IRJEMS International Research Journal of Economics and Management Studies
Published by Eternal Scientific Publications
ISSN: 2583 – 5238 / Volume 3 Issue 1 January 2024 / Pg. No: 184-195
Paper Id: IRJEMS-V3I1P122, Doi: 10.56472/25835238/IRJEMS-V3I1P122

Original Article

Stock Valuation of a Geothermal Company in Indonesia Considering Carbon Trading Activity Case Study: PT Pertamina Geothermal Energy

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Received Date: 26 December 2023 Revised Date: 31 December 2023 Accepted Date: 05 January 2024 Published Date: 13 January 2024

Abstract: *Pertamina Geothermal Energy, a major Indonesian geothermal energy company, holds vast potential with its existing power plants and expansion plans. This research explores Pertamina Geothermal Energy's financial performances throughout 2019-2022, focusing on carbon trading's potential to become a significant revenue stream amid a growing carbon credit market. Analyzing both traditional electricity generation and carbon trading revenue growth. Valuing the company's stock price using absolute and relative valuation methods. The research concludes Pertamina Geothermal Energy's share price is undervalued in each scenario with a projected carbon revenue contribution of 0.75%-11% by 2033, highlighting its promising future in the evolving renewable energy and sustainability landscape.*

Keywords: *Absolute Valuation, Carbon Credit, DCF Method, Relative Valuation, Stock Valuation.*

I. INTRODUCTION

Since 2015, many of the world's leaders have come to an agreement to limit the global temperature rise below 2oC pre-industrial level through the Paris Agreement. This has catapulted the rise of renewable energy to replace fossil fuel-based energy which accounts for around 80% of the global carbon production (International Energy Agency, 2021). By transitioning to cleaner energy sources such as geothermal, wind, solar and hydropower as fast as possible, the goal of limiting the temperature rise will be met. Every country is working towards achieving that goal by exploring and exploiting available renewable energy sources within their areas.

Although Indonesia is said to have the world's biggest geothermal reserves, as of 2023 Indonesia's installed capacity of geothermal power is approximately a mere 2,356 MW (ThinkGeoEnergy, 2023), utilizing only 8.7% of the total reserves. The fact that the installed capacity is way below its reserves makes this business have huge upside potential in terms of development. This makes geothermal one of the most alluring renewable energy resources in Indonesia. The development of geothermal exploitation is also aligned with the target made by the Ministry of Energy and Mineral Resources of Indonesia to set a renewable energy proportion of 23% on the national energy mix by 2025.

Besides having positive benefits for the environment, the use of renewable energy as opposed to fossil fuel also has a potential financial benefit. Electricity generated by fossil fuels produces greenhouse gasses such as carbon dioxide (CO2), Methane (CH4) and nitrous oxide (N2O), these gases harm the environment. Hence the world has adopted the concept of carbon credit as a way to mitigate the risk of carbon emissions.

A carbon credit can be explained as a tradable permit that represents the reduction, avoidance, or removal of one ton of greenhouse gases, expressed in carbon dioxide equivalent (CO2e) (International Emissions Trading Association, 2022). The global market value for the carbon credit market as of 2022 is estimated to be around $87.8 B and is projected to grow at 14.2% CAGR until 2032 to be around $343.6 B (Global Market Insights, 2022).

PT Pertamina Geothermal Energy was established in 2006 as one of Pertamina's subsidiaries focusing on developing its geothermal assets. Its history started in 1974 when Pertamina was assigned to identify the potential sources of geothermal across Indonesia. Pertamina opened its first geothermal generator (PLTP Kamojang) in West Java in 1983. It further expanded its operation area by opening PLTP Sibayak in 1996 in North Sumatera, PLTP Lahendong in 2001 in North Sulawesi and several locations scattered across Indonesia. As of 2023, PT Pertamina Geothermal Energy operates 13 PLTPs both own operation and join operation with a total capacity of 1877 MW.

Pertamina is committed to developing geothermal energy in Indonesia. It has a plan to increase its current geothermal power generation capacity by around 600 MW by 2028. This means that there will be large investments needed to fund and further develop this business. This is also aligned with Indonesia's energy transition goal that aims to reduce its dependency on

coal, oil and other fossil fuel-based energy and significantly increase the use of renewable energy to reach net-zero emissions by 2060. Despite the potential upside, there are also some challenges to the development and utilization of geothermal energy. The fund needed to generate 1 MW of electricity from geothermal is approximated to be around US$ 4-5 million according to Jakarta Drilling Society. The development of geothermal plants can take years to finish due to the high risk and high cost. The lack of infrastructure is also one of the challenges as most of the geothermal resources in Indonesia are located in rural areas with limited supporting infrastructure such as roads.

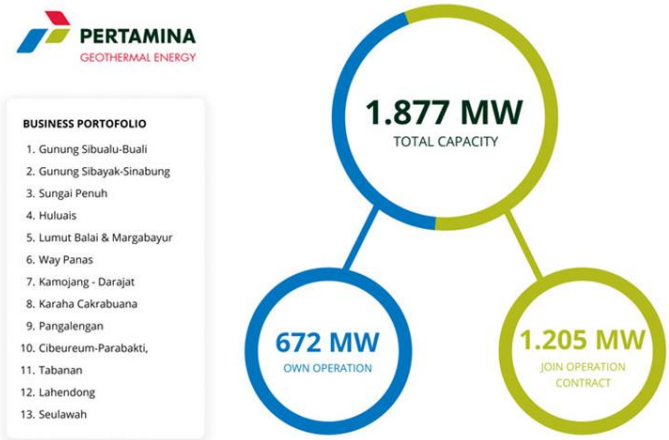


Figure 1: Pertamina Geothermal Energy Total Installed Capacity (PGEO's Website, 2023)

Besides the needed outside investment, the revenue growth for the main business of electricity generation is crucial in helping PGEO utilize its reserve. The new revenue stream from carbon trading is promising as the market for carbon credit both compliance market and voluntary market is expected to grow at an exponential level due to several factors such as increasing urgency to address climate change, policy and regulatory advancements, growing corporate commitment to sustainability and overall increased investor.

PGEO as the largest geothermal energy producer in Indonesia has a big responsibility and potential to spearhead the development of geothermal energy to help Indonesia achieve its goal of net-zero emission by 2060. Analyzing and forecasting the business and financial aspects of the company and its carbon trading activity can be the first important step to understanding the trajectory of this company in the future.

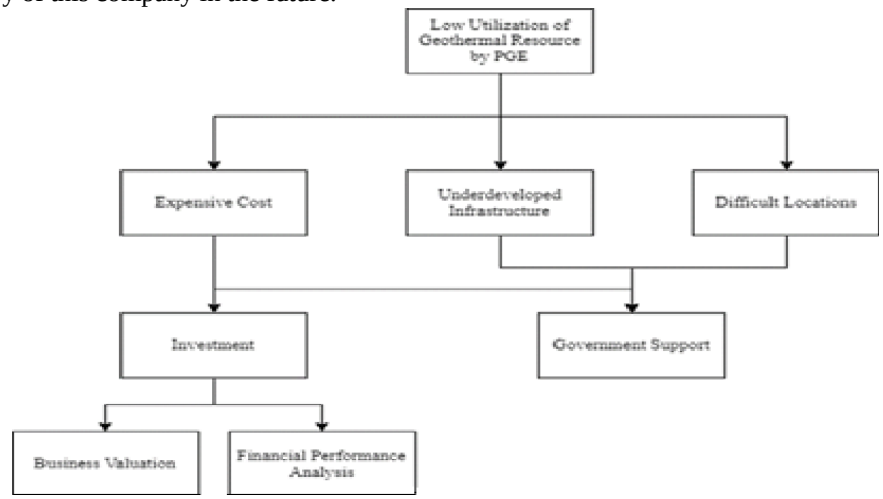


Figure 2: Root Cause Analysis

The root cause analysis started with the business issue of low utilization of geothermal resources by PGEO. This problem is caused by three things: expensive cost for exploration and exploitation, underdeveloped surrounding infrastructure in the potential area containing geothermal resources, and difficult locations as 80% of proven geothermal resource locations are in the protected forest area. These problems should be solved in two ways: investment to fund the projects and government

support in the form of favourable regulations to aid the company in fastening its effort to increase the utilization of geothermal resources. In terms of investment, there are two ways to assess whether the company is worth of investment: business valuation and the financial performance analysis of the company.

II. LITERATURE REVIEW

A. Macro-Environment

According to Thompson (2022), A company's operations are shaped not only by its immediate industry rivals and the specific dynamics of its field, but also by the broader economic, social, technological, legal, and environmental forces that make up the "macro-environment". This complex interplay of factors creates a dynamic landscape that companies must navigate to achieve success. Macroeconomic factors such as GDP growth rate, inflation rate and unemployment rate must also be taken into account. The macro-environment consists of six components: political, economic conditions, sociocultural, technological, environmental and legal factors. Five concurrent challenges exist for businesses within an industry, according to Porter's five forces structure: rivalry, competition from possible new entrants, competition from substitute goods, bargaining leverage among suppliers, and consumer bargaining power.

B. Industry Analysis

Renewable energy's share in the Indonesia energy mix has been experiencing some increase since 2011. In 2023, the renewable energy portion in the country's overall energy mix is approximated to be around 14.1%. The table below shows the type of renewable energy used in Indonesia in 2023.

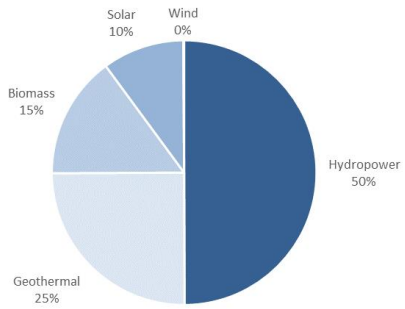


Figure 3: Source of Renewable Energy in Indonesia (Indonesia's MEMR, 2023)

Geothermal is the number two source of renewable energy in Indonesia. Although it is in second place, it has huge upside potential as Indonesia has 40% of the world's resources for geothermal amounting to 28.2 GW (ESDM, 2011). Despite the potential, PT Pertamina Geothermal Energy Tbk as the largest geothermal company in Indonesia currently operates 13 plants amounting to approximately 1,877 MW, only about 6.5% of the total potential. Numerous obstacles, both technological and non-technical, prevent Indonesia from using geothermal energy (Yudha et al, 2022). Here are the selected challenges: High Risk of Geothermal Exploration, Difficult Geothermal Locations and Permit, Underdeveloped Infrastructure. All the challenges need to be resolved either by attracting new funds from investors or implementing policies that benefit geothermal exploration so that the government's plan to have 23% renewable energy in the country's energy mix can be achieved.

C. Carbon Credit Trading

Carbon credit represents tradable units of every one ton of CO2 removed from the atmosphere. There are two types of carbon market: A compliance market usually established by governments using the cap and trade system expected to grow at 13.7 CAGR from 2022 to 2032, and a voluntary market where every company or individual can trade carbon offsets freely. Currently, the voluntary market value is much lower than that of the compliance market but will grow at a faster pace than the former. In 2021 the market value is at $2 B and will be expected to grow to $10-40 B by 2030.

Indonesia's development in the compliance market carbon trading started in 2021 with Presidential Regulation number 98, 2021 about Carbon Economic Value. The full version of the compliance market is expected to be launched in 2022 but was delayed until 2025. The path to carbon trading has started for Indonesia and companies like Pertamina Geothermal Energy can reap the benefit by making carbon offsets its sizeable revenue stream

D. Company Analysis

From the information on the financial statement, one can examine a company's financial performance using financial ratios. Some selected financial ratios are liquidity ratios (current ratio, quick ratio), and profitability ratios (net profit margin, operating profit margin, gross profit margin, return on equity).

Valuation is a combination of science and art, meaning that there are components that are exact such as financial statements, ratios, and statistical analysis and there are components that need further interpretation such as forecast, competition and management team. (Corporate Finance Institute, 2023).

The absolute valuation model looks at an organization's intrinsic value in isolation. Meaning that other companies and market conditions do not contribute to the valuation process. The most common way to estimate the intrinsic value of an organization is through the Discounted Cash Flow (DCF) method.

A technique for estimating a company's worth involves using the time value of money to discount its anticipated future cash flows back to the present. Discounted cash flow method has been used since the 1700s and was developed by John Burr Williams in 1938. The theory is the cash flow of a company will continue to grow at a certain level as long as the company is still in operation (going concern). After a certain period of time, the company will continue to grow at a stable growth rate usually by following the growth rate of the gross domestic product in which the company operates. In order to reflect the continuing cash flow after a certain period, terminal value will have to be determined. Hence the formula will look as follows:

$$\sum_{t=1}^{t=n} \frac{CFt}{(1+r)^t} + \frac{\frac{Cash\ Flow_{t+1}}{r-g}}{(1+r)^n}$$

n = Life of the assets
CFt = Cash flow in period t
r = discount rate
g = stable growth rate

To value an entire business, the cash flow used in the equation must account for all suppliers of capital from debt and equity after the company pays its operating and investing expenses to sustain its continuity. In other words, the cash flow used must first remove its capital structure effect to arrive at a fair amount. Hence the Free Cash Flow to the Firm (FCFF) is used. The formula is as follows:

$$FCFF = (EBIT \times (1 - TR)) + D - LI - IWC$$

EBIT = Earnings before interest and taxes
TR = Tax rate
D = Depreciation
LI = Long-term investment
IWC = Investment in working capital

Discount rate must also reflect all suppliers of capital from equity to debt. Hence the Weighted Average Cost of Capital (WACC) is used. The formula for WACC is as follows:

$$WACC = \left(\frac{E}{V}\ x\ Re\right) + \left(\frac{D}{V}\ x\ Rd\ x\ (1 - TR\right)$$

E = Equity
Re = Cost of equity
D = Debt
Rd = Cost of debt
V = Debt + Equity
TR = Tax rate

Cost of equity Cost of equity is the cost needed to compensate for the risk presented to equity investors. In other words, it is the cost needed to raise capital through equity. Cost of equity can be calculated using the following formula:

$$CAPM = R_e = R_f + \beta\ x\ (R_m - R_f)$$

Rf = Risk-free rate
B = Sensitivity
Rm = Expected return of the market

Cost of debt is the return needed for all creditors and debtholders of a company for the risk they take. The cost of debt can be calculated using the following formula:

$$After\text{-}Tax\ Cost\ of\ Debt = Pre\text{-}Tax\ Cost\ of\ Debt\ x\ (1 - TR)$$

Relative valuation or market approach model looks at an organization's closest peers and compares them to the target organization. The worth or value of a company or asset is determined by comparing its price to other company's price, after adjusting for differences using a common factor like earnings, cash flow, revenue, or book value (Damodaran, 2012). The method that is usually used is multiple (i.e., price-to-earnings multiple) and Enterprise Value to EBITDA (EV/EBITDA). The relative valuation model can be a better tool to understand and reflect the market condition and might produce a valuation that is closer to the market price than the absolute valuation model. By combining those two valuation models, a fairer value can be obtained and the estimate can be closer to reality.

Based on the relevant theories mentioned above, a conceptual framework can be made.

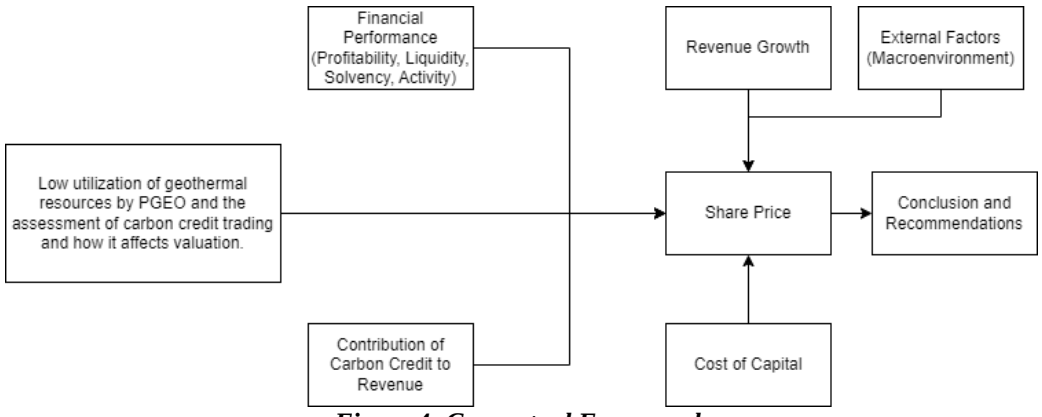


Figure 4: Conceptual Framework

Based on the aforementioned problem, several factors can affect the financial performance of PGEO. the main factor that will affect the financial performance is revenue from electricity production. According to various authors, sales growth has a positive impact on firm performance (Feng et al., 2017), (Lechner et al., 2016), (Parida et al., 2016). This research will explore different revenue growth scenarios of electricity production and the effect on revenue based on global and Indonesia market growth projections.

The next factor is carbon credit trading. Pertamina Geothermal Energy has successfully sold carbon credit in 2023 in the newly established Indonesian carbon market. The carbon trading activity is viewed as a contributing factor in a company's valuation as carbon emission disclosure and trading have positive impacts on firm value as it will be seen as a positive move by investors (Hardiyansyah et al., 2020). The carbon market is expected to grow at an exponential rate (Vonden, 2022). Pertamina Geothermal Energy as a renewable energy company could benefit from this activity as it increases its production capacity and fastens its carbon credit certification which then can be sold at the carbon market. Carbon credit trading can become a sizeable revenue stream in the future.

Other factors that can affect a company's valuation are cost of capital, and financial performance which can be measured using ratios such as liquidity ratios, profitability ratios, solvency ratios, and activity ratios (Damodaran, 2012). External factors can also affect a company's share price to a certain level (Subing et al., 2017). Based on these interconnected factors that affect a company's valuation, recommendations for management could be made.

III. RESULTS AND DISCUSSION

A. Financial Performance Analysis

Liquidity ratios are used to evaluate a company's capacity to settle its short-term debts as they become due. Low or declining liquidity is a common sign of financial distress and bankruptcy. Theoretically speaking having more liquid assets such as cash will make the company's liquidity ratio better, but shareholders will not perceive over-investment in liquidity as a good thing. The company needs to balance between the need for liquidity and the low return that it provides (Gitman, 2022).

From 2019 to 2020 the company had a very low current and quick ratio this is mainly due to the current maturities of long-term loans for those years causing current liabilities to increase.

Both of the liquidity ratios increased in 2021 due to the significant decrease in the current maturities of long-term loans. The liquidity ratio decreased once again to a low level in 2022 due to the significant increase in short-term bank loans.

Profitability ratios enable the evaluation of a company's profit-making ability related to revenue, assets and the shareholders' investment (Gitman. 2015).

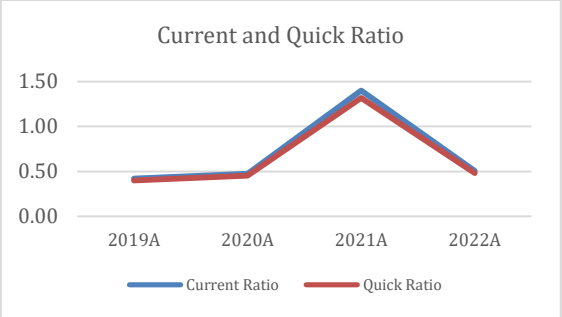


Figure 5: Liquidity Ratios

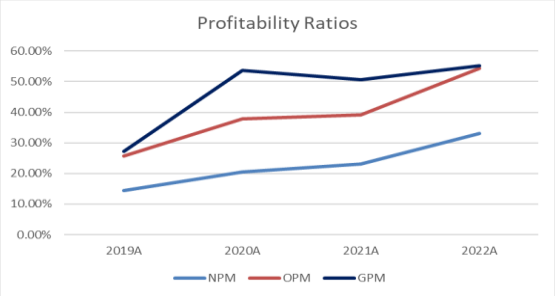


Figure 6: Profitability Ratios

The gross profit margin has been progressing at a range of 27% to 55%, The operating profit margin has been steadily increasing from 25% in 2019 to 54% in 2022 at a CAGR of 28%. The net profit margin from 2019 to 2022 has been steadily increasing at the level of 14% to 32% at a CAGR of 32%.

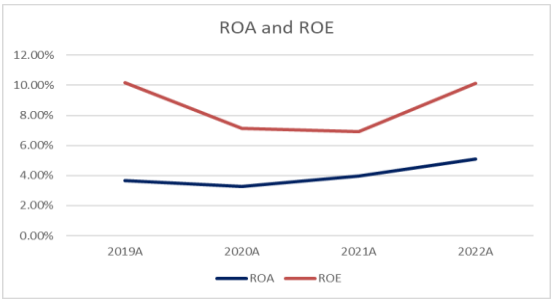


Figure 7: ROA and ROE

The return on assets has been at relatively steady growth since 2019 at the level of 3% to 5%. The 2020 ROA decreased from 3.68% to 3.27% in 2019 due to decreased net profit which the COVID-19 pandemic might have a role in. In 2022 the ROA increased to 5.11% due to a substantial increase in net profit.

The return on equity fluctuates between 2019 to 2022. In 2019 the ROE was at the level of 10% due to higher net profit and equity compared to 2020 and 2021. In 2020 and 2021, the increase in equity is not aligned with the increase in net profit hence the downward-sloping graph. The company bounced back in 2022 to 10.14% ROE due to a huge increase in net profit and decreased equity.

B. Absolute Valuation

The first step is to project revenue growth from its own operation and from carbon credit trading.

Table 1: Revenue Projection

Revenue Base Case											
	2023	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**
Own Operations											
Sales Growth	5.63%	5.63%	5.63%	5.63%	5.63%	5.63%	5.63%	5.63%	5.63%	5.63%	5.63%
Sales	392,824	414,993	438,357	463,036	489,105	516,642	545,729	576,453	608,908	643,189	679,401

Carbon Credit											
Sales Growth	29.20%	29.20%	29.20%	29.20%	29.20%	29.20%	29.20%	29.20%	29.20%	29.20%	29.20%
Sales	1375	1777	2295	2966	3832	4950	6396	8264	10677	13794	17822
Production Allowance											
Sales Growth	4.51%	-0.64%	1.67%	1.85%	0.96%	1.49%	1.44%	1.30%	1.41%	1.38%	1.36%
Sales	14,772	14,678	14,923	15,199	15,345	15,575	15,798	16,003	16,228	16,452	16,667
Total Revenue	409,021	431,447	455,575	481,201	508,282	537,167	567,923	600,720	635,813	673,436	713,899

Based on the base case scenario model above, it can be seen that the revenue from carbon credit will amount to US$17 million and the total revenue will amount to US$713 million in 2033. In 2022 carbon credit trading contributed to around 0.19% of total revenue and in 2033 it will contribute to around 2.5% of revenue. Even though the increase is quite substantial at a 10x level, this proves that carbon trading will not be a significant revenue stream under the base case scenario.
The next step is to project the income statement. Assumptions for the income statement are as follows:

Table 2: Assumptions for Income Statement

Items	Method Used
Cost of Revenue	Moving Average of 2019-2022
G&A	Historical Average of 2019-2022
Finance Income	Moving Average of 2019-2022
Other Income/(Expenses)	Moving Average of 2019-2022
Finance Cost	Moving Average of 2019-2022
Tax Rate	Historical Average of 2019-2022
Other Comprehensive Income	Moving Average of 2019-2022

Table 3: Income Statement Projection

Income Statement

	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Revenue	409,021	431,447	455,575	481,201	508,282	537,167	567,923	600,720	635,813	673,436	713,899
Cost of Revenue	(218,394)	(209,340)	(223,476)	(235,588)	(254,048)	(263,902)	(279,875)	(296,378)	(314,295)	(331,967)	(352,210)
GROSS PROFIT	**190,626**	**222,107**	**232,099**	**245,613**	**254,234**	**273,265**	**288,048**	**304,341**	**321,518**	**341,469**	**361,690**
G&A	(5,783)	(6,100)	(6,441)	(6,803)	(7,186)	(7,594)	(8,029)	(8,493)	(8,989)	(9,521)	(10,093)
Finance Income	1,236	1,094	1,085	1,154	1,143	1,119	1,125	1,135	1,131	1,128	1,130
Other income/(expenses),net	(23,096)	(27,517)	(20,449)	(15,935)	(21,749)	(21,413)	(19,887)	(19,746)	(20,699)	(20,436)	(20,192)
OPERATING PROFIT	**162,984**	**189,584**	**206,295**	**224,030**	**226,442**	**245,377**	**261,257**	**277,238**	**292,961**	**312,640**	**332,535**
Finance Cost	(19,366)	(17,963)	(16,679)	(17,207)	(17,804)	(17,413)	(17,276)	(17,425)	(17,480)	(17,399)	(17,395)
PROFIT BEFORE INCOME TAX EXPENSE	**143,618**	**171,621**	**189,616**	**206,822**	**208,638**	**227,964**	**243,981**	**259,813**	**275,481**	**295,241**	**315,140**
Income Tax Expense	(49,428)	(59,065)	(65,258)	(71,180)	(71,805)	(78,456)	(83,969)	(89,417)	(94,810)	(101,610)	(108,459)
PROFIT FOR THE YEAR	**94,191**	**112,556**	**124,358**	**135,642**	**136,833**	**149,508**	**160,013**	**170,395**	**180,672**	**193,631**	**206,681**
PROFIT FOR THE YEAR ATTRIBUTABLE TO:											
Owners of the parent entity	**94,223**	**112,594**	**124,400**	**135,688**	**136,879**	**149,558**	**160,067**	**170,453**	**180,733**	**193,696**	**206,751**
Non-controlling interest	(32)	(38)	(42)	(46)	(46)	(51)	(54)	(58)	(61)	(66)	(70)
Total	94,191	112,556	124,358	135,642	136,833	149,508	160,013	170,395	180,672	193,631	206,681
EARNINGS PER SHARE ATTRIBUTABLE TO OWNERS OF THE PARENT ENTITY (FULL AMOUNT)	**0.00227**	**0.00272**	**0.00300**	**0.00328**	**0.00330**	**0.00361**	**0.00386**	**0.00412**	**0.00436**	**0.00468**	**0.00499**

It can be seen that based on the base case scenario, the total revenue for PGEO will reach US$715 million in 2033 compared to US$409 million in 2022. The net income will reach US$206 million in 2033 compared to US$94 million in 2023. This research uses the discounted cash flow method because by looking at the historical data, the cash flows of PGEO were generally stable. Free Cash Flow to the Firm or Unlevered Free Cash Flow is the type of cash flow that is used in this research because it removes the effect of capital structure and is related to both debtors and equity investors. The projected FCFF on the base case scenario is as follows:

Table 4: Free Cash Flow to the Firm

FCFF Base Case

	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
EBIT	162,984	189,584	206,295	224,030	226,442	245,377	261,257	277,238	292,961	312,640	332,535
Depreciation and Amortization	103,266	111,895	121,007	130,631	140,796	151,540	162,898	174,913	187,629	201,097	215,375
Current Taxes	49,428	59,065	65,258	71,180	71,805	78,456	83,969	89,417	94,810	101,610	108,459
Capital Expenditure	(163,608)	(172,579)	(182,230)	(192,480)	(203,313)	(214,867)	(227,169)	(240,288)	(254,325)	(269,374)	(285,560)
Change in Working Capital	100,590	(15,142)	(48,521)	26,304	20,256	(5,758)	(3,165)	11,887	6,877	2,642	5,365
Free Cash Flow to the Firm	**252,660**	**172,824**	**161,809**	**259,664**	**255,986**	**254,749**	**277,790**	**313,167**	**327,952**	**348,615**	**376,174**

Based on the free cash flow to the firm base case projection above, in 2033 the FCFF will amount to US$376 million growing at a CAGR of around 4.6%. It can also be seen that the FCFF will decrease substantially in 2024 and 2025 compared to 2023 due to increased capital expenditure and the decrease in net working capital.

The capital asset pricing model or CAPM helps investors understand the potential volatility of a company's stock based on its historical relationship with the overall market. The assumptions used for cost of capital calculation are as follows:

Table 5: Assumptions for Cost of Capital

Assumptions for Cost of Capital	Sources	Value
PGEO's Beta	Average Unlevered Industry Average Beta and Calculated Beta	**0.77**
Risk Free Rate	PHEI's Indonesia 10 Years T-Bond	**6.71%**
Equity Risk Premium	Damodaran's Country Default Spread and Risk Premiums	**7.89%**
Indonesia's Default Spread	Damodaran's Country Default Spread and Risk Premiums	**2.04%**
Tax Rate	Calculated from PGEO's Financial Statements	**34%**

The calculation for CAPM is as follows:

Table 6: CAPM Calculation

CAPM	
Beta	0.77
Risk Free Rate	6.71%
Equity Risk Premium	7.89%
CAPM	**12.79%**

The cost of debt is the expected rate of return that investors who supply the firm with debt capital require. The after-tax cost of debt for PGEO is as follows:

Table 7: Cost of Debt Calculation

Cost of Debt	
Risk Free Rate	6.71%
Indonesia Default Spread	2.04%
Pre-Tax Cost of Debt	8.75%
Tax Rate	34%
After-Tax Cost of Debt	**5.78%**

Weighted Average Cost of Capital (WACC) considers all sources of capital, debt and equity by taking into account their proportion in the company's capital structure. The calculation for WACC is as follows:

Table 8: WACC Calculation

Weighted Average Cost of Capital		
	Weight	**Cost**
Debt Capital	22.12%	5.78%
Equity Capital	77.88%	12.79%
Weighted Average Cost of Capital		**11.24%**

From all the data gathered above, the absolute valuation of PGEO using the discounted cash flow method can be conducted. The assumptions for the discounted cash flows are as follows:

Table 9: DCF Assumptions

Main Assumptions	Value
Terminal Growth (Inflation Rate 2025-2029)	3.10%
Weighted Average Cost of Capital	11.24%
USD to IDR (14th December 2023)	15,514

Using all the assumptions and drivers above, here is the PGEO's discounted cash flow model:

Table 10: DCF Projection

Valuation	Discrete Forecast										Terminal Value
(YY-MM-DD)											
12/14/2023	12/31/2023	12/31/2024	12/31/2025	12/31/2026	12/31/2027	12/31/2028	12/31/2029	12/31/2030	12/31/2031	12/31/2032	12/31/2033
12/14/23	6/30/23	6/30/24	6/30/25	6/30/26	6/30/27	6/30/28	6/30/29	6/30/30	6/30/31	6/30/32	6/30/33
Free Cash Flow to The Firm	252,660	172,824	161,809	259,664	255,986	254,749	277,790	313,167	327,952	348,615	376,174
Unadjusted Cash Flow											
Discrete Forecast	252,660	172,824	161,809	259,664	255,986	254,749	277,790	313,167	327,952	348,615	
Terminal Value	0	0	0	0	0	0	0	0	0	4,623,110	
Total Cash Flow	**252,660**	**172,824**	**161,809**	**259,664**	**255,986**	**254,749**	**277,790**	**313,167**	**327,952**	**4,971,725**	
Adjusted Cash Flow											
Partial Period Adjustment	0.05	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Discrete Forecast	11,931	172,824	161,809	259,664	255,986	254,749	277,790	313,167	327,952	348,615	
Terminal Value	0	0	0	0	0	0	0	0	0	4,623,110	
Total Cash Flow	**11,931**	**172,824**	**161,809**	**259,664**	**255,986**	**254,749**	**277,790**	**313,167**	**327,952**	**4,971,725**	
Discounted Cash Flow											
Years for Discounting	0.46	1.46	2.46	3.46	4.46	5.46	6.46	7.46	8.46	9.46	
Discrete Forecast	11,366	148,008	124,576	179,720	159,277	142,495	139,687	141,569	133,276	1,816,358	
Terminal Value	0	0	0	0	0	0	0	0	0	1,688,996	
Total Cash Flow	**11,367**	**148,010**	**124,579**	**179,724**	**159,281**	**142,501**	**139,694**	**141,576**	**133,285**	**3,505,364**	

Based on the DCF calculation in the table above the enterprise value, equity value and fair share price for PGEO are as follows:

Table 11: Equity Value, Equity Value per Share

Equity Value	
Enterprise Value	4,685,380
Less: Net Debt	-680,982
Equity Value	**4,004,398**

Equity Value per Share	
Equity Value	4,004,398
Shares Outstanding	41,396,142,000
Equity Value per Share	**1,501**

With the discounted cash flow method employed at PGEO stock, it can be concluded that the fair share price according to this model is IDR1, 501. The current share price of PGEO as of 14th December 2023 is IDR1,240. This means that there is a potential upside of 21%.

C. Relative Valuation

Relative valuation measures the company's value derived from similar companies operating in a relatively same business standardized with the same common variable like cash flows, earnings, or revenue. Relative valuation relies on the assumption that the market is behaving accordingly in terms of stock prices on average (Damodaran, 2012). In this research, PGEO will be compared to companies in a similar industry. The chosen companies are Dian Swastika Sentosa (DSSA), Ormat Geothermal Energy (ORA), Kencana Energi Lestari (KEEN), Barito Pacific (BRPT), Indika Energy (INDY). Kencana Energi Lestari and Dian Swastika Sentosa are well-established power generator companies in Indonesia. Due to the lack of comparable companies, the author chose Barito Pacific which is the parent company of the newly listed Barito Renewables, and Indika Energy which showed positive efforts towards developing renewable energy projects. Ormat Geothermal Energy operates in many countries across the globe and is one of the operators of Sarulla Operations, one of the biggest geothermal power plants in Indonesia.

EV/EBITDA essentially tells how much investors are willing to pay for each dollar of a company's operating profit. EV/EBITDA analysis is as follows:

Table 12: EV/EBITDA

EV/EBITDA	2022A
KEEN	10.5
BRPT	19.9
DSSA	1.7
INDY	0.7
ORA	18
Average	**10.16**
Median	**10.50**
PGEO	8.5

From the table above it can be seen that the EV/EBITDA of PGEO is below the average and median of comparable companies. From this information, it can be inferred that in terms of EV/EBITDA value, PGEO is undervalued compared to other companies.

Price to earnings ratio is commonly used by investors to assess the share value. This ratio measures how much investors are willing to pay for each dollar of expected earnings (Gitman, 2022). The value of this ratio can be an indication of the level of confidence that investors have in the firm's future financial performance. The P/E ratio is as follows:

Table 13: P/E Ratio

	P/E
	2022A
KEEN	10.9
BRPT	2430.1
DSSA	3.3
INDY	1.7
ORA	76.1
Average	504.42
Median	10.90
PGEO	11.3

The price-to-earnings ratio for the comparable companies varied greatly with BRPT having more than 2000 P/E and more than 200 P/E. Therefore, the right calculation to use would be the median. PGEO's P/E for both 2022 and 2023 are greater than the industry median. This might mean that investors generally expect the company to grow its net profit at a faster rate compared to its industry peers. PGEO as a state-owned renewable energy company might have an edge over its peers, hence the higher P/E ratio.

D. Scenario and Sensitivity Analysis

Scenario and sensitivity analysis are widely employed methods in various fields, including finance, to assess the impact of diverse sources of uncertainty in model inputs on the overall uncertainty of the model output (Liu, 2022). Scenario and sensitivity analysis are used in the valuation of PGEO to determine the share price fluctuation under three different scenarios: base case, bull case, and bear case. There are also other key drivers determining the discount rate that is going to be observed: cost of capital and perpetual growth rate. The calculation of the share price based on those scenarios and assumptions are as follows:

Table 14: Scenario Analysis

		Perpetuity Growth Rate				
		1.1%	2.1%	3.1%	4.1%	5.1%
WACC	13.2%	908	973	1,050	1,144	1,261
	12.2%	1,062	1,146	1,248	1,375	1,538
	11.2%	1,251	1,362	1,501	1,678	1,913
	10.2%	1,487	1,638	1,831	2,087	2,443
	9.2%	1,788	1,998	2,277	2,665	3,241

The base case scenario resulted in the share price in the range of IDR908 to IDR3, 241. To test what drivers contribute the most to equity value, a sensitivity analysis is conducted.

Table 15: Sensitivity Analysis

Revenue Growth		Cost of Revenue		Perpetuity Growth Rate		WACC	
0%	1,501	0%	1,501	0%	1,501	0%	1,501
5%	2,186	5%	1,279	1%	1,678	1%	1,248
-5%	1,051	-5%	1,723	-1%	1,362	-1%	1,831

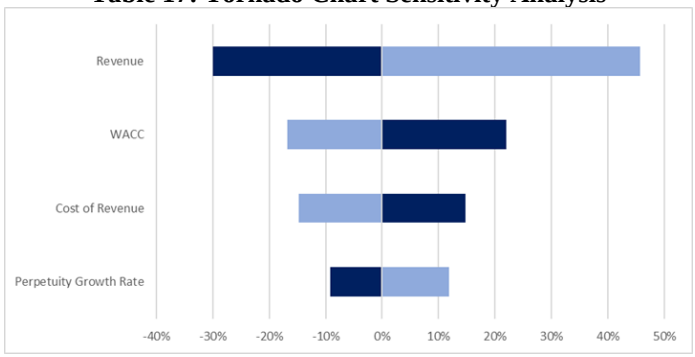
In the table above, drivers that influence the equity value of PGEO are examined. The revenue growth and cost of revenue sensitivity were tested at a range of -5% to +5%. The perpetuity growth rate and the WACC were tested at a range of -1% to +1%. Here is a table summarizing the changes made by each driver.

Table 16: Sensitivity Analysis Drivers' Impact

Driver	Pos	Neg
Perpetuity Growth Rate	12%	-9%
Cost of Revenue	-15%	15%
WACC	-17%	22%
Revenue	46%	-30%

Here is a tornado chart that represents the impact of the above-mentioned drivers on PGEO's share price:

Table 17: Tornado Chart Sensitivity Analysis



Based on the tornado chart above, Revenue growth has the most influence on the share price ranging from -30% to 46%, followed by the WACC ranging from -17% to 22%, cost of revenue ranging from -15% to 15%, and perpetuity growth rate ranging from -9% to 12%.

- Pertamina Geothermal Energy company operations have a range of potential ESG risks. Here are some notable risks.
- Environmental risks: air and water pollution, deforestation.
- Social risks: land acquisition, biodiversity impacts.
- Governance risks: climate change vulnerability, transparency and stakeholder engagement

IV. CONCLUSION

Pertamina Geothermal Energy is one of the biggest geothermal companies in the world, with a total installed plant capacity of 1.87 GW scattered all around Indonesia. Despite its size, the total installed capacity is still way below the total resources that Indonesia has which is around 28 GW.

The company successfully made its initial public offering in February of 2023 with an offer price of IDR875/share. Since then the stock's price has gone up to around IDR1,240 in December of 2023. The market capitalization of the company as of December 2023 is US$3.3 billion.

The macro-environment surrounding Pertamina Geothermal Energy is favourable for the company's growth. Political stability, beneficial regulations, the projected increase in energy demand in Indonesia, technological advancements and various economic incentives, all these factors are in the company's favor. The high barrier to entry for the industry also gives an edge to Pertamina Geothermal Energy's market share.

As a renewable energy company, Pertamina Geothermal Energy can utilize its carbon credit to become a potentially sizeable revenue stream. Carbon credit trading seems like a promising source of revenue since the IDX Carbon market officially opened in September of 2023. However, based on the projected model using various assumptions on carbon credit revenue growth, the proportion of carbon credit trading is insignificant to the total revenue and the effect on the stock's price is minimal. This condition can change in the future should the government increase the price of carbon in the compliance carbon market or the registered carbon per year by Pertamina Geothermal Energy increases.

The financial performance of the company from 2019 to 2022 is proven to be healthy. The company showed its ability to improve its profitability metrics (gross profit margin, operating profit margin and net profit margin). The return on equity also has been quite stable in those periods

The valuation process concludes that the company's stock price is undervalued by a large margin. The DCF method estimated the share price to be IDR2,390. This result is based on the assumptions that the revenue growth rate is 5.63%, the WACC rate of 10.19% and the terminal growth rate of 4.9%. Compared to the December share price of IDR1,240 this implies a potential upside of 92%. This might mean the company have the potential to grow bigger in the coming years but can also mean that the market lacks interest or knowledge about the company.

A. Recommendations for Pertamina Geothermal Energy

Carbon trading is viewed as a prospective revenue stream in the future. However, through the analysis conducted in this research, it is proven that only under the bull case scenario will carbon trading be a sizeable revenue stream. To address this, Pertamina Geothermal Energy should consider aggressive initiatives regarding carbon credit issuance and selling strategy.

Fasten Carbon Certification Process: Pertamina Geothermal Energy should fasten its carbon certification process. Market Awareness: Pertamina Geothermal Energy should work closely with carbon trading regulators to raise awareness about the company's initiatives in carbon credit trading. This includes participating in industry conferences, publishing reports on sustainability efforts, and engaging with the media.

Strategic Partnerships: Explore partnerships with other companies in the renewable energy and sustainability space to enhance carbon credit trading opportunities. This can include joint ventures, collaborations, or alliances that amplify the impact of carbon credit initiatives.

Regarding the valuation, Pertamina Geothermal Energy is viewed as undervalued through absolute and relative valuation methods. The company should respond to this information by doing the following things:

Communication and Transparency: Pertamina Geothermal Energy should engage with analysts and investors to communicate the strengths and growth prospects of the company. This includes highlighting factors that may not have been fully considered in the DCF valuation, such as potential future projects, technological advancements, or strategic partnerships.

Operational Efficiency: The Company should focus on improving operational efficiency to boost free cash flows. This might involve cost-cutting measures, optimizing project timelines, or negotiating favorable terms with suppliers.

Strategic Initiatives: Explore strategic initiatives that could enhance the company's long-term value, such as entering new markets, diversifying revenue streams, or investing in innovative technologies.

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