

THE IMPACT OF CLIMATE CHANGE AND ENVIRONMENTAL COST DISCLOSURE ON FIRM PERFORMANCE

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Abstract

There is a lack of literature explaining the effect of climate change and environmental cost disclosure on corporate performance and corporate welfare. The impact on welfare has been recognized through the declaration by G20 countries in Bali in 2022. This paper investigates the effects of climate change and environmental cost disclosures on firm performance. The research used 61 samples from the energy sector that directly impacted climate change from 2017 to 2022. The research findings suggest that climate change disclosures can improve the performance and value of the firm, while environmental cost disclosure does not. Investors tend to view environmental costs as expenses that decrease net income and they are indifferent to environmental cost disclosures, as these do not directly impact the firm's value.

Keywords: climate change disclosure, environmental cost, disclosure, performance, value of the firm.

Introduction

Global warming accompanied by climate change has been recognized as a problem with the highest priority level facing the world today. Climate change not only has an impact on companies but also on the world more generally. Growing societal awareness and concern about the negative effects brought by climate change have increased the demands of stakeholders, investors, and regulatory bodies for companies to provide more detailed and comprehensive information about their corporate strategies and initiatives aimed at mitigating the risks of climate change impacting a firm's operation and performance (Buallay, 2019; Hristov et al., 2021; Huang et al., 2023). The rationale behind this increased call for greater disclosure of corporate policies regarding climate change is the belief that such transparency can increase the quality of the decisions made by investors and other stakeholders, and thus drive improvements in corporate adaptation to climate change.

Previous research indicates that climate change disclosure can provide valuable information to stakeholders, enabling them to make more informed decisions. Stakeholders nowadays show increasing concern about climate change, and they seek out companies that are transparent about their environmental footprint and climate-related risks (Cao et al., 2022). Voluntary disclosure of climate-related information can help firms enhance their reputation and demonstrate their commitment to sustainability, which can lead to improved financial performance (Pradhananga et al., 2021). Therefore, the quality of climate change disclosures is very important for enhancing investor decision-making quality by providing more information, and ultimately for boosting a firm's performance.

Some researchers have already tested the causality between environmental disclosure and market response toward a firm's shares and found a positive association, both in developed or emerging markets (Du et al., 2017; Middleton, 2015; Zhou & Yin, 2017). Some studies have shown that improved financial disclosure with respect to climate change can benefit corporations by identifying the best long-term investments, which ultimately safeguard and improve profitability (Vestrelli et al., 2024). One key finding from the literature is that climate change disclosure can enhance a firm's financial performance. Researchers have found that a firm's effort to disclose its environmental performance and climate-related risks can lead to improved corporate governance and better management of environmental challenges (Alareeni & Hamdan, 2020).

A study on voluntary disclosure in Indonesia finds that voluntary disclosure, including information about climate change mitigation and adaptation, can increase a firm's market value, as it helps to reduce information asymmetry by providing additional non-financial information for shareholders, fostering goodwill among the community, and boosting the confidence of investors (Mahmudah et al., 2023). High-quality disclosure rates can reduce capital costs and convince the market about the company's capabilities. Conversely, low-quality disclosures have the potential to reduce the confidence of the market and lenders which damages market integrity (OECD, 2004). High-quality disclosure can translate into tangible financial benefits, such as increased investor confidence, better access to capital, and enhanced brand reputation (Mahmudah et al., 2023). There have also been many studies about the willingness of firms to bear environmental costs and its impact on company performance, both environment and financially (Carter et al., 2000; Johnston, 2005; Lee et al., 2015; Molina-Azorin et al., 2009). Handfield et al. (1997)

suggest that increasing investments in operations and maintenance as well as performing regular assessments of the impact of a company's activities on the environment can have a positive impact on the environment itself, thereby promoting more sustainable economic development ([Gupta et al., 1995](#); [Handfield et al., 1997](#)).

However, others studies have also revealed a negative or even no relationship between climate change disclosure and firm performance ([Baboukardos, 2017](#); [Radhouane et al., 2018](#)). Some studies have found that managers may be inclined to manipulate or withhold information to avoid negative perceptions, undermining the reliability and usefulness of the disclosed data. Additionally, the costs associated with collecting, verifying, and reporting climate-related information can be significant, potentially outweighing the benefits for some firms ([Kouloukoui et al., 2018](#)). In Indonesian capital markets, environmental disclosures by companies have also shown inconsistent results, such as positive relationships ([Anggraeni, 2015](#); [Hermawan et al., 2018](#)) and negative ones ([Deswanto & Siregar, 2018](#); [Permana & Tjahjadi, 2020](#)). Furthermore, one study finds that companies that are active in the energy sector have a massive impact on climate and the environment, but the application and knowledge of their disclosures are still limited ([Comyns, 2018](#)).

Thus, this study has examined the effect of climate change and environmental disclosures on company performance in Indonesia by testing the causality between those three. This is inseparable from the commitment of countries around the world to maintain a global temperature increase at a maximum of 2^o C through GHGS reductions among others ([Comyns, 2018](#)). This commitment has an impact on a company's obligation to reveal GHGS emissions and increase the urgency to understanding environmental performance and its impact on the company. According to Haque and Islam (2015), there are demands for accountability and disclosure regarding climate change coming from various interested parties, including institutional investors, government agencies (regulators), environmental organizations, and the media. This study assumes that the energy sector will also get these benefits through pro-environmental efforts. This study also aims to analyze environmental expenses and company financial performance. It is hoped the findings will provide some insight into potential benefits of environmental expenditures and climate change disclosure for firms in the energy sector. Thus, environmental management can support companies in improving its performance.

Literature Review and Hypothesis Development

The stakeholder theory explains which parties a company should be responsible to ([Freeman & Reed, 1983](#)), whereas the sustainability of the company is tightly bound to its stakeholders; therefore, the companies have to obtain their support (Gray and Larson, 1997). Firms need to pay serious attention to the needs of their stakeholders; one of the strategies is to disclose the information required by the stakeholders. The non-resource information in the sustainability report is expected to meet the needs of stakeholders.

The sustainability report reveals information about the environment associated with climate change. Climate change disclosure is found relatively little in multinationals' reports ([Comyns, 2018](#)), whereas in Indonesia, climate change disclosures can improve a firm's value alongside financial performance ([Abdullah et al., 2020](#); [Kurnia et al., 2020](#)). This is because climate change can lead to a decline in assets and financial risks. Therefore, the handling of GHG emissions should be disclosed regularly. High-quality disclosure can reduce capital costs and convince the market about the company's capabilities. Conversely, low-quality disclosures have the potential to reduce the confidence of the market and lenders and thus damage market integrity (OECD, 2004).

[Jaggi et al. \(2017\)](#) state there is an in-line causality between stock prices and carbon disclosure showing investors' tendency to regard carbon information as useful for their decision making. In this context, there is a sustainability evolution towards specific climate change disclosure both in the private and public sectors, with the Kyoto Protocol as its catalyst ([Gulluscio et al., 2020](#)). Therefore, the disclosure of climate change will improve firm performance by reducing carbon emissions to preserve nature.

The size of a company and a high rate of profitability can increase carbon emission disclosed information ([Yulianti & Waworuntu, 2024](#)). In the US, climate risk disclosure can enhance firm value and firm market value ([Vestrelli et al., 2024](#)). [Megeid \(2024\)](#) finds that the more information related to climate risk, the more it can improve the financial performance of companies in Egypt.

H1: climate change disclosure positively impacts financial performance.

The agency theory states that organizations providing information to shareholders and complete disclosures can raise their stock prices, while the stakeholder theory provides information not only to investors but to all stakeholders. As for other non-financial disclosures, namely environmental disclosures, [Saputra \(2024\)](#) finds strong environmental revelations can boost markets and confidence (trust). Efficient environmental expenditure can improve productivity and financial performance ([Wang, 2014](#)). [Wang \(2014\)](#) measured efficiency with Data Envelopment Analysis (DEA). This finding is consistent with [Wu and Li \(2023\)](#) who find that environmental cost can improve performance.

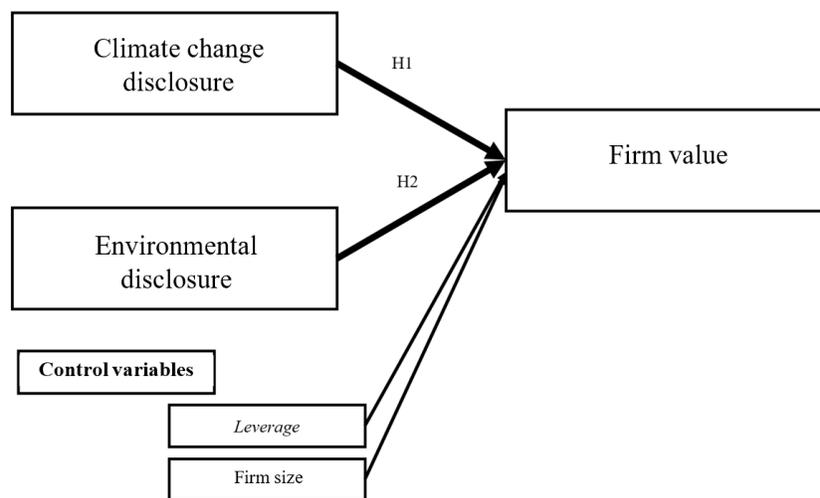
[Nguyen et al. \(2021\)](#) find that companies with a high level of disclosure of environmental information can improve performance. Environmental disclosure is also a relevant indicator of performance (Saini and Singhania, 2018). Some indicators use both financial performance (ROE and ROCE/return on capital employed), as well as market performance. Environmental costs can improve performance using both accounting and market-based measures ([Singh et al., 2023](#)).

Empirically, a lot of the existing research highlights the closeness of the link between environmental costs and performance, both environmentally and financially ([Carter et al., 2000](#); [Johnston, 2005](#); [Lee et al., 2015](#); [Molina-Azorín et al., 2009](#)). [Handfield et al. \(1997\)](#) state that the implementation of policies that are pro-environment increase the chain of value information and improve the overall industrial performance. Likewise, voluntary disclosure of environmental information can enhance a firm's environmental performance and financial outcomes ([Hart, 2015](#)).

In Indonesia, environmental disclosure can also improve the performance of palm oil companies ([Abdullah et al., 2020](#)); this is consistent with [Nguyen et al. \(2021\)](#) who state that profitability can be increased by environmental disclosure as one of its indicators. Thus, the hypothesis formulated is as follows:

H2: environmental expenditure disclosure positively impacts financial performance.

Figures 1. Research Model



Source: Authors (2024)

Research Methods

This study used energy sector listed companies in the Indonesia Stock Exchange (IDX) from 2017 to 2022. The energy sector producing greenhouse gases accounted for 36 percent globally, tripling in 20 years (<https://lcdi-indonesia.id/grk-energy/>, accessed 20 January 2024). Data were extracted from the official websites of the IDX and each firm. The sample was selected based on the purposive sampling method. Companies that used currencies other than Rupiah were excluded from the sample to avoid high data variability. After the application of the sample selection criteria, this research is based on 76 firm-year observations as its sample (see table 1).

Operationalization of Variable

This research used firm performance as a dependent variable, that measured by ROE.

$$ROE = \frac{NI}{E}$$

ROE = Return on equity; NI =; and E = Equity.

Climate change as an independent variable is measured by using an index formed by the quality of disclosure and conformity with the disclosure standards for GHGs. There are seven principles that underpin GHG reporting quality: completeness, credibility, relevance, consistency, accuracy, transparency, and timeliness. Each quality criterion is deemed to be one dimension, and their aggregate score is firm's overall GHG disclosure quality. Reporting requirements for GHG emissions (WBCSD & WRI, 2004) and the Oil Industry Guidelines for GRK Emission Reporting (IPIECA & API, 2003; IPIECA/API/OGP, 2011) are used as benchmarks for every dimension. By doing so, there are 18 criteria in total ([Comyns, 2018](#)), see Appendix 1.

Environmental Disclosure

The measure of environmental disclosure is the Indonesian Environmental Reporting Index (IER) developed by [Suhardjanto & Miranti \(2009\)](#). This index represents stakeholder demand with a certain weighting.

Leverage

This study uses the leverage control variable which describes debt’s role in the capital structure of a company. This study uses financial leverage because it indicates the company's financial condition and its relationship with stakeholders who have a role in funding, namely investors and creditors (Brigham & Houston, 2019). Financial leverage is measured by Debt-to-Equity Ratio (DER) equation as follows:

$$DER = \frac{\text{total liabilitas}}{\text{ekuitas pemegang saham}}$$

Firm Size

Some researchers use firm size to control the effects. This is because firm profitability in general can increase incrementally according to firm size. Log total assets is a common method to measure firm size, and it is also applied to this study. The causality relationship between firm size and company performance for a long time has been a topic of significant interest in the field of finance and management. Research suggests that larger firms tend to exhibit superior financial performance compared to their smaller counterparts (Yadav et al., 2022). This can be attributed to several factors, including economies of scale, access to capital markets, and enhanced competitive advantages.

The existing literature provides empirical evidence to support the notion that firm size is positively correlated with financial performance. Large firms often possess the technical expertise, manufacturing capabilities, and marketing resources to optimize their operations and achieve higher profitability. Firm size as measured by the log of total assets is a key determinant of a company's financial performance (Yadav et al., 2022). Large firms tend to have better innovation to protect the environment, thus disclosing more information about their environmental action. This is in line with the findings from Liu (2020), which suggest that firm size, as reflected by total assets, is a significant factor in influencing a company's financial performance.

Results and Discussion

Sample

Table 1 Sample Selections

| No. | Sample Criteria | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | total |
|-----|-------------------------------|------|------|------|------|------|------|-------|
| 1. | Energy sector company | 56 | 62 | 64 | 65 | 66 | 76 | |
| 2. | Incomplete data | (20) | (14) | (12) | (11) | (11) | (4) | |
| 3. | Companies in foreign currency | (24) | (35) | (39) | (41) | (43) | (59) | |
| | Firm-years | 12 | 13 | 13 | 13 | 12 | 13 | |

Source: Authors (2024)

The size of that sample from the observation period (2017 - 2022) is in accordance with the determined criteria and it comprised 76 firm-years. The research sample only includes energy companies selected using the purposive sampling method. Based on the table above, 76 data were obtained from the sample firms in the research. In selecting the sample, there were companies whose data could not be taken because the company website could not be accessed and the reporting was incomplete; therefore, 72 data remained. From the 72 data, there were some reductions (11 samples) due to them being outliers. The final sample comprises 61 firm-years that have been used for analysis.

Descriptive Analysis

Testing of descriptive statistical results is as follows:

Table 2 Descriptive Statistics

| Variable | N | Minimum | Maximum | Mean | Std. Deviation |
|---------------------------|----|---------|---------|--------|----------------|
| Firm Performance | 61 | -0.31 | 1.37 | 0.1121 | 0.28672 |
| Climate Change disclosure | 61 | 1.80 | 32.10 | 7.0082 | 9.01677 |
| Environmental Disclosure | 61 | 0.08 | 0.96 | 0.5057 | 0.27141 |
| Size | 61 | 1.81 | 4.56 | 3.1577 | 0.79162 |
| Leverage | 61 | -15.42 | 18.20 | 0.0886 | 4.59330 |

Description: The sample data that can be obtained is 61 firm-years

Source: Analysis by the Authors (2024)

Table 2 describes each variable employed in this study for minimum, maximum, mean and standard deviation. Classical assumption testing is carried out to test a good regression model. The results of the classical assumption test show that the Kolmogorov Smirnov test results have a significance value of 0.129 > 0.05, so the normality assumption is met. Multicollinearity testing shows that the VIF value of each independent variable does not have a value of more than 10, and there is also no tolerance value below 0.1. Thus, multicollinearity does not occur. The

heteroscedasticity test shows that the sig level. $> \alpha 0.05$, namely $0.06 > 0.05$ on the environmental disclosure variable, $0.53 > 0.05$ on the climate change disclosure, $0.32 > 0.05$ on the company size, and $0.29 > 0.05$ on the leverage variable. Therefore, the research is free from symptoms of heteroscedasticity. The final test, based on the results of the autocorrelation test, shows the Durbin Watson table at $\alpha = 5\%$, $N = 61$ $k = 4$ (N is the number of samples and k is the number of variables tested) the dU value is 1.728, while the dW value is based on the results of two tests the above method shows 1,744. Thus, the model meets the requirements for the equation $dU < dw < (4-dU)$, namely $1.7281 < 1.744 < 2.2719$, so that the regression model has been accepted and there is no autocorrelation problem.

Hypothesis Testing Results

Hypothesis testing can be seen in table 3.

Table 3 Results of Hypothesis Testing

| | Coefficient | t | Sig. |
|--|-------------|--------|----------|
| (Constant) | -5.544 | -5.025 | 0.000*** |
| Climate Change Disclosure | 0.073 | 2.260 | 0.028** |
| Environmental disclosure | 0.064 | 1.184 | 0.242 |
| Firm Size | -0.185 | -1.365 | 0.178 |
| Leverage | 1.426 | 5.106 | 0.000*** |
| Note: F test 9.379 (sign 0.000) Adjusted R Square 0,358 ***) sign level at 1%; **) Sign level at 5% | | | |

Source: Analysis by the Authors (2024)

The results of hypothesis testing show that **hypothesis 1 is supported**, because the significance value is 0.028 (t-value 2.260), which indicates that a higher quality of climate change disclosure can improve performance. Conversely, **hypothesis 2 is not supported**; the significance value is 0.242 (t-value 1.184) meaning that disclosure of environmental expenditure does not lead to improved performance. The leverage control variable shows significant positive results, the higher the debt of energy sector companies the more disclosure about climate change. Contrary, firm size is not significant (value of significancy 0.178 and t-value -1.365). It means size of the company doesn't impact to climate change disclosure.

Discussion

Good quality climate change disclosures will affect companies' levels of return on capital made by investors meaning that more investments will be made in these companies. Investors need as much information as possible to make investments, and, when there are IPOs, intensive climate change information can attract investors ([Chen et al., 2023](#)). This will benefit the company in the future meaning that it can improve company performance.

According to the Paris Agreement, national governments have committed to reducing carbon emissions by 1.5-2%, therefore several regulations have been enacted to achieve this target in Indonesia (Per Pres No 98, 2021; Per Men LHK 7, 2023 and POJK on carbon emissions trading). Therefore, climate change disclosure is a concern for companies in managing carbon and greenhouse gas emissions, as well as the impact on the earth and society. The better the disclosures about the management of carbon emissions and greenhouse gases, the more investors will give positive signals in the market, and in addition, the more a firm's performance will increase ([Berkman et al., 2024](#); [Vestrelli et al., 2024](#)). This trend is captured in Fig. 1 where both Climate Change Disclosure and ROE are having a positive increase between 2017 – 2022.

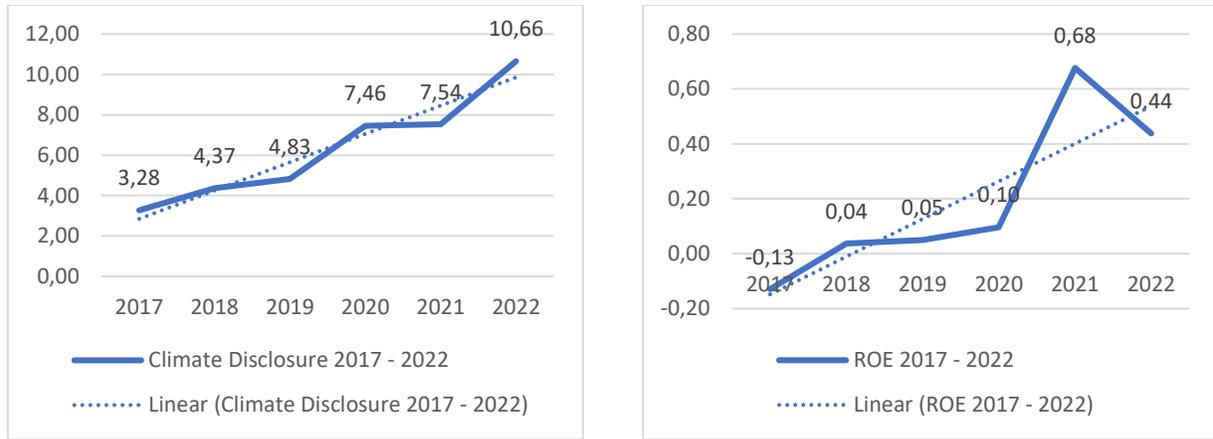


Figure 1. Climate Disclosure – ROA Trend Between 2017-2022

Source: Analysis by the Authors (2024)

The results obtained support the agency theory according to which the representative of the owner (agent) does not act in accordance with the owner’s interest. On the other hand, the company is required to provide benefits for stakeholders so that they can still survive and obtain legitimacy. Control of GHGS emissions is one example of these demands, which means companies must express their GHGS activities to the public. This finding also demonstrates that the stakeholder theory is supported. There is an increasing need for companies to divert their attention toward the desire of stakeholders as the main owners of the resources used by the companies to operate. Therefore, companies must make maximum efforts to provide satisfaction to related stakeholders, one of which is by disclosing information about climate change-related policies. This research supports the notion that sustainability is important for stakeholders to consider.

Environmental disclosure has been not proven to improve performance. Environmental disclosures made by companies are not used by investors as a significant investment consideration. Doan & Sassen (2020) state that environmental disclosure has nothing to do with environmental performance, while environmental performance can improve performance and strengthen the market (Aydoğmuş et al., 2022; Khalil et al., 2024). This is because investors are not interested in information and costs that do not have a beneficial impact on their investments (Permana & Tjahjadi, 2020).

According to stakeholder and agency theory, environmental disclosure can be one of the media used by the management to provide benefits to stakeholders which will have an impact on the survival of the company. Hypothetically speaking, positive information conveyed effectively in disclosures, in this case, environmental disclosures, will have a good impact on stakeholder’s trust and return. However, the results figured that environmental disclosure in a sustainability report issued by the management cannot enhance a company’s performance. This may be the case because investors consider that environmental disclosure has no direct impact or benefit (Baboukardos, 2017; Radhouane et al., 2018). Environmental costs that are not managed properly will be able to increase product prices, causing a decrease in company performance (Nyahuna et al., 2023).

Control variables show that a higher level of company leverage is positively associated with a company’s performance, while company size does not guarantee high company performance. This result emphasized the role of leverage as financial performance ‘leverer’, where high leverage is presumed as good capital for firm’s performance. However, companies must understand that high leverage only resulted in high financial performance when managed well. Contrary to leverage, company size cannot be used as a guarantee in measuring the quality of the company and cannot convince investors of the management’s ability manage assets (Deswanto & Siregar, 2018). In general, investors can make decision by examining various aspects of firm, except company size, such as firm’s financial report, dividend policy, and firm’s image.

Conclusion

This study focused on examining the causality between climate change disclosure, environmental disclosure, and company performance. This is directly related to climate change risk which impose negative effects for countries. Thus, many countries have committed to reduce carbon emission with Net Zero Carbon programme in 2050. Paris Agreement is ratified in line with that commitment in 2016. To show the effects of disclosure on firm performance, this research used 61 sample taken from energy sector-listed companies in the IDX from 2017 to 2022. The results showed that companies with good quality climate change disclosures will see an effect on the rate of return on capital made by investors meaning that more investments will be made in these companies. This also shows that

stakeholder awareness of the impact of carbon and greenhouse gas emissions on climate change has developed, so if companies care about managing carbon and greenhouse gas emissions, as well as their impact on the earth and society, and make good quality disclosures, then investors will give a positive response. Therefore, the company's performance will increase.

Environmental disclosure cannot improve company performance; this is because investors do not consider environmental disclosure important because it has no direct impact on investor profits. This research contributed to Stakeholder and Agency Theory, pointing the urge to disclose climate change issue. In practice, companies can continue this positive trend whilst government should increase the status of such disclosure to mandatory. This study is far from perfect, and it has some limitations. First, the data collection method used was content analysis which is affected by researcher subjectivity in interpreting the content of sustainability reports or annual reports. Future researchers could use research staff to reduce this subjectivity. The second limitation is that a lot of data were incomplete which caused the sample size to be relatively small.

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Appendix 1 Measurement of GHG reporting quality.

| Quality Dimension | No. | Criterion |
|-------------------|-----|---|
| Accuracy | 1 | Apart from the assurance statement, the report includes measures taken to ensure the accuracy of the emission estimation process i.e. details of internal processes or auditing procedures for verifying data. |
| | | |
| Completeness | 2 | Scope 1 CO ₂ emissions are reported. |
| | 3 | Scope 2 CO ₂ emissions are reported. |
| | 4 | Scope 3 CO ₂ emissions are reported. |
| | 5 | Global Warming Potential – Emissions data for all direct GHG emissions are reported in tonnes of CO ₂ equivalents using a recognized GWP. |
| | | |
| Consistency | 6 | Consistency in reporting boundary, accounting approach, and data reported. |
| | 7 | Reporting of normalized data (for example tonnes of CO ₂ per barrel of oil produced) which is comparable between years. |
| | 8 | Standards – The report refers to whether GHG or CO ₂ data is reported by internal or external reporting guidelines. |
| | 9 | Performance – The company's performance in terms of setting and achieving quantitative GHG emission reduction targets is reported. |
| Credibility | 10 | There is an assurance statement which includes the assurance of GHG or CO ₂ data. |
| | 11 | Company contact information is provided in the sustainability report. |
| Relevance | 12 | The Company reports absolute levels of quantitative greenhouse gas emissions. |
| | 13 | The boundary for the greenhouse gas inventory is described and the GHG data reported is complete given the boundary definition. |
| Timeliness | 14 | The reporting period that the data covers is outlined in the sustainability report. |
| | 15 | There is a consistent reporting schedule. |
| Transparency | 16 | The methodologies which have been used to calculate or measure emissions are outlined. |
| | 17 | All terms and jargon are clearly explained. |
| | 18 | The GHG data that the company is reporting is clear. It is clear whether the company is reporting on Scope 1, Scope 2, or Total CO ₂ data. Where GHG data is reported it is clear which pollutants this data includes. |