

No	Description	Cost/ disadvantage of behind target
1.	Installed capacity of 140MW with 50MW gross	Energy cannot be generated caused the late of target (5 month) = 45MW x 5 x 30 x 24 hours = 162.000 Mwh
2	Disadvantage caused by the late of unit 3	196.830.000.000
3	Penalty should be paid	30.000.000.000

As the above table, the late Commercial Operating Date (COD) unit-3 was as significant as data research from informants on the field. If we see from value chain activity is in main activity (inbound logistic & outbound logistic) as the info it was caused by covid-19 pandemic. By having this situation impact to mobilize either employees or inbound & outbound materials. Also impact to other operational activity is normal than usual.

## CONCLUSION

- Application of value chain in geothermal business by doing research with qualitative method (observation, interview, & FGD) with the informants & expert who have the related experience. According to the aims of research, it is concluded as follow;

- There were few differences between theoretical if we see from the description of activity but it is same with the previous research by Maharani Ayuningtyas, Harianto, Arief Safari (2018). from main activity & support activity.
  - Inbound logistic in geothermal business the materials are used for support operations because raw material in geothermal business is resource that drilled from geothermal well.
  - Marketing & sales in geothermal business is not assigned to special person, because the generated electricity will be transformed to The State Electricity Company (PLN) as single buyer by having the Power Purchase Agreement (PJBL) during 30 years as guarantee according to the law of Indonesia (Permen ESDM No. 17 Tahun 2014) about Power Purchase Agreement of geothermal energy by State-Owned Company (PLN)”
- b. Competitive advantage in geothermal business of PT Sorik Marapi Geothermal Power
- The implementation of strategy management in geothermal development gives positive impact to get the achievement of efficiency & effectiveness in geothermal business.
  - PT Sorik Marapi Geothermal Power develops its business achieves the competitive advantage with more efficient cost by achieving 1 unit/years with 140MW capacity transformed to PLN through 150 kv transmission.
  - PT Sorik Marapi Geothermal Power uses the updated technology to develop geothermal by having the profit & electricity production 2.2 than the utilization of conventional technology.
  - The competitive advantage of PT Sorik Marapi Geothermal Power using drilling methods safely, efficiently & effectively, the utilization of binary cycle power plant can give the business system more competitive than other geothermal developer. By using screw expander & ORC (Organic Rankine Cycle) that utilize steam & brine. technology can use the waste brine from the expander can be used for power plant binary systems to get electricity energy for this technology, company gets the energy 2.2 compared with other (conventional system).
  - The final result is energy power that sold to The State Electricity Company (PLN) with the price under the basic cost of supply (BPP) 8.1 cent/ Kwh.
- c. The impact of the behind Commercial Operating Date (COD) unit-3
- Commercial Operating Date (COD) unit-3 is a significant disadvantage as explained in discussion result.

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