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Analysis of Accounting Disclosures on Stranded Asset Risks, Oil and Gas Reserve Uncertainty, Energy Transition Risks, and Decommissioning Liability in Oil and Gas Companies

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Abstract

This study aims to analyze accounting disclosures of stranded assets, oil and gas reserve uncertainty, energy transition risk, and decommissioning liability in oil and gas companies. The study uses a descriptive qualitative approach with the objects of PT Pertamina Hulu Energi (PHE), PT Pertamina Hulu Indonesia (PHI), and PT Medco Energi Internasional Tbk (MedcoEnergi). Research data was obtained from annual reports, financial statements, sustainability reports, and official company publications. The analysis was carried out through documentation, information classification, comparison between companies, and qualitative content analysis. The results of the study show that PHE emphasizes the relationship between reserves, asset value, impairment, and Asset Retirement Obligation (ARO) as well as the management of Abandonment and Site Restoration (ASR) funds. PHI focuses more on production, reserves, decarbonization, and decommissioning, with 2024 production of 44.27 MBOPD of oil and 526.04 MMSCFD of gas and emission reduction of 198 Kton CO_2e until October 2024. Meanwhile, MedcoEnergi showed more explicit disclosure regarding energy transition risks, through an analysis of IEA APS and STEPS scenarios as well as the implementation of internal carbon pricing. MedcoEnergi also revealed restoration and rehabilitation provisions of around US$124.61 million in 2024 and US$154.08 million in 2025. Research shows that stranded assets, reserve uncertainty, energy transition risk, and decommissioning liability are interrelated. However, disclosure of the linkage of these risks to financial impacts, especially on asset value, impairment, cash flow, and profitability, still needs to be strengthened.

Keywords: Stranded Assets; Oil and Gas Reserves; Energy Transition Risk; Decommissioning Liability; Accounting Disclosure.

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INTRODUCTION

The oil and gas industry is one of the strategic sectors that has a great contribution to the economy, but also faces various risks due to changes in energy and environmental conditions. Dependence on fossil energy sources, policy changes towards low-carbon energy, the development of renewable energy technology, and changes in energy demand can affect the sustainability of oil and gas companies' business activities. These conditions raise the need for more transparent disclosure of information on the condition of assets, reserves, climate change risks, and corporate liabilities after production activities end.(Agustini & Arifa, 2024)

One of the increasingly important risks is stranded assets, which are conditions when assets are no longer able to generate economic benefits according to previous estimates. In oil and gas companies, these risks can be related to a decrease in reserves, changes in oil and gas prices, decreased production, changes in environmental policies, low-carbon energy technology, and increasing carbon costs. The risk of stranded assets can have an impact on the recorded value of assets and cause the need for impairment. Therefore, information about the uncertainty of reserves and the economic life of assets is an important part of the accounting disclosure of oil and gas companies.(Zahra et al, 2026)

In addition to stranded assets, energy transition risks are also a concern in the management of oil and gas companies. The transition to low-carbon energy can affect oil and gas demand, operating costs, investment decisions, and the outlook of the company's assets. Companies need to anticipate these changes through decarbonization strategies, the use of renewable energy, energy efficiency, and climate change risk management. Disclosure of transition risks is important for investors and stakeholders because it can provide an overview of the company's ability to maintain its performance and economic value in the face of changes in the energy system.(Almaeda et al, 2023)

Oil and gas companies also face uncertainty over reserves and decommissioning liabilities. Reserves determine the estimated production and economic useful life of assets, so changes in estimated reserves can affect depreciation, amortization, impairment, and future cash flows. On the other hand, after production activities end, companies still have an obligation to carry out facility demolition and environmental restoration. These liabilities can be material liabilities and require estimated costs, settlement times, discount rates, and other assumptions (Wahyuni et al., 2025).

The focus of this research is to analyze in an integrated manner how stranded assets, oil and gas reserve uncertainty, energy transition risk, and decommissioning liability are disclosed and associated with accounting consequences in oil and gas companies. The research uses a qualitative approach by comparing PT Pertamina Hulu Energi (PHE), PT

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Pertamina Hulu Indonesia (PHI), and PT Medco Energi Internasional Tbk (MedcoEnergi). The novelty of the research lies in the combination of these four aspects in one analysis of accounting disclosures and inter-company comparisons, not just discussing emissions or climate change risks separately as in some previous studies. This study specifically explores the relationship between changes in reserves → the economic value and life of assets → potential stranded assets/impairment → energy transition risks → decommissioning liabilities. Thus, the research is expected to provide a more comprehensive picture of how sustainability risks and energy transition can affect financial information and economic sustainability of oil and gas companies.

LITERATURE REVIEW

Stakeholder Theory

Stakeholder theory explains that the company not only has responsibilities to shareholders, but also to various parties interested in the company's activities, such as the government, investors, creditors, employees, the community, and the environment. In the oil and gas industry, the interests of stakeholders are becoming increasingly important because oil and gas business activities are related to the use of natural resources, state revenue, environmental risks, and changes in energy policy. Therefore, companies are required to provide transparent information about the risks and impacts of their operational activities to stakeholders.(Universitas Nusa Nipa Indonesia, 2022)

Disclosures regarding stranded assets, uncertainty of oil and gas reserves, energy transition risks, and decommissioning obligations are part of the information needed by stakeholders in assessing the company's condition and sustainability. This information can help investors and creditors understand possible changes in asset value, the company's ability to maintain production, and liabilities that may arise in the future.

Legitimacy Theory

The theory of legitimacy explains that the sustainability of a company is influenced by public acceptance of the company's activities. Companies need to show that their operational activities are in accordance with the values, norms, and expectations of the community. In the context of oil and gas companies, legitimacy is important because this industry faces high concerns related to carbon emissions, climate change, natural resource use, and post-operation activities.

One form of effort to gain and maintain legitimacy is through the disclosure of information about environmental risks and energy changes. Disclosure of climate risks and environmental change can be a means for companies to demonstrate their responsibility

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and response to sustainability demands. The development of research in Indonesia also shows that there is increasing attention to the disclosure of climate change information in companies.(Sherita et al, 2025)

Thus, the disclosure of energy transition risks and decommissioning obligations not only has an accounting aspect, but also relates to the company's efforts to maintain the trust of the public and stakeholders.

Accounting Disclosures on the Oil and Gas Industry

Accounting in the oil and gas industry has different characteristics from other business sectors. Oil and gas companies are dealing with exploration and production assets, natural resource reserves, uncertainty of exploration results, changes in commodity prices, and liabilities that arise when operating activities end. Therefore, the accounting information of oil and gas companies needs to be able to reasonably describe the condition of the company's assets, reserves, business risks, and liabilities.

Oil and gas accounting is basically related to recording and reporting activities ranging from exploration, development, production to post-operation activities. These characteristics cause information regarding reserves, development costs, asset value, and post-operation liabilities to be important in the financial statements of oil and gas companies. (Kadim, 2018)

Adequate disclosure is becoming increasingly important as changes in the business environment and energy policy can affect the assumptions a company uses in determining the value of its assets and liabilities. Thus, financial statements not only need to show financial figures, but also provide information that helps report users understand the uncertainties inherent in oil and gas business activities.

Stranded Asset

Stranded assets are assets that have experienced a decrease in economic benefits or cannot be used according to the initial plan before the end of their economic useful life. In the oil and gas industry, stranded asset risks can arise when changes in energy policy, the development of renewable energy technology, a decrease in demand for fossil fuels, and emission reduction policies cause oil and gas assets to no longer provide economic benefits as previously estimated.

The risk of stranded assets has consequences for accounting because changes in the economic outlook of an asset can affect the valuation, measurement, and disclosure of assets in financial statements. Companies need to consider whether there are indications of asset value decline due to changes in the business environment and energy policies.

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Research on stranded assets in the oil and gas industry shows that changes towards a low-carbon economy can have an impact on the sustainability of the economic benefits of oil and gas companies' assets.(Zahra et al, 2026)

In this study, stranded assets were analyzed through information disclosed by the company regarding the risk of asset value decline, changes in economic assumptions, economic life of assets, investment in oil and gas assets, and company strategies in dealing with changes towards low-carbon energy.

Uncertainty of Oil and Gas Reserves

Oil and gas reserves are one of the most important pieces of information in the oil and gas industry because they are directly related to the company's ability to generate revenue in the future. However, oil and gas reserves have a high level of uncertainty because their amount and production capabilities are influenced by geological conditions, technology, commodity prices, production costs, and government policies.

Reserve uncertainty can affect various accounting decisions, especially those related to the estimated productive life of assets, depreciation, amortization, cost recognition, and assessment of the company's ability to generate economic benefits. Therefore, information about reserves needs to be presented transparently so that users of financial statements can understand the level of uncertainty inherent in the company's assets and production activities.

In the context of this study, reserve uncertainty is analyzed through the company's disclosure of the amount and type of reserves, changes in reserve estimates, factors that cause changes in reserves, and their impact on the sustainability of production activities and the economic value of the company.

Energy Transition Risks

Energy transition risks are risks that arise due to changes towards a lower carbon energy system. These changes can come from government policies, technological developments, changes in consumer behavior, investor demands, and changes in energy market conditions. For oil and gas companies, the energy transition can affect oil and gas demand, operational costs, investments, business strategies, and asset values.

Climate change and the transition to a low-carbon economy also encourage companies to increase transparency about the risks they face. Research on climate change disclosure in Indonesia shows that the issue of climate change is growing in accounting research and corporate reporting.(Sherita et al, 2025)

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Energy transition risk disclosure in company reports can include strategies to deal with changes in the energy mix, investments in low-carbon energy, emission reduction targets, policy risk analysis, and the impact of the energy transition on the company's assets and performance. This information is important to assess the company's readiness to deal with changes in the structure of the energy industry.

Decommissioning Liability

Decommissioning liability is an obligation related to the termination and restoration of facilities after the end of operational activities. In the oil and gas industry, these obligations can include the dismantling of production facilities, site cleaning, environmental restoration, and abandonment and site restoration (ASR) activities.

Post-operating liabilities have important characteristics because their realization is in the future and the amount of costs that must be incurred may change due to technical conditions, changes in regulations, inflation, technology, and the timing of the implementation of activities. Therefore, companies need to make adequate estimates and disclosures of these obligations.

Research on Abandoned Site Restoration In the upstream oil and gas industry, it shows that post-operation activities can give rise to residual liabilities that need to be managed appropriately by the company. In addition, asset management in ASR activities is also an important part of managing the company's responsibilities after oil and gas operations activities end.(Wahyuni et al, 2025)

In this study, decommissioning liability was analyzed based on disclosures about the existence of liabilities, estimated costs, changes in estimates, settlement times, and company policies in carrying out abandonment and site restoration activities.

Previous Research

Previous research has been used to show the development of studies on stranded assets, sustainability disclosure, climate change, carbon emissions, energy transition risks, and decommissioning in the energy and oil and gas sectors. Previous studies have shown that research on the energy sector in Indonesia increasingly discusses the transparency of environmental risks and climate change. However, research that specifically integrates stranded assets, oil and gas reserve uncertainty, energy transition risk, and decommissioning liability in the perspective of accounting disclosure of oil and gas companies is still relatively limited. Some relevant research can be presented as follows.

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No.	Researcher	Research Focus	Research Results	Research Gap
1	Zahra, Fakhirah, Sapitri, & Tjandrakirana DP (2026)	*Stranded Assets in the Oil and Gas Industry: An Accounting Perspective and Its Impact on Financial Statements*	The study analyzed the phenomenon of stranded assets in the oil and gas industry and its impact on financial statements. The results of the study show that the transition to a low-carbon economy can increase the risk of depreciation of oil and gas assets and affect the company's financial stability and long-term investment decisions.	The research focuses on stranded assets, but has not integrated stranded assets with oil and gas reserve uncertainty, energy transition risk, and decommissioning liability in one accounting disclosure analysis.
2	Al Ghazali & Kirana DP (2026)	*Sustainability Disclosure in Oil and Gas Industry Companies: Determinants and Impact on Company Value*	The study used the *Systematic Literature Review method* to examine the determinants and impact of *sustainability disclosure* on the oil and gas industry. The results of the study show that sustainability disclosure is a strategic aspect for oil and gas companies due to high ESG pressure, environmental impact, and stakeholder demands.	The research discusses sustainability disclosure in general and its relation to company value, but has not specifically analyzed the disclosure of stranded asset risks, oil and gas reserves, energy transition, and decommissioning liability.

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No.	Researcher	Research Focus	Research Results	Research Gap
3	Musyarofah & Purnamasari (2026)	*Determinants of Carbon Emission Disclosure in Energy Sector Companies in Indonesia: The Role of Capital Expenditure, Financial Slack, and Firm Size*	The study examines the influence of *capital expenditure*, *financial slack*, and *firm size on the carbon* emissions disclosure of energy sector companies for the 2020–2024 period. The study highlights the increasing importance of carbon emission transparency in the energy sector after the increasing demands for sustainability reporting.	The research uses a quantitative approach and focuses on the determinants of carbon emission disclosure. The study has not discussed accounting disclosure of stranded assets, oil and gas reserves, energy transition risks, and decommissioning liability qualitatively.
4	Rismahmudah & Mukhibad (2026)	*Determinants of Carbon Emission Disclosure: The Role of Gender Diversity in Moderating Financial and Environmental Factors in Energy Sector Companies*	Research on energy sector companies for the period 2021–2024 found that leverage and environmental management have an effect on carbon emission disclosure, while institutional ownership does not show a significant influence. Gender diversity also plays a role as a moderation variable in the relationship between financial and environmental factors	The research focuses on factors that affect carbon emission disclosure, so it has not addressed the broader substance of risk disclosure, particularly stranded assets, reserve uncertainty, energy transition, and decommissioning obligations.

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No.	Researcher	Research Focus	Research Results	Research Gap
			and carbon emission disclosure.	
5	Sherita, Zhafira, Setiawan, & Aryani (2025)	*Development of Climate Change Disclosure Research in Indonesia*	The study used the *Charting the Field* method on 28 articles from 22 journals for the period 2015–2024. The results of the study show that the study of climate change disclosure in Indonesia is growing and most of the research uses analytical approaches and non-financial variables.	The study maps the development of the literature on climate change disclosure, but does not specifically examine oil and gas companies and has not linked climate change disclosure to stranded assets, oil and gas reserves, energy transition risks, and decommissioning liability.
6	Wahyuni, Nyka, Harris, Sujianto, Baiquni, & Ni'am (2025)	*Abandoned Site Restoration: Addressing Residual Liability in Upstream Oil and Gas Industry*	The research discusses *decommissioning policies* in Indonesia's upstream oil and gas sector and shows that the regulatory framework related to *residual liability* is still limited. The research also emphasizes the importance of legal certainty and risk sharing in *abandonment and site restoration activities*.	The research uses an empirical juridical approach and emphasizes more on legal aspects and the division of responsibilities. It has not been analyzed how decommissioning liability is disclosed and explained in the financial statements of oil and gas companies and their relationship with

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No.	Researcher	Research Focus	Research Results	Research Gap
				asset risks and energy transition.
7	Putri, Savitri, & Silfi (2025)	*Carbon Emissions Disclosure: Understanding the Role of Profitability, Board Gender, and Media Exposure*	The research discusses the disclosure of carbon emissions in companies in Indonesia and highlights the importance of emission transparency for companies, especially sectors that have a significant contribution to emissions and face environmental issues.	The research focuses on profitability, board gender, and media exposure as factors for carbon emission disclosure. The research has not examined more specific accounting risks for oil and gas companies, such as impairment due to stranded assets and decommissioning liabilities.
8	Az-Zahwa, Purwohedi, & Zairin (2025)	*Analysis of Factors Affecting Carbon Emission Disclosure in Energy and Agriculture Sector Companies in Indonesia*	The study examines the influence of industry type, *green investment*, and *media exposure* on carbon emission disclosure in companies in the energy and agriculture sectors for the 2019–2023 period. The results of the study provide an overview of factors related to the company's carbon emission disclosure practices.	The research covers the energy sector but does not specifically focus on oil and gas companies. In addition, the focus of the research is on factors that affect the disclosure of carbon emissions, not the analysis of the content of the disclosure regarding stranded assets, reserves, energy transition

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No.	Researcher	Research Focus	Research Results	Research Gap
				risks, and decommissioning liabilities.
9	Agustini & Arifa (2024)	*Climate Change Accounting and Disclosure: A Systematic Literature Review*	The study conducted *a Systematic Literature Review* of 49 articles for the period 2009–2022 and mapped the development of accounting literature and climate change disclosure. The research shows that the issue of climate change is increasingly developing in the field of accounting and corporate reporting.	The study provides a broad overview of climate change accounting and disclosure, but has not specifically tested disclosure practices in oil and gas companies in Indonesia and has not integrated the four main risks of this study.
10	Almaeda, Pramuda, & Setiawan (2023)	*Development of Carbon Disclosure Research in Indonesia*	The study used the *Charting the Field* method on 43 articles on *carbon disclosure* in Indonesia for the period 2013–2022. The results of the study show that profitability, company size, and environmental performance are antecedent variables that are often researched, while company value is	The research focuses on mapping the development of carbon disclosure and has not specifically examined the substance of accounting risk disclosure in the oil and gas industry, especially stranded assets, reserve uncertainty, energy transition risk, and

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No.	Researcher	Research Focus	Research Results	Research Gap
			widely used as a consequential variable.	decommissioning liability.

RESEARCH METHODS

Types and Research Approaches

This study uses a descriptive qualitative approach. The qualitative approach is used because the research aims to understand and analyze in depth how oil and gas companies disclose information about stranded asset risks, oil and gas reserve uncertainty, energy transition risks, and decommissioning liability in company reports. The research is not directed to statistically test the relationship between variables, but to identify, describe, and interpret the information that has been disclosed by the company.

A descriptive approach is used to provide an overview of the form, content, and depth of accounting disclosure for these four aspects. The results of the study are then compared to see the similarities, differences, and tendencies of disclosure between companies.

Objects of Research

The object of the research is accounting disclosure and risk information on companies engaged in the oil and gas industry in Indonesia. The disclosures analyzed include information in annual reports, financial statements, sustainability reports, and other relevant company information.

The research is focused on four main aspects, namely:

1. Stranded Assets, which relate to the possibility of oil and gas assets losing economic benefits before the end of their economic life;
2. Uncertainty of Oil and Gas Reserves, which is related to the estimation of the amount and production capacity of oil and gas reserves;
3. Energy Transition Risks, which relate to changes in policies, technologies, markets, and demands towards low-carbon energy;
4. Decommissioning Liability, which relates to the obligation to cease operations, demolition of facilities, and abandonment and site restoration (ASR).

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Data Sources

The research uses secondary data. Secondary data is obtained from publicly available documents that are relevant to the purpose of the research. Primary data sources include annual reports, financial statements, sustainability reports, governance reports, risk reports, and official company publications.

In addition to company documents, the research uses supporting sources in the form of scientific journal articles, books on oil and gas accounting, accounting standards, and government regulations related to upstream oil and gas business activities, the environment, and post-operating obligations.

The use of these various sources is intended to obtain a more comprehensive understanding and triangulate sources, so that the results of interpretation are not only based on one type of document.

Data collection techniques

The data collection technique used is documentation. The researcher collects company documents that can be accessed through the company's official website, the Indonesia Stock Exchange, and other official sources.

The collected documents were then examined by searching for information related to the four research focuses. The keywords used in the search process include stranded assets, impairment, oil and gas reserves, reserve uncertainty, energy transition, climate risk, decommissioning, abandonment and site restoration, asset retirement obligation, and other terms that have similar meanings.

Data Analysis Techniques

Data analysis is carried out using qualitative content analysis. Content analysis is used to identify information contained in company documents and group them based on the research theme.

The stages of data analysis are carried out through several steps as follows:

1. Document Identification

The researcher identifies and selects the company's report that is relevant to the research period. The selected document must contain information regarding the company's financial condition, assets, reserves, risks, sustainability, or post-operating activities.

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2. Information Collection

Information relating to the four research focuses was collected from the selected documents. Each piece of information was recorded based on the source of the document and the disclosure section where it was found.

3. Data Classification

The information obtained is classified into four main categories:

Categories	Information Analyzed
Stranded Asset	Risk of asset impairment, changes in the economic life of assets, impairment, potentially unproductive assets, and the impact of the energy transition on assets
Uncertainty of Oil and Gas Reserves	Number of reserves, changes in reserve estimates, technical and economic factors, production life, and uncertainty of estimates
Energy Transition Risks	Low-carbon energy policies, changes in oil and gas demand, regulatory risks, technology, energy prices, diversification strategies, and emission reduction targets
Decommissioning Liability	Post-operating liability estimates, decommissioning costs, ASRs, facility demolition, site recovery, and liability estimate changes

4. Data Interpretation

The data that has been grouped is then interpreted to find out how the company identifies and discloses each risk. The analysis not only looks at the presence or absence of information, but also pays attention to completeness, clarity, linkage with financial statements, and explanations of the impact of risks on the company.

5. Comparison Between Companies

The results of each company's disclosure were compared to find out the similarities and differences in disclosure practices. The comparison was carried out based on four research themes so that it could be known which aspects had been adequately disclosed and which aspects were still limited.

6. Conclusion Drawing

The last stage is to draw conclusions based on the results of interpretation and comparison. The conclusion is directed to answer how oil and gas companies disclose stranded asset risks, oil and gas reserve uncertainty, energy transition risks, and

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decommissioning liability and the extent to which these disclosures provide relevant information for stakeholders.

Data Validity

The validity of the data is carried out through source triangulation. Triangulation is carried out by comparing information obtained from annual reports, financial statements, sustainability reports, risk reports, official company publications, scientific journals, and relevant regulations.

In addition, the information obtained from the company's reports is compared with the applicable literature and provisions to avoid interpretations that are based solely on the company's perspective. In this way, the results of the research are expected to have a better level of credibility and objectivity.

RESULTS AND DISCUSSION

Research Results

This study analyzes accounting disclosures related to four main aspects of oil and gas companies, namely stranded assets, oil and gas reserve uncertainty, energy transition risk, and decommissioning liability. The research objects include PT Pertamina Hulu Energi (PHE), PT Pertamina Hulu Indonesia (PHI), and PT Medco Energi Internasional Tbk (MedcoEnergi). Data were obtained from financial statements, annual reports, sustainability reports, and official company publications.

PT Pertamina Hulu Energi (PHE)

The results of the review of PHE's financial statements show that the company uses the principles of the 2018 Petroleum Resources Management System (PRMS) in determining proven reserves of oil and gas. PHE also revealed that the estimated reserves may change due to changes in economic assumptions and additional geological information. Changes in the estimated reserves may affect depreciation and amortization, the economic useful life of the asset, the provision of demolition and restoration of the site, as well as the recorded value of assets and deferred tax liabilities. (PT Pertamina Hulu Energi, 2025)

The disclosure shows that oil and gas reserves are not only operational information, but also one of the important bases in the measurement and valuation of the company's accounting accounts. Thus, changes in reserves can be directly related to the economic value of oil and gas assets and post-operating liabilities.

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In terms of decommissioning liability, PHE acknowledges the existence of an Asset Retirement Obligation (ARO) for assets located in the PSC's work area. One of PHE's disclosures shows the placement of Abandonment and Site Restoration (ASR) funds by PHE OSES of around US$180,027.96 thousand on May 21, 2024. The funds were placed based on SKK Migas' provisions regarding the placement of ASR funds.(PT Pertamina Hulu Energi, 2025)

In addition, changes in reserve estimates that affect the time and cost of decommissioning and restoration activities can also lead to changes in decommissioning provisions. Thus, PHE disclosures show a relationship between reserves, asset economic life, impairment, and restoration liabilities.(PT Pertamina Hulu Energi, 2025)

PT Pertamina Hulu Indonesia (PHI)

In 2024, PHI recorded oil production of 44.27 thousand barrels of oil per day (MBOPD) and gas production of 526.04 million standard cubic feet per day (MMSCFD). In the same year, PHI reported an additional P1 proven reserves of 64.48 MMBOE, Reserves to Production (RTP) of 3.8 years, and the discovery of 2C contingent resources of 106.38 MMBOE. (PT Pertamina Hulu Indonesia, 2024)

The data provides an overview of the condition of the company's reserves and production capabilities. Information on production, proven reserves, RTP, and contingent resources is an important part in assessing the sustainability of oil and gas exploration and production activities.

In terms of energy transition risks, PHI reported that until October 2024 the company managed to reduce emissions by 198 Kton CO_2e, or 44.6% higher than the year-to-date (YTD) target. These efforts are carried out through a number of programs, including new technologies, production optimization, electrification towards renewable energy, production shutdown, and the use of carbon credits.(PT Pertamina Hulu Indonesia, 2024)

In the aspect of decommissioning, PHI also discloses various activities related to the termination and release of production assets. One of the approaches used in PHI's operating environment is Rig to Reef, which is the utilization of structures that have been stopped from production activities for certain purposes after meeting applicable regulations. This information shows that decommissioning is not only related to the termination of assets, but can also be related to environmental and sustainability aspects.

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PT Medco Energi Internasional Tbk

MedcoEnergi exhibits relatively broad disclosures regarding climate change risks and energy transition risks. The company states that climate risks are integrated into risk management, business planning, financial planning, and asset management. By 2024, MedcoEnergi has conducted a quantitative assessment of the impact of transition risks using IEA-based scenario analysis, namely the Announced Pledges Scenario (APS) and the Stated Policies Scenario (STEPS).(MedcoEnergi, 2026)

MedcoEnergi also implements internal carbon pricing as one of the instruments to assess the impact of transition risks on businesses. The internal carbon price is used in business models and investment testing to see the possible impact of carbon emission costs on project profitability.(MedcoEnergi, 2026)

In terms of decommissioning, MedcoEnergi's financial statements show that there is a long-term restoration and rehabilitation provision of US$124,606,895 in 2024. In the 2025 financial statements, this value increases to around US$154,083,944 (PT Medco Energi Internasional Tbk, 2025).

MedcoEnergi also publicly provides annual reports, sustainability reports, and financial statements for the 2024 and 2025 periods. This allows report users to obtain information about the company's financial performance, sustainability, risks, and liabilities.

Comparison of Research Results

Aspects	PHE	PHI	MedcoEnergi
Uncertainty of the proposal	Using PRMS 2018; changes in reserves may affect depreciation, amortization, asset useful life and restoration provisions.	Reveal production, P1 proven reserves, RTP, and 2C resources.	Reserves and production conditions are part of the economic considerations of assets and operating activities.
Stranded asset	Relating to changes in the economic value of assets, impairment, reserves,	Relating to production sustainability, asset	Associated with transition risks and climate change scenario analysis.

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Aspects	PHE	PHI	MedcoEnergi
	prices and useful life of assets.	life, and production stoppage.	
Energy transitio n risks	Related to the economic condition of assets and the sustainability of upstream oil and gas activities.	It is demonstrated through emission reduction, electrification, renewable energy, decommissioning, and carbon credits.	Measured through IEA scenario analysis and internal carbon pricing.
Decomm issio-ning liability	Recognize ARO and place ASR funds.	Implement asset termination and decommissioning programs.	Recognize the provision of restoration and rehabilitation with material value.
Disclosu re characte ristics	Stronger on the backup–asset–ARO relationship.	Stronger in production–reserves–decarbonization–decommissioning.	Stronger on the integration of transition–financial–decommissioning risks.

Based on these results, all three companies equally disclosed information related to reserves, climate change or transition risks, and post-operating obligations, but had different emphasis. PHE showed more of the relationship between reserves and assets and restoration obligations; PHI showed the relationship between production, reserves, decarbonization, and asset decommissioning; while MedcoEnergi showed a more explicit integration of transition risk with financial and investment planning.

Discussion

Disclosure of Stranded Assets in Oil and Gas Companies

The results of the study show that the term stranded assets have not always been presented explicitly as a separate account in the financial statements of oil and gas companies. However, the indication can be traced through disclosures regarding

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impairment, recorded value of assets, reserves, production, commodity prices, asset useful life, and energy transition risks.

In PHE, changes in reserves are explicitly said to affect the economic useful life of assets, depreciation and amortization, as well as the provision of dismantling and restoration. This is important because a decrease in reserves or changes in economic conditions can shorten the useful period of oil and gas assets.(PT Pertamina Hulu Energi, 2025)

In PHI, production information of 44.27 MBOPD for oil and 526.04 MMSCFD for gas, as well as an RTP of 3.8 years, provides information on the ability of assets to generate economic benefits in the future.(PT Pertamina Hulu Indonesia, 2024)

Meanwhile, MedcoEnergi uses scenario analysis to assess the transition risks and potential financial impacts of carbon pricing. This approach is closer to the initial identification of the possibility of assets losing their economic value due to changes in policy, technology, carbon pricing, and energy demand direction.(MedcoEnergi, 2026)

Thus, stranded assets in the oil and gas industry can be understood not only as assets that have ceased to be used, but also as assets that are potentially unable to generate economic benefits as previously thought. These risks can arise due to declining reserves, changes in oil and gas prices, climate policy, low-carbon energy technologies, changes in demand, or rising carbon costs.

Uncertainty of Reserves and Economic Value of Assets

Oil and gas reserves have a strong relationship with the company's accounting because the reserves determine the estimated production and recovery period of the economic benefits of the asset. PHE directly reveals that changes in the estimated reserves can affect depreciation, amortization, asset useful life, decommissioning provisions, as well as deferred tax positions.(PT Pertamina Hulu Energi, 2025)

The findings show that reserve uncertainty is one of the important sources of accounting uncertainty in oil and gas companies. Lower reserves can cause production estimates to decrease, so the economic benefit period of assets can also change.

PHI provides examples of quantitative disclosures through 2024 production of 44.27 MBOPD and 526.04 MMSCFD, P1 of 64.48 MMBOE, and RTP of 3.8 years. This information helps report users understand the relationship between reserves and the company's ability to maintain production.(PT Pertamina Hulu Indonesia, 2024)

Thus, the greater the uncertainty over reserves and production life, the greater the need to explain the impact on asset value, depreciation/depletion, impairment, future cash flows, and decommissioning liabilities.

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Energy Transition Risks and Accounting Implications

Energy transition risks arise due to changes in government policies, technological developments, changes in consumer preferences, changes in fossil energy demand, and the implementation of carbon pricing mechanisms.

PHI demonstrates a response to these risks through an emission reduction program. As of October 2024, PHI recorded an emission reduction of 198 Kton CO_2e or 44.6% above the YTD target. Programs implemented include new technologies, production optimization, electrification, renewable energy, decommissioning, and carbon credits.(PT Pertamina Hulu Indonesia, 2024)

MedcoEnergi shows a more explicit approach in terms of risk measurement. The company conducts a quantitative assessment of transition risks using IEA APS and STEPS scenarios and implements internal carbon pricing to test the impact of carbon costs on investment and project profitability.(MedcoEnergi, 2026)

From an accounting perspective, such information is important because transition risks can ultimately affect estimated cash flows, fair value, asset impairment, investment decisions, asset useful life, provisions, and a company's ability to generate future economic benefits.

Therefore, the disclosure of transition risks will be more informative if the company not only presents emission reduction targets, but also explains its financial impact on assets, liabilities, revenue, costs, cash flow, and profitability.

Decommissioning Liability as a Long-Term Consequences

Decommissioning liability is one of the important aspects in the accounting of oil and gas companies because these liabilities can still arise even if production activities have stopped. In the context of PSAK 237, provision is a liability whose time or amount is uncertain so that it requires adequate estimation and disclosure (Indonesian Institute of Accountants, 2025).

PHE acknowledged the ARO and made the placement of ASR funds. The disclosure indicates that the obligation to terminate and restore assets has become part of the company's financial considerations. (PT Pertamina Hulu Energi, 2025)

At MedcoEnergi, the amount of restoration and rehabilitation provisions increased from around US$124.61 million in 2024 to US$154.08 million in 2025. The increase shows that post-operating liabilities can have material value to the company's financial position.(MedcoEnergi, 2026)

Meanwhile, PHI shows that decommissioning also has an environmental dimension through various asset decommissioning and management programs. Thus,

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decommissioning is not only an accounting obligation, but also related to the company's environmental responsibility and sustainability.

Linkages of Stranded Assets, Reserves, Transition Risks, and Decommissioning Liability

The four aspects of research have an interrelated relationship. The relationship can be described as follows:

Reserve uncertainty → changes in estimated economic life → changes in asset value → risk of impairment/stranded assets → cessation or reduction of operations → decommissioning liability.

Energy transition risks can strengthen these relationships. Changes in climate policies, renewable energy technologies, carbon prices, and fossil energy demand can reduce the economic viability of some oil and gas assets. When assets no longer generate economic benefits as expected, the risk of impairment or stranded assets increases.

Furthermore, if the assets are terminated sooner, the company can still have an obligation to carry out decommissioning and restoration. Therefore, the risk of energy transition can affect not only the value of the asset, but also the amount and timing of the realization of the decommissioning liability.

Disclosure Based on the Perspective of Stakeholder Theory

From the perspective of stakeholder theory, disclosure of reserves, stranded assets, transition risks, and decommissioning is necessary because the information is related to the interests of investors, creditors, governments, the community, and other parties.

Investors need this information to assess the sustainability of cash flow and the value of the company. Creditors need it to assess the company's ability to meet its obligations. The government is interested in the management of natural resources and environmental obligations, while the community is interested in the impact of oil and gas activities on the environment. Therefore, the more complex the risks faced by oil and gas companies, the more important is disclosure that links sustainability information to financial consequences.

Disclosure Based on the Perspective of Legitimacy Theory

The legitimacy theory explains that companies need to show that their activities are in accordance with the values and expectations of the community. In the oil and gas industry, this need is getting stronger because exploration and production activities have a direct relationship with the environment and climate change.

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PHI, for example, revealed a reduction in emissions of 198 Kton CO_2e and various decarbonization programs. MedcoEnergi also revealed the use of climate change scenario analysis and internal carbon pricing as part of the response to transition risks.(PT Pertamina Hulu Indonesia, 2024)(MedcoEnergi, 2026)

The disclosure can be seen as a form of corporate communication to stakeholders that environmental risks and energy transition have become part of the company's management. However, from an accounting perspective, disclosure will be stronger when the information about sustainability is clearly linked to asset value, impairment, liabilities, costs, cash flow, and investment decisions.

Discussion Synthesis

Based on the overall results of the study, it can be seen that the accounting disclosures of oil and gas companies are starting to evolve from a traditional focus on production and reserves to broader disclosures regarding climate risks, energy transition, decommissioning, and the sustainability of asset value.

PHE shows a strong relationship between reserves, assets, depreciation/amortization, and ARO. PHI more emphasizes the relationship between production, reserves, decarbonization, and asset decommissioning. Meanwhile, MedcoEnergi shows a more explicit approach in linking transition risk with scenario analysis, carbon pricing, investment decisions, and restoration obligations.

Thus, the ideal disclosure for oil and gas companies not only explains how large reserves and assets they have, but also explains how resilient these assets are to price changes, climate policies, technology, energy demand, carbon prices, and post-operating liabilities. Such integrated disclosures will provide a more complete picture of the economic sustainability of oil and gas companies.

CONCLUSIONS AND SUGGESTIONS

Conclusion

Based on the results of the research and discussion regarding accounting disclosure of stranded assets, oil and gas reserve uncertainty, energy transition risk, and decommissioning liability at PT Pertamina Hulu Energi (PHE), PT Pertamina Hulu Indonesia (PHI), and PT Medco Energi Internasional Tbk (MedcoEnergi), it can be concluded as follows.

1. PT Pertamina Hulu Energi (PHE) showed strong disclosure in the aspects of reserve uncertainty, asset value, impairment, and decommissioning liability. PHE used PRMS 2018 in reserve management and revealed that changes in reserve estimates can affect the

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economic useful life of assets, depreciation and amortization, impairment, and decommissioning and restoration obligations. PHE also recognizes the Asset Retirement Obligation (ARO) and conducts the placement of Abandonment and Site Restoration (ASR) funds. These findings show that in PHE, the relationship between oil and gas reserves, asset economic value, and post-operating liabilities has become an important part of accounting disclosures.

2. PT Pertamina Hulu Indonesia (PHI) shows stronger disclosure characteristics in the aspects of production, reserves, decarbonization, and decommissioning. In 2024, PHI recorded oil production of 44.27 MBOPD, gas production of 526.04 MMSCFD, P1 proven reserves of 64.48 MMBOE, and RTP of 3.8 years. PHI also reported a reduction in emissions of 198 Kton CO_2e until October 2024, supported by production optimization programs, electrification, renewable energy, technology, decommissioning, and carbon credits. These findings show that PHI links the sustainability of oil and gas operations with decarbonization efforts and post-operative asset management.
3. PT Medco Energi Internasional Tbk (MedcoEnergi) has shown more explicit disclosure on the risk aspects of the energy transition and its integration with business decision-making. MedcoEnergi uses IEA APS and STEPS scenario analysis to assess transition risks and apply internal carbon pricing in investment evaluations. The company also has a low-carbon energy development strategy and emission reduction targets. In terms of decommissioning, MedcoEnergi acknowledged restoration and rehabilitation provisions of approximately US$124.61 million in 2024 and approximately US$154.08 million in 2025. These findings indicate that transition risks and post-operating liabilities have been considered in the company's risk management and planning.
4. Based on the comparison of the three companies, there are differences in disclosure focus. PHE emphasizes the linkage of reserves–assets–impairment–ARO, PHI emphasizes production–reserves–decarbonization–decommissioning, while MedcoEnergi emphasizes transition risks–scenario analysis–carbon pricing–investment–decommissioning. These differences show that each company has a different approach in communicating sustainability risks and their impact on business activities.
5. The disclosure of stranded assets does not fully use the term stranded assets directly, but the indication can be found through information on impairment, changes in reserves, asset useful life, production, commodity prices, and transition risks. In PHE, the indication can be seen from the relationship between reserves and asset value. In PHI, it can be seen from the relationship between production and the economic life of assets. In MedcoEnergi, these risks are more associated with energy transition scenarios and changes in economic conditions due to climate policies.

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6. Reserve uncertainty, energy transition risk, stranded assets, and decommissioning liability are interrelated risks. A decrease or change in reserves can affect the economic life of assets and their recorded value. At the same time, changes in climate policy, technology, carbon prices, and energy demand can accelerate the decline in the economic value of oil and gas assets. If assets are stopped sooner, companies still face demolition and restoration obligations.
7. Overall, the three companies have disclosed operational risks, environmental, reserves, and post-operating liabilities. However, the direct relationship between these risks and financial impacts can still be strengthened, especially regarding the influence of transition risks and stranded assets on impairment, asset value, cash flow, profit, and the company's ability to maintain the economic benefits of oil and gas assets.

Suggestions

1. For PT Pertamina Hulu Energi (PHE), it is recommended to strengthen disclosure regarding the relationship between changes in reserves, impairment, recorded value of assets, and ARO. PHE can also explain in a more measurable way how changes in oil and gas prices, production, reserves, and useful life of assets can affect asset value and decommissioning liabilities.
2. For PT Pertamina Hulu Indonesia (PHI), it is recommended to strengthen the relationship between production and reserve information with the financial impact of energy transition risks. Information on emission reduction, electrification, renewable energy, and decommissioning will be more informative if accompanied by an explanation of their impact on costs, investments, cash flows, and asset value.
3. For MedcoEnergi, the use of scenario analysis and internal carbon pricing can be further developed through the disclosure of quantitative impact on asset value, profitability, cash flow, and investment decisions. Disclosure regarding the increase in restoration and rehabilitation provisions also needs to be accompanied by a more detailed explanation of the factors for the change in the estimated liability.
4. For oil and gas companies in general, it is recommended to integrate financial and sustainability disclosures. Information on reserves, stranded assets, transition risks, and decommissioning should not be presented separately, but described as a set of risks that can affect the value of the company's assets and financial condition.
5. For investors and creditors, the valuation of oil and gas companies should not only be based on profits, revenue, and total assets, but also consider the quality of reserves, the economic life of the asset, the risk of impairment, the potential for stranded assets, energy transition strategies, and the amount of decommissioning liability.

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6. For regulators, there is a need for more integrated disclosure guidelines regarding climate change and energy transition risks in oil and gas company reports. Disclosures should include their impact on assets, liabilities, cash flow, profitability, and business continuity.
7. For future researchers, the study can expand the number of companies and observation periods and use the disclosure index to compare the level of disclosure of stranded assets, reserve uncertainty, energy transition risk, and decommissioning liability. Subsequent research can also quantitatively test the relationship between transition risk, impairment, decommissioning liability, profitability, and company value.

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