Viability and Challenges of Energy Transition Policies on the Oil and Gas Industry in Malaysia

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ABSTRACT

Energy transition involves a significant shift from one energy source or supply to another, aiming to decrease fossil fuel consumption and mitigate climate change. Malaysia's transition policies, such as the National Energy Transition Roadmap and the National Energy Policy, target ambitious renewable energy goals, including achieving net-zero emissions by 2050. However, the oil and gas sector, a cornerstone of Malaysia's economy, faces significant challenges during this transition. This paper critically examines these challenges and presents actionable recommendations to leverage the expertise and resources of Malaysia's oil and gas industry to support energy transition efforts. Recommendations include introducing financial incentives, promoting stakeholders' collaboration, fostering research and development and ensuring a socially inclusive transition. This study contributes to understanding the viability of energy transition policies in Malaysia and provides insight for policymakers and industry stakeholders.

Keywords: energy transition policies; oil and gas industry; renewable energy; economic sustainability; environmental challenges

INTRODUCTION

As the world progresses towards a more sustainable energy future, Malaysia, like many other nations, faces the challenge of transitioning from traditional fossil fuel dependency towards renewable and cleaner energy sources. Following Amartya Sen's theory of distributive justice (Osmani, 2010), there is a need to enhance the capabilities of all individuals, ensure equitable distribution of resources and opportunities, involve stakeholders in policy design, and learn from global experiences. These principles can guide the construction and application of fair and effective energy transition policies in Malaysia, addressing the challenges of the oil and gas (O&G) industry while promoting sustainable development.

This transition is necessitated by climate change, environmental degradation, and the need for energy security (United Nations, 2021). In Malaysia, the National Energy Transition Roadmap (NETR) led by Tenaga Nasional Berhad (TNB) lays out new projects that aim to accelerate the country's decarbonisation journey. (Ministry of Economy, Malaysia, 2023). The NETR sets ambitious goals for Malaysia, targeting net-zero emissions by 2050 alongside a gradual increase in renewable energy shares, notably 31% by 2025, 40% by 2035, and an impressive 70% by 2050 (Malaysian Investment Development Authority, 2024).

However, the energy transition poses uncertainties for a country like Malaysia, whose economy largely relies on its O&G industry. The problem lies in understanding the feasibility and challenges of implementing energy transition policies in Malaysia's O&G sector. This sector has been a cornerstone of the nation's economy, contributing about 20% to its Gross Domestic Product (GDP) annually. (Malaysian Investment Development Authority, 2024). Consequently, any transition policies planned to reduce reliance on fossil fuels must be carefully evaluated to ensure they do not undermine the country's economic stability while simultaneously

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addressing environmental concerns. Therefore, this paper aims to provide insights into the viability and challenges of energy transition policies in Malaysia's O&G industry.

Despite the imperative to transition towards renewable energy sources and decarbonise the economy, the Malaysian government's energy transition policies pose intricate challenges for the O&G industry. The need to examine the viability and ramifications of these policies on Malaysia's O&G sector is crucial, considering technological advancements, regulatory frameworks, economic implications, employment impacts, and geopolitical considerations. Addressing this problem would enable proper insights for policymakers, industry stakeholders, and other relevant parties to navigate the transition towards a more sustainable energy future while ensuring the resilience and competitiveness of Malaysia's O&G industry.

LITERATURE REVIEW

The Concept of Energy Transition Policies

Energy transition policies are crucial to global sustainable development, reflecting the shift from fossil-based energy systems to renewable and low-carbon sources. This transition is essential for addressing climate change, achieving net-zero emissions, and ensuring long-term socio-economic development. As Genc and Kosempel (2023) explain, the global energy sector is transforming profoundly to reduce carbon footprints and foster sustainability. The legal and regulatory frameworks surrounding energy transition have evolved to ensure equitable resource management, economic growth, and environmental protection. Bynoe and Moonsamy (2023) emphasise that energy transition is a critical mitigation strategy to address global warming caused by greenhouse gas emissions.

The legal dimension of energy transition policies is increasingly discussed in the context of international law. Agreements like the Paris Agreement (2015) underscore the shared responsibility of nations to mitigate climate change through commitments to reduce emissions. Global concerns also extend to the fair distribution of resources and ensuring that transitioning economies have access to technology and funding. The literature on energy transition has expanded to address these issues, moving beyond technical and supply-side efficiency (Gill et al., 2010) to include legal frameworks, social equity, and economic viability.

Energy transition is deeply interwoven with environmental jurisprudence, which seeks to balance developmental needs with environmental protection. The principles of sustainable development, intergenerational equity, and the precautionary principle underpin the legal frameworks guiding energy transitions worldwide. International bodies, such as the United Nations Framework Convention on Climate Change (UNFCCC), have emphasised these principles in global climate negotiations.

The jurisprudence of energy transition also extends to human rights law, particularly the right to a clean and healthy environment. Courts worldwide have begun to interpret constitutional provisions in light of environmental concerns. For instance, in *Urgenda Foundation v. The Netherlands* (2015), the Dutch Supreme Court ordered the government to reduce emissions to protect citizens' rights to life and well-being. Such cases highlight the intersection between human rights and environmental law, pushing governments to adopt robust energy transition policies.

Malaysia demonstrates how jurisprudence and global concerns shape national energy transition strategies. The NETR outlines a strategic plan to achieve net-zero emissions by 2050 (Malaysian Investment Development Authority [MIDA], 2024). This roadmap aligns with Malaysia's commitments under the Paris Agreement, emphasising renewable energy development and reduced dependence on fossil fuels. Aziz et al. (2024) highlight that programs such as the Small Renewable Energy Program (SREP) and Feed-in Tariff (FiT) system have accelerated the adoption of biomass, biogas, mini-hydropower sources and even ocean renewable energy. These initiatives reflect a broader effort to ensure energy equity, environmental sustainability, and economic growth.

Legal scholars argue that Malaysia's energy policies incorporate principles of environmental jurisprudence, focusing on intergenerational equity and sustainable development. However, Babatunde et al. (2023) caution

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that effective implementation requires more transparent regulatory frameworks and enhanced public-private partnerships. To achieve its energy goals, Malaysia must address global concerns, such as ensuring technology transfer and financial assistance to transitioning economies.

The socio-economic benefits of energy transition policies are significant. Investments in renewable energy contribute to GDP growth, create green jobs, and reduce socio-economic disparities (PricewaterhouseCoopers [PWC], 2023). Watch (2024) notes that renewable energy projects in Malaysia, particularly in rural areas, provide employment opportunities, improve infrastructure, and enhance access to electricity. These initiatives align with global efforts to achieve inclusive development through energy transition.

Globally, energy transition raises concerns about equitable resource distribution and financial support for developing nations. Developed countries have historically contributed more to greenhouse gas emissions, prompting debates about their responsibility to assist less developed nations in transitioning to sustainable energy. Initiatives like the Green Climate Fund aim to address this imbalance by providing financial support for renewable energy projects in developing countries.

The geopolitical dimensions of the energy transition also warrant attention. Fossil fuel dependency has historically shaped international relations, but the shift to renewable energy is changing power dynamics. Countries rich in renewable energy resources, like Malaysia, are gaining prominence in the global energy market. However, these shifts also create new challenges, such as ensuring the ethical sourcing of rare earth minerals needed for renewable energy technologies.

Malaysia's energy transition policies face several challenges, including regulatory uncertainties, high initial investment costs, and resistance from fossil fuel industries. Aziz et al. (2024) emphasise the importance of legal clarity and institutional reforms to overcome these barriers. Babatunde et al. (2023) highlight the need for international collaboration to ensure Malaysia's transition aligns with global sustainability goals.

Opportunities lie in leveraging Malaysia's abundant renewable energy resources and strategic location. Collaboration with international organisations, such as the International Renewable Energy Agency (IRENA), can enhance Malaysia's capabilities in renewable energy development. Moreover, integrating principles of environmental jurisprudence into national policies can ensure that the transition benefits current and future generations.

The concept of energy transition policies reflects a multidimensional effort to achieve environmental sustainability, economic growth, and social equity. Malaysia's experience highlights the importance of aligning national policies with global commitments, integrating jurisprudential principles, and addressing socio-economic concerns. As the world transitions to a sustainable energy future, Malaysia's strategies and challenges offer valuable insights into energy transition's legal, economic, and social implications.

The Significance of the Oil and Gas Industry

The O&G industry holds a significant position among energy sources available globally. Literature provides that the prominent role of the O&G industry is due to its myriads of functions, namely producing various types of energy required for projects that contribute to world development (Aziz, 2015). Statistics have indicated that the O&G industry accounts for more than half of the world's energy consumption, and the demand for O&G has been increasing rapidly, starting as early as 1988 (BP, 2014).

Similarly, the Malaysian O&G industry has long been an essence of the nation's economy, serving as a significant source of revenue and employment (Ali et al., 2019). A recent 2022 study also showed that Malaysia is the second-largest oil producer in Southeast Asia and the world's third-largest exporter of liquefied natural gas (Bhattacharya & Hutchinson, 2002). Subsequently, literature has also highlighted the capital-intensive nature of the O&G industry, even more with the emergence of the "oil and gas 4.0" (Marimuthu, Hamzah, & Bangash, 2023).

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Studies have also identified that Malaysia's energy infrastructure depends heavily on fossil fuels. The transition towards renewable energy sources would need significant investment in new infrastructure and technologies (International Renewable Energy Agency [IRENA], 2023). Even so, the literature also explains that embracing renewable energy and transitioning away from fossil fuels could potentially open up new markets and business opportunities for O&G companies, particularly in the areas of renewable energy infrastructure development and technology innovation (Andriosopoulos & Papaefthimiou, 2019).

The worldwide energy transition is expected to reshape relations between O&G exporting and importing countries. Resource-rich countries like Malaysia must develop comprehensive "energy diplomacy" to proactively engage with a world moving away from hydrocarbons (Hafner & Tagliapietra, 2020). While the O&G industry accounts for only 1% of total clean energy investment globally, reducing emissions from company operations is a key priority. Nevertheless, companies that aim to cut such emissions only produce less than half of the global O&G output (International Energy Agency, 2023).

Thus, the literature on the O&G industry provides adequate proof that O&G has played a major role in Malaysia's economy through significant contributions to energy consumption, GDP, revenue, and employment. It dominates global increases in energy consumption, with demand steadily increasing to this day. Malaysia's energy infrastructure heavily relies on fossil fuels, necessitating substantial investments to transition to renewable sources. Despite these challenges, embracing renewable energy presents new opportunities for O&G companies, particularly in infrastructure development and technology innovation.

METHODOLOGY

The study employs a doctrinal research methodology to critically analyse the viability and challenges of energy transition policies within Malaysia’s O&G industry. The methodology evaluates primary legal and policy materials, including Malaysia’s NETR, National Energy Policy (NEP) and international agreements like the Paris Agreement. These sources are supplemented by secondary material, such as academic, government reports and industrial analyses, to provide a contextual understanding of the socio-economic and environmental dimension of the energy transition. This approach synthesises legal, policy, and economic insight to assess the compatibility of Malaysia’s energy policies with its commitments to sustainable development while addressing the implications for the heavily fossil-fuel-dependent O&G sector. The placement of this methodology ensures that the conceptual framework is seamlessly integrated into the analysis.

FINDINGS

Malaysia’s Current Plan for Implementing Energy Transition Policies

The NEP has been established to ensure that Malaysia is on track with global megatrends and economic opportunities arising from the energy transition (Ministry of Economy, Malaysia, 2022). This policy involves a time frame between 2022 and 2040, with continuing assessments every three years. Additionally, the NEP has established the Low Carbon Nation Aspiration 2040 based on the existing energy plans, which entails the government’s proactive role in developing a low-carbon economy.

In realising Malaysia’s plan to net-zero carbon emissions and increase renewable energy shares, the NETR lays out six energy transition levers, which include energy efficiency (EE), renewable energy (RE), hydrogen (HY), bioenergy (BI), green mobility (GM), and carbon capture, utilisation, and storage (CC) (Ministry of Economy, Malaysia, 2023). Coordinating the six levers aims to reduce the country’s dependence on fossil fuels for electricity generation and economic growth. Accordingly, the NETR has introduced the Responsible Transition (RT) targets that would enable proper correlation to be made to each energy transition lever, to be achieved by the year 2050, as in Table 1 below.

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Table 1: Summary of the Six Energy Transition Levers in NETR

Energy transition levers	Key driver	RT 2050 targets
EE	Industry and commercial energy savings	23%[1]
	Residential energy savings	20%[1]
RE	Coal share of installed capacity	0%
	RE share of installed capacity	70%
HY	Green hydrogen production (MTPA[1])	Up to 2.5
	Grey hydrogen feedstock phase off	100%
	No. of hydrogen hubs	3
BI	Biofuel capacity (billion litres)	3.5
	Bioenergy power generation (GW)	1.4
To achieve the targets set for 2050, we see extensive opportunities that industry players can leverage on		

Energy transition levers	Key driver	RT 2050 targets
GM	Urban public transport modal share	60%
	xEV (4W[4]) share of fleet	80%
	E2W[5] share of fleet	80%
	Light vehicle fuel economy	~30%
	Heavy transport fuel economy	~24%
	Biofuel blending for heavy transport	B30%
	Hydrogen penetration for heavy transport	5%
	Green fuel in marine transport	40%
	SAF[6] blending mandate by 2050	47%
CC	No. of CCUS clusters	3-6
	Co_2 storage capacity (MTPA)	40-80

[1]Compared to business-as-usual scenario (BAU), [2] Million tonnes per annum, [3] Plug-in hybrid electric vehicle (PHEV), Battery Electric Vehicles (BEV), etc. [4]4-wheeler, [5]electric 2-wheeler, [6]Sustainable aviation fuel (SAF)

Source: PwC Summary of the National Energy Transition Roadmap

Following that, two key initiatives have been set regarding policy and regulations under the NETR (Ministry of Economy, Malaysia, 2023). The first initiative is to rationalise energy subsidies, which involves developing a targeted subsidy mechanism based on the public's needs. The second initiative is to launch the Natural Gas Roadmap to optimise the country's value-add of indigenous natural gas resources and enhance the competitiveness of upstream O&G to meet domestic demand and energy transition needs. The NEP provides a foundational policy reference for the energy transition plan, while the NETR operationalises the NEP.

In addition to the initiatives discussed, the successful implementation of the NETR and NEP, Malaysia has implemented several flagship initiatives and actions to further its energy transition levers and emphasise ten flagship catalyst projects designed to drive significant investments and job creation. These projects include large-scale solar installations, developing green hydrogen production facilities and implementing bioenergy solutions (PwC, 2023). These initiatives collectively aim to reduce Malaysia's dependence on fossil fuels, particularly in electric generation, while creating over 207,000 new jobs and contributing substantially to national GDP.

To complement these flagship projects, the government is actively promoting public-private partnerships to facilitate the integration of renewable energy technologies. For example, program such as the Large-Scale Solar Initiative and the Net Energy Metering Scheme incentivises private sector investment and public adoption of renewable energy (Malaysian Investment Development Authority, 2024). These programs have already demonstrated significant progress, with Malaysia achieving substantial capacity additions to its renewable energy mix through solar power.

One of the critical elements under the NETR is the focus on rationalising energy subsidies, shifting from blanket subsidies to targeted mechanisms aimed at lower-income groups. This move aligns with global best practices and ensures fiscal sustainability while incentivising energy efficiency and renewable energy adoption among the broader public (Ministry of Economy, Malaysia, 2023). However, implementing this subsidy rationalisation policy requires comprehensive stakeholder engagement to address potential public resistance.

Another notable development under the NETR is the Natural Gas Roadmap, which seeks to optimise Malaysia's indigenous natural gas resources. This initiative aims to enhance the competitiveness of upstream

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O&G operations while ensuring sufficient domestic supply during the transition period. The roadmap also aligns with global trends of utilising natural gas as a transitional energy source, bridging the gap between fossil fuel and fully renewable energy systems (PwC, 2023)

Furthermore, Malaysia's focus on technology-driven solutions has seen significant advancements in carbon capture, utilisation, and storage (CCUS) technologies. These innovations aim to mitigate emissions from high-pollution industries, enabling the O&G sector to align with decarbonisation goals while maintaining economic viability (Malaysian Investment Development Authority, 2024). In addition, introducing hydrogen as a critical lever in the NETR highlights the government's ambition to position Malaysia as a regional hub for green hydrogen production.

Malaysia's Current Dependency on the Oil and Gas Industry

In understanding the transition process, it is crucial to understand the country's current dependency on the O&G industry. As stated, Malaysia has long depended heavily on its O&G industry, a cornerstone of the national economy and a critical source of public revenue. This reliance has deeply influenced the country's economic landscape and fiscal policies, making the O&G sector a key driver of Malaysia's growth and development. The industry contributes significantly to GDP, public finances, export earnings, and employment while supporting industrial expansion and social progress.

The Malaysian government relies heavily on income generated by the O&G sector, which provides a substantial proportion of public revenue through taxes, royalties, and dividends. Petronas, the national oil company, is a pivotal contributor. In 2021, it provided RM34 billion in dividends to the government, underscoring its role in financing public services, infrastructure projects, and economic initiatives (Malaysian Petroleum Resources Corporation [MPRC], 2021). Historically, the sector has stabilised during fiscal downturns, helping maintain socio-political stability and fund essential services.

The O&G sector also supports Malaysia's employment landscape. Approximately 4,000 companies operate within the industry, including international majors such as ExxonMobil, Shell, and Chevron, as well as numerous domestic firms. Together, these companies form a robust value chain encompassing upstream, midstream, and downstream activities. The sector directly employs about 59,000 individuals, providing exploration, refining, and petrochemical manufacturing opportunities while also creating indirect employment in logistics and engineering services (MIDA, 2023). This has fostered skills development and enhanced Malaysia's workforce competitiveness on a global scale (Aziz et al., 2024).

Beyond employment, the sector significantly affects Malaysia's trade and foreign exchange earnings. Fuel and derived products have historically been a significant component of Malaysia's exports. In 1990, O&G products accounted for 18.3% of all merchandise exports. While this figure declined to 14.5% by 2019, the sector remains a substantial driver of foreign exchange earnings and a critical pillar of Malaysia's external account stability (Babatunde et al., 2023). Despite global challenges, this contribution highlights the industry's enduring importance to Malaysia's trade dynamics.

Petronas is a symbol of Malaysia's success in the global energy industry. As the only Malaysian company listed in the Fortune Global 500 in 2021, Petronas represents Malaysia's industrial strength and ability to compete in international markets (MPRC, 2021). Petronas has also played a central role in advancing technological innovation, investing heavily in research and development to ensure operational efficiency and sustainability.

The O&G industry's impact extends to Malaysia's social landscape. By creating job opportunities and fostering community development, the sector has contributed to socio-economic progress. Many O&G companies, including Petronas, have implemented Corporate Social Responsibility (CSR) programs to improve education, healthcare, and infrastructure in rural areas. For instance, the Petronas Education Sponsorship Program has provided scholarships to thousands of students, enhancing access to higher education and professional development (Petronas, 2023). However, the industry's operations have also raised

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environmental and health concerns. Issues such as gas flaring, oil spills, and industrial emissions affect air and water quality, posing risks to communities near operational sites (Gill et al., 2010).

While the O&G sector has historically played a central role in Malaysia's economy, it now faces significant challenges that could impact its long-term contributions. Global market volatility, frequent price shocks, and the structural decline of the fossil fuel industry due to climate change mitigation efforts have created uncertainty. Malaysia's commitments under the Paris Agreement to achieve net-zero emissions by 2050 will necessitate a gradual shift away from fossil fuel dependency, potentially reducing the sector's share in public revenue and export earnings (Aziz et al., 2024). Moreover, the growing global emphasis on renewable energy is accelerating the transition to cleaner energy systems, further diminishing the prominence of traditional O&G activities.

In response to these challenges, Malaysia has begun diversifying its economy and investing in renewable energy. The NETR outlines a strategy to reduce reliance on fossil fuels and enhance sustainability through investments in solar, hydrogen, and biomass energy (MIDA, 2023). Petronas has also announced plans to develop clean energy technologies, including carbon capture and hydrogen production, to align with global sustainability goals. These efforts are critical for ensuring the sector's relevance in a decarbonising global economy.

In summary, Malaysia's dependency on the O&G industry remains significant, with the sector playing a vital role in the country's economy and socio-political stability. However, the challenges posed by market volatility, environmental concerns, and global energy transitions necessitate strategic adjustments. By leveraging technological advancements, investing in renewable energy, and addressing socio-economic disparities, Malaysia can reduce its reliance on the O&G sector while ensuring sustainable growth. As the nation navigates these changes, the O&G industry will remain a key pillar of its economic foundation, albeit with a redefined role in a more sustainable and diversified future.

Challenges of Implementation of Energy Transition Policies towards the Oil and Gas Industry in Malaysia

Implementing energy transition policies in Malaysia faces several challenges, particularly in the O&G industry. One of the key challenges is the need to balance the country's economic growth with environmental sustainability. The NEP, 2022-2040, emphasises the importance of leveraging gas access to enhance economic competitiveness and ecological sustainability through petroleum products to gas switching (Ministry of Economy, Malaysia, 2022). Another significant challenge is the need to optimise the current indigenous O&G production. The current policy enhances all available upstream investment attraction by increasing the fiscal regime and ensuring its competitiveness to attract upstream investment by government bodies. This is core to ensuring energy security through reducing energy imports and adding competitiveness to the upstream O&G sector.

It is noted that such a transition towards cleaner energy sources does pose significant challenges. The policy ensures the increase of the share of renewable energy in a dynamic energy mix that targets a 20% RE in the power capacity mix by 2025 (Nathan, 2023). However, achieving this requires significant investments in infrastructure and technology, not to mention the substantial research and development and commercialisation of these technologies, which might be a transparent barrier towards rapid implementation despite the current policy, which recognises the importance of technology in ensuring consistent energy transition. This can be achieved by emphasising the available development and adoption of new technology to optimise O&G production, especially in challenging fields like high CO2 and H2S. (Malaysian Investment Development Authority, 2024).

There is a need to ensure a coordinated long-term vision and action plan that would involve all stakeholders, economic sectors, and energy-related industries that would be able to address these challenges and gain advantages and benefits from the global energy transition trend. Achieving this requires strong energy sector governance and planning to drive the planning, development, and implementation of a comprehensive yet integrated energy policy. In summary, ensuring Malaysia successfully implements dynamic and reliable energy

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transition policies requires a thorough and multifaceted approach that balances its economic growth with considerable environmental sustainability and leverages technology to drive the transition.

RECOMMENDATIONS

Strategies for Enhancing Malaysia's Energy Transition Through the Oil and Gas Industry

Malaysia's O&G industry has long been central to its economic development, public revenue generation, and energy security. However, as the global energy landscape shifts towards low-carbon and renewable energy sources, Malaysia faces the challenge of managing its energy transition while ensuring economic stability, technological innovation, and social inclusion. The recommendations proposed here aim to provide a comprehensive roadmap for Malaysia to leverage its O&G expertise and infrastructure to facilitate a sustainable and inclusive energy transition.

To begin with, it is essential to conduct a robust analysis of all available and potential opportunities within the O&G industry to support the energy transition. While the O&G sector remains integral to Malaysia's economy, its future role must be redefined to align with global sustainability goals. A thorough analysis of the sector's capabilities, including technological expertise and infrastructure, can help identify ways to repurpose these assets for renewable energy development. For instance, platforms used for offshore oil production could be converted into facilities for Ocean Thermal Energy Conversion (OTEC), thereby avoiding the environmental and financial costs of dismantling existing structures (Abdul Rani et al., 2017). Such innovative approaches extend the life cycle of O&G infrastructure and demonstrate how the sector can contribute to the renewable energy transition.

A critical aspect of this transition is the active participation of all stakeholders, including policymakers, industrial leaders, civil society organisations, and local communities. Ensuring broad-based involvement is necessary for understanding the dynamics and trade-offs involved in the energy transition. Countries like Denmark have implemented inclusive approaches by involving diverse stakeholders in energy planning, improving policy outcomes and public acceptance (Jensen & Skytte, 2002). Malaysia can benefit from institutionalising forums where stakeholders can share insights, discuss trade-offs, and collaborate on solutions to address the transition's social, economic, and environmental challenges.

Furthermore, Malaysia must comprehensively analyse energy transition policies implemented by other countries with similar economic structures and dependencies on O&G. For example, the renewable energy initiatives of Saudi Arabia and the United Arab Emirates under their respective Vision 2030 frameworks provide valuable insights into how resource-dependent economies can diversify while maintaining growth (Al-Fattah, 2021). By studying these countries' successes and challenges, Malaysia can adapt its policies to mitigate potential negative impacts on employment, income distribution, and job security. Such comparative analyses will enable Malaysia to formulate context-specific and socially inclusive strategies, ensuring no stakeholder is left behind during the transition.

Investing in research and development (R&D) for renewable energy is another vital step. The O&G industry possesses decades of expertise in engineering, project management, and resource exploration, which can be repurposed to accelerate technological advancements in renewable energy. For instance, companies like BP and Shell have diversified their portfolios by investing in solar, wind, and hydrogen energy projects (Stephenson et al., 2021). Malaysia's O&G companies, particularly Petronas, can adopt similar strategies to lead innovation in clean energy technologies. Collaborations with academic institutions and private sector entities can further enhance R&D efforts, ensuring Malaysia remains competitive in the evolving global energy market.

Financial mechanisms and incentives must also be developed to encourage investments in renewable energy projects. Establishing green bonds, subsidies, and tax incentives can attract domestic and international investors, providing the financial support needed to scale up renewable energy infrastructure. Malaysia can also partner with global organisations such as the Green Climate Fund to secure funding for large-scale renewable energy initiatives (United Nations, 2021). These financial models must be complemented by a

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robust regulatory framework that streamlines approval processes, reduces bureaucratic barriers, and ensures transparency in project implementation.

Integrating energy transition policies into Malaysia's urban development plans can accelerate progress. Urban areas account for a significant share of energy consumption and emissions, making them critical to the success of the transition. Policies should incentivise the adoption of renewable energy technologies in urban planning, including installing solar panels on buildings, developing energy-efficient public transportation systems, and establishing electric vehicle charging infrastructure (Aziz et al., 2024). Such initiatives reduce urban carbon footprints and create opportunities for economic growth and job creation in renewable energy sectors.

Addressing the social dimensions of the energy transition is equally important. As Malaysia shifts away from fossil fuels, it is crucial to ensure that workers in the O&G sector are equipped with the skills needed for new roles in renewable energy. Vocational training programs, partnerships with technical institutes, and government-led reskilling initiatives can minimise job displacement and social disruption. The International Renewable Energy Agency (IRENA) emphasises the importance of a just transition, where workers and communities are supported through policies prioritising social equity and inclusion (IRENA, 2023). By integrating these principles, Malaysia can ensure its fair and equitable transition to renewable energy.

Establishing a carbon market and emissions trading system (ETS) can further incentivise the adoption of clean energy technologies. The European Union's ETS successfully reduced emissions while maintaining economic growth and is a model for how market-based mechanisms can drive sustainability (Ellerman et al., 2016). Malaysia can adapt this approach to create a national carbon market that encourages O&G companies to invest in low-carbon solutions, reducing their environmental impact while maintaining profitability.

Finally, a clear and comprehensive national energy transition framework must be developed to guide Malaysia's efforts. This framework should outline short-term, medium-term, and long-term goals with measurable milestones to ensure consistency in policy direction. From Germany's Energiewende policy, Malaysia can establish a structured roadmap that balances environmental sustainability with economic and social considerations (Hake et al., 2015). Such a framework would provide a unified vision for the country's energy future, fostering stakeholder collaboration and ensuring the transition is managed effectively.

In summary, Malaysia's energy transition presents both challenges and opportunities. Malaysia can achieve a sustainable and inclusive energy future by leveraging the expertise and resources of its O&G industry, investing in renewable energy R&D, fostering stakeholder collaboration, and adopting best practices from other nations. Integrating financial incentives, regulatory reforms, and social equity principles will further enhance the transition, ensuring it benefits all stakeholders while minimising its negative impacts. Through these measures, Malaysia can position itself as a regional leader in the global energy transition, paving the way for long-term economic growth and environmental sustainability.

CONCLUSION

Malaysia's energy transition policies present opportunities and challenges for the O&G industry. While the transition to renewable energy sources offers economic growth, job creation, and environmental benefits, it poses significant challenges. Malaysia's heavy reliance on the O&G sector, which contributes substantially to the country's GDP, revenue, and employment, means that the industry's diminishing returns and structural decline pose risks to economic growth. Implementing energy transition policies requires balancing economic development with environmental sustainability, optimising indigenous O&G production, and investing in renewable energy infrastructure and technology.

In conclusion, Malaysia's energy transition presents both opportunities and challenges. Addressing the risks posed by the declining O&G industry while investing in renewable energy will require a carefully balanced approach guided by a long-term vision and effective policy implementation through collaborative stakeholder engagement.

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