

# THE APPLICATION OF RENEWABLE ENERGY SOURCES IN THE OIL INDUSTRY: A STRUCTURED REVIEW AND STRATEGIC IMPLICATIONS FOR BOSNIA AND HERZEGOVINA

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## Abstract

The energy transition represents an inevitable technological advancement, posing significant challenges for the oil industry. This paper analyzes the challenges and opportunities faced by the oil sector within the context of the global energy transition and the principles of sustainable development. The research is based on the assumption that, due to the depletion of fossil fuels and increasing environmental pressures, the oil industry must undergo transformation to ensure long-term economic sustainability. By examining key concepts such as the green economy and sustainable development, the paper explores the impact of international regulatory frameworks, including the CBAM mechanism, on business operations. It provides a detailed assessment of the economic justification and environmental benefits of integrating renewable energy sources into the business models of oil companies. The practical implementation of solar energy and other renewable sources is considered a strategic imperative for reducing operational costs and enhancing competitiveness. It was analyzed how the existing infrastructure of the oil company can be used in the area of Bosnia and Herzegovina and Republic of Srpska to diversify its business model. The transformation from traditional oil companies into modern energy enterprises is presented not only as an environmental obligation but also as a key economic strategy for achieving efficiency and profitability.

**Keywords:** oil industry, renewable energy sources, sustainable development, alternative fuels, sustainability.

## 1. INTRODUCTION

The oil industry has been one of the fundamental pillars of global economic development since the industrial revolution, enabling large-scale industrialization, mass transportation, and sustained economic growth throughout the twentieth and early twenty-first centuries. Despite its continued importance, the industry is increasingly confronted with profound structural challenges arising from climate change, environmental degradation, regulatory pressure, and accelerating technological change. The growing recognition of the negative externalities associated with the intensive use of fossil fuels particularly greenhouse gas emissions and their contribution to global warming has placed the oil industry at the center of the global energy transition.

In response to these challenges, the concept of sustainable development has emerged as a dominant framework for reconciling economic growth with environmental protection and social responsibility. International climate agreements, such as the Paris Agreement, alongside policy instruments including the European Union's Carbon Border Adjustment Mechanism (CBAM), have intensified pressure on energy-intensive industries to reduce carbon emissions and adopt cleaner technologies. Within this evolving regulatory and market environment, oil companies face not only environmental obligations but also strategic risks related to long-term competitiveness, cost structures, and market relevance.

At the same time, renewable energy sources particularly solar energy, wind energy, biomass, and energy storage

technologies have experienced rapid technological progress and significant cost reductions. These developments have transformed renewable energy from a purely environmental consideration into a viable economic and strategic option. For oil companies, the integration of renewable energy sources represents an opportunity to reduce operational costs, diversify energy portfolios, enhance energy security, and improve corporate sustainability profiles, while simultaneously responding to regulatory and societal expectations.

In smaller and developing economies, such as Bosnia and Herzegovina, the challenges of the energy transition are compounded by structural constraints, regulatory alignment with the European Union, and limited domestic energy diversification. Oil companies operating in this context must navigate global transition trends while adapting solutions to local market conditions, infrastructure, and policy frameworks. The existing infrastructure, logistical networks, and market presence of oil companies create both opportunities and constraints for integrating renewable energy solutions into their business models.

The aim of this paper is to provide a structured review of the application of renewable energy sources in the oil industry and to synthesize strategic implications for oil companies operating in Bosnia and Herzegovina. Rather than presenting original empirical research, the paper adopts a review-based approach that integrates existing literature, international practices, and policy frameworks to develop a coherent analytical

perspective. A particular focus is placed on identifying renewable energy solutions that are economically and strategically relevant for oil companies, with a contextual application to the case of Optima Group.

The contribution of this paper lies in its systematic synthesis of renewable energy applications within the oil

industry and its structured strategic assessment of opportunities and constraints in a specific national context. By combining a comparative review with a SWOT-based application, the paper seeks to bridge the gap between global energy transition discourse and practical decision-making at the company level.

## 2. LITERATURE REVIEW

The global energy sector is currently navigating an unavoidable and profound transition, catalyzed by both aggressive technological advancements and rapidly escalating ecological pressures. While the oil industry has been central to industrial progress for over a century, its traditional business model is now unsustainable. The literature overwhelmingly argues that the industry must undertake a fundamental transformation to maintain long-term economic viability, driven primarily by the finite nature of fossil fuels and the intensifying threat of global warming.

### 2.1. Sustainable Development, Planetary Boundaries, and Resource Constraints

The contemporary literature on energy and economic development is increasingly framed by the principles of sustainable development and the green economy. Sustainable development emphasizes the need to balance economic growth with environmental protection and social responsibility, ensuring that current development does not compromise the ability of future generations to meet their needs (Saks, 2014). Within this framework, economic activity is constrained by ecological “planetary boundaries,” beyond which environmental degradation becomes irreversible and economically destabilizing.

A central concern highlighted in the literature is the role of greenhouse gas emissions, particularly carbon dioxide (CO<sub>2</sub>), in driving climate change. Empirical analyses indicate that atmospheric CO<sub>2</sub> concentrations have reached historically unprecedented levels, intensifying the greenhouse effect and contributing to rising global average temperatures (Radovanović, 2021; Our World in Data, 2024). These developments are associated with increasingly frequent extreme weather events, ecosystem disruption, and rising economic costs across multiple sectors. As a result, environmental degradation is no longer treated as an externality but as a systemic risk to long-term economic stability.

In parallel, the literature emphasizes the structural limitation of fossil fuel dependence. Geological assessments confirm that fossil fuel resources are finite, with remaining reserves of oil, natural gas, and coal constrained by both physical availability and rising extraction costs (Rajković Milić, 2009). This combination of environmental pressure and resource depletion has intensified calls for energy diversification and accelerated the transition toward low-carbon energy systems. Within this context, the oil industry is increasingly positioned as both a contributor to the problem and a necessary participant in the solution.

### 2.2. Regulatory and Technological Drivers of Transformation in the Oil Industry

The literature identifies regulatory and technological forces as the primary external drivers accelerating the transformation of the oil industry. International climate agreements and policy instruments have introduced binding constraints that directly affect the cost structures and strategic positioning of energy-intensive industries. Among these, the European Union’s Carbon Border Adjustment Mechanism (CBAM) is frequently cited as a policy instrument that internalizes carbon costs and increases financial pressure on companies with carbon-intensive production and supply chains (Chamber of Commerce and Industry of the Republic of Srpska, n.d.). For oil companies operating in or trading with the European market, CBAM represents a significant incentive to reduce emissions and invest in low-carbon solutions.

Technological change further amplifies these regulatory pressures. The literature consistently highlights electrification as a disruptive force reshaping energy demand, particularly in the transport sector. Rapid technological progress, combined with supportive policy measures, has accelerated the adoption of electric vehicles (EVs), fundamentally challenging the long-term demand outlook for petroleum-based fuels (Our World in Data, 2024). This shift is interpreted not as a short-term fluctuation but as a structural transition with profound implications for oil company business models.

Together, regulatory constraints and technological disruption are portrayed in the literature as mutually reinforcing forces. While regulation increases the cost of maintaining carbon-intensive operations, technological innovation simultaneously lowers the barriers to adopting alternative energy solutions. As a result, the oil industry faces a narrowing strategic space in which inaction increasingly represents the highest risk option. The literature therefore frames adaptation not as a discretionary strategy, but as a prerequisite for long-term survival and competitiveness.

### 2.3. The Strategic Imperative: Integration of Renewable Energy Sources in the Oil Industry

A growing body of literature converges on the conclusion that oil companies must actively integrate renewable energy sources into their operational and strategic frameworks to respond effectively to the pressures of the energy transition. This integration is consistently framed as a strategic imperative rather than a purely environmental response, with authors emphasizing its role

in preserving competitiveness, improving efficiency, and reducing long-term risk exposure (Spasić, 2022).

One of the most frequently cited advantages of renewable energy integration is its potential to generate immediate operational and financial benefits. Studies highlight that investments in renewable energy technologies reduce dependence on volatile electricity markets, lower operational expenditures, and improve corporate environmental performance (International Renewable Energy Agency [IRENA], 2025). These benefits are particularly relevant for downstream oil operations, where electricity consumption represents a significant component of operating costs. Consequently, renewable energy adoption is increasingly viewed as a mechanism for cost optimization and risk management.

Among renewable technologies, solar photovoltaic systems are most consistently identified as the preferred entry point for oil companies. The literature emphasizes the high compatibility of photovoltaic installations with existing oil infrastructure, including petrol stations, administrative facilities, warehouses, and refineries (Spasić, 2022; Kovač & Palkova, 2015). Declining technology costs, long system lifespans, and low maintenance requirements further enhance the attractiveness of solar energy as a scalable and economically justified solution for achieving partial energy self-sufficiency.

In addition to solar energy, the literature discusses diversification into alternative energy carriers such as biofuels and hydrogen. Biofuels are highlighted for their potential integration into existing refinery infrastructure, allowing oil companies to utilize established assets while reducing lifecycle emissions (SERBIO, 2013). Hydrogen, particularly when produced through renewable-powered electrolysis, is identified as a long-term strategic option, albeit one associated with higher investment requirements and technological uncertainty (Spasić, 2022). These technologies are generally positioned as complementary rather than immediate substitutes, forming part of a gradual transition toward diversified energy portfolios.

### 3. METHODOLOGY

#### 3.1. Research design

This study adopts a qualitative research design based on a structured literature review and conceptual synthesis. The methodological approach is intended to integrate existing academic research, institutional reports, and policy documents related to energy transition, sustainable development, and the oil industry. Rather than generating primary empirical data, the study aims to synthesize established knowledge and identify dominant patterns, strategic drivers, and constraints relevant to the integration of renewable energy sources in oil company operations.

The review focuses on peer-reviewed academic publications, international agency reports, and industry-related analyses that address renewable energy technologies, regulatory frameworks, and strategic

Beyond technological adoption, the literature points to a broader transformation in the identity of oil companies. Successful adaptation is increasingly associated with a shift from traditional fuel retailing toward integrated energy service provision, encompassing electricity generation, energy trading, and alternative fuels (Spasić, 2022). In this context, renewable energy integration is interpreted as a catalyst for business model innovation rather than as an isolated technical intervention.

#### 2.4. Research Gaps and Contribution of the Study

Despite extensive research on renewable energy integration in the oil industry, a significant gap persists in the existing literature. Most studies focus on large multinational oil companies operating in developed markets characterized by regulatory stability, strong capital availability, and mature energy infrastructures (IRENA, 2025). Consequently, limited attention has been devoted to oil companies operating in smaller or developing economies, where regulatory uncertainty, constrained investment capacity, and market size impose additional strategic challenges.

In particular, the literature provides insufficient guidance on how renewable energy solutions should be prioritized and adapted within specific national and regional contexts. Questions related to the economic feasibility, operational integration, and strategic sequencing of renewable energy investments remain underexplored for oil companies operating in transitional economies such as Bosnia and Herzegovina and the Republic of Srpska.

This study addresses these gaps by synthesizing existing literature on renewable energy integration and applying it within a localized strategic context. By linking global and regional transition insights to a company-level SWOT-based assessment, the paper contributes to bridging the divide between abstract transition discourse and practical strategic decision-making in smaller energy markets.

transformation within the oil sector. Through thematic categorization and comparative analysis, the reviewed literature is organized into coherent analytical themes that inform the subsequent strategic assessment.

#### 3.2. Analytical framework and levels of analysis

To ensure coherence and avoid analytical fragmentation, the study is structured across three interconnected analytical levels.

The global level provides a benchmark perspective by examining international trends in energy transition, regulatory pressures, and strategic responses of oil companies. This level establishes the broader context within which renewable energy integration is discussed, without implying direct comparability to local conditions.

The regional level focuses on oil companies operating in Southeast Europe and comparable transitional

economies. This level enables a more realistic assessment of structural constraints, regulatory alignment with European energy policy, and investment capacities that resemble those of Bosnia and Herzegovina.

The local level applies insights from the global and regional review to the specific context of Bosnia and Herzegovina, with particular reference to Optima Group. At this level, the study evaluates how renewable energy integration strategies can be adapted to local infrastructural, regulatory, and market conditions.

This multi-level analytical framework allows global transition dynamics to be systematically linked to company-level strategic considerations, thereby strengthening internal coherence.

### **3.3. Strategic synthesis method: SWOT analysis**

As a synthesis and application tool, the study employs a SWOT (Strengths, Weaknesses, Opportunities, Threats) analysis to structure the strategic implications of renewable energy integration for Optima Group. The SWOT analysis is derived exclusively from insights developed in earlier sections of the paper, including infrastructure characteristics, market positioning, regulatory exposure, and renewable energy potential.

## **4. RESULTS**

### **4.1. A strategic framework for sustainable transformation in the oil industry**

The results of the structured literature review indicate that the integration of renewable energy sources within the oil industry represents a central strategic response to the combined pressures of energy transition, regulatory constraints, and market transformation. Across the reviewed literature, renewable energy integration consistently emerges as a mechanism for improving operational efficiency, reducing exposure to energy price volatility, and enhancing long-term strategic resilience (Spasić, 2022; International Renewable Energy Agency [IRENA], 2025).

A key result of the analysis is the identification of solar photovoltaic systems as the most immediately applicable renewable energy technology for oil companies. The literature consistently highlights solar energy as particularly suitable due to its compatibility with existing oil industry infrastructure, scalability, and declining investment costs (Kovač & Palkova, 2015; Spasić, 2022). These characteristics position solar energy as a low-risk entry point for renewable energy adoption, enabling oil companies to achieve partial energy self-sufficiency while maintaining operational continuity (IRENA, 2025).

The results further indicate that other renewable energy options, such as biofuels and hydrogen, play a

The purpose of the SWOT analysis is not to provide a predictive or quantitative evaluation, but to translate the reviewed literature into a structured strategic assessment relevant to company-level decision-making. This approach enables the identification of internal capabilities and external pressures that shape the feasibility and prioritization of renewable energy investments.

### **3.4. Limitations of the methodological approach**

Several limitations of the adopted methodology should be acknowledged. First, the study does not rely on primary data collection or quantitative modeling, which limits the ability to assess project-specific financial performance or environmental impacts. Second, the SWOT analysis represents a qualitative and conceptual assessment rather than a formal optimization or forecasting model.

Despite these limitations, the chosen methodology is appropriate for the objectives of a review-based study, providing a coherent analytical framework that connects global energy transition literature with strategic considerations in a localized context.

complementary but longer-term role in the transformation of oil company energy portfolios. Biofuels are primarily associated with the repurposing of existing refinery infrastructure and gradual reductions in lifecycle greenhouse gas emissions (SERBIO, 2013). Hydrogen, particularly when produced through renewable-powered electrolysis, is identified in the literature as a future-oriented energy carrier with significant strategic relevance but higher technological and investment uncertainty (Spasić, 2022). Collectively, these findings suggest that renewable energy integration within the oil industry is most effectively approached as a phased and differentiated process, rather than as a single technological substitution.

Beyond technological considerations, the results highlight a broader structural transformation in oil company business models. The literature consistently associates successful adaptation with a shift from traditional fuel retailing toward integrated energy service provision, encompassing electricity generation, alternative fuels, and energy-related services (Spasić, 2022). This transformation is framed as a strategic necessity for maintaining market relevance in the context of declining long-term demand for fossil fuels and increasing electrification of the transport sector (Our World in Data, 2024).

**Table 1:** SWOT analysis of Optima Group in the context of the energy transition

Strengths	Weaknesses
<p>Established position in the oil products market of Bosnia and Herzegovina and the Republic of Srpska, with a recognizable brand and developed retail network.</p> <p>Existing infrastructure, including petrol stations, storage facilities, administrative buildings, and logistics assets, suitable for the integration of renewable energy technologies, particularly solar photovoltaic systems.</p> <p>Vertical integration and operational experience in energy supply chains, providing organizational capacity for managing large-scale infrastructure projects.</p> <p>Strong financial performance and profitability in recent years, enabling potential internal financing of gradual renewable energy investments.</p>	<p>High dependence on fossil fuel sales, exposing the company to long-term demand decline driven by decarbonization and electrification trends.</p> <p>Limited diversification of the energy portfolio beyond traditional oil derivatives, compared to more diversified regional competitors.</p> <p>Exposure to regulatory uncertainty and increasing compliance costs related to climate and energy policy alignment with the European Union.</p> <p>Lack of prior large-scale experience in renewable energy project development and electricity market operations.</p>
Opportunities	Threats
<p>Integration of solar photovoltaic systems at petrol stations, warehouses, and administrative facilities to reduce electricity costs and increase energy self-sufficiency.</p> <p>Diversification into new energy services, such as electricity supply, EV charging infrastructure, and energy-related services, leveraging the existing retail network.</p> <p>Utilization of renewable energy investments to improve environmental performance, corporate reputation, and alignment with sustainable development objectives.</p> <p>Strategic repositioning from a traditional oil company toward an integrated energy company, improving long-term resilience and market relevance.</p>	<p>Implementation of the Carbon Border Adjustment Mechanism (CBAM), which may increase costs and reduce competitiveness for companies reliant on carbon-intensive energy sources.</p> <p>Rapid growth of electric vehicles and alternative fuels, which threatens long-term demand for petroleum-based transport fuels.</p> <p>Increasing competition from regional and domestic oil companies that are actively diversifying into renewable energy and electricity markets.</p> <p>Risk of delayed adaptation, leading to missed investment cycles and loss of strategic position in the emerging low-carbon energy market.</p>

*Note:* This table presents a qualitative SWOT analysis of Optima Group based on the structured literature review and contextual analysis conducted in this study. Strengths and weaknesses reflect internal organizational factors, while opportunities and threats represent external regulatory, technological, and market influences relevant to renewable energy integration.

#### 4.2. Results of the SWOT analysis: Optima group

The SWOT analysis presented in Table 1 synthesizes internal organizational characteristics and external environmental factors affecting Optima Group in the context of the energy transition. The results highlight a combination of strong structural assets and emerging strategic vulnerabilities derived from the reviewed literature and contextual analysis.

On the internal dimension, the analysis identifies Optima Group's extensive retail network, existing infrastructure, and established market position as key strengths. The literature emphasizes that such infrastructural assets provide favorable conditions for integrating renewable energy technologies, particularly solar photovoltaic systems, across petrol stations, storage facilities, and administrative buildings (Kovač & Palkova, 2015; Spasić, 2022). In addition, recent financial performance discussed in the literature suggests that internally generated resources may support gradual renewable energy investments without immediate reliance on external financing.

At the same time, the results reveal significant internal weaknesses. The most prominent weakness is the company's high dependence on fossil fuel sales, which increases exposure to long-term demand decline driven by electrification and decarbonization trends (Our World in Data, 2024). Furthermore, limited prior experience in

renewable energy project development and electricity market operations represents an organizational constraint that may slow diversification efforts, a challenge frequently identified in the literature on traditional oil companies entering renewable energy markets (IRENA, 2025).

The external dimension of the SWOT analysis identifies several opportunities associated with renewable energy integration. These include the potential to reduce operational electricity costs through on-site renewable generation, diversify revenue streams through new energy services such as EV charging infrastructure, and improve alignment with sustainable development objectives (Spasić, 2022). The literature also emphasizes that regulatory alignment with European climate policy can create incentives for early movers in renewable energy adoption (Chamber of Commerce and Industry of the Republic of Srpska, n.d.).

Conversely, the analysis highlights substantial external threats. Regulatory instruments such as the Carbon Border Adjustment Mechanism are identified as increasing cost pressures on carbon-intensive business models, thereby directly affecting competitiveness in regional and European markets (Chamber of Commerce and Industry of the Republic of Srpska, n.d.). In parallel, the rapid growth of electric vehicle adoption poses a structural threat to long-term demand for petroleum-based

transport fuels (Our World in Data, 2024). The literature further notes that increasing competition from regional oil companies actively diversifying into renewable energy and electricity markets intensifies the risk of strategic lag for companies that delay adaptation (IRENA, 2025).

#### 4.3. Synthesis of results

Taken together, the results indicate that Optima Group occupies a strategic transition position characterized by strong infrastructural and market foundations alongside increasing exposure to regulatory, technological, and market risks. The combination of internal strengths and external pressures suggests that renewable energy

### 5. DISCUSSION

The findings of this study provide further support for the growing body of literature that frames renewable energy integration as a strategic rather than purely environmental issue for the oil industry. The results indicate that renewable energy adoption contributes simultaneously to operational efficiency, risk mitigation, and long-term strategic resilience. This interpretation reinforces existing research emphasizing that the energy transition fundamentally reshapes competitive dynamics within the oil sector (Spasić, 2022; International Renewable Energy Agency [IRENA], 2025).

The identification of solar photovoltaic systems as the most immediately applicable renewable energy option for oil companies aligns with previous studies highlighting their modularity, declining costs, and infrastructural compatibility (Kovač & Palkova, 2015). The results extend this literature by demonstrating that solar energy is not only technically feasible but also strategically suitable for gradual integration within existing oil company operations. This supports the view that early-stage renewable investments can serve as a learning platform for broader diversification, rather than requiring disruptive organizational transformation at the outset.

The SWOT-based results for Optima Group illustrate how global transition dynamics manifest within a localized context. Consistent with international studies, the analysis confirms that infrastructural assets and market presence constitute significant strategic strengths for oil companies entering renewable energy markets (IRENA, 2025). At the same time, the findings highlight that dependence on fossil fuel revenues and limited experience in renewable energy project development represent structural vulnerabilities that may constrain adaptation.

### 6. CONCLUSION

This paper examined the role of renewable energy integration in the oil industry through a structured review of the literature and a contextual strategic application to Bosnia and Herzegovina. By synthesizing existing research on energy transition, sustainable development, and renewable energy technologies, the study sought to clarify the strategic relevance of renewable energy

integration represents both an opportunity for operational efficiency gains and a necessary response to structural change within the energy sector (Spasić, 2022; IRENA, 2025).

Importantly, the results do not imply the need for abrupt or disruptive transformation. Instead, they support a gradual and phased transition logic, in which solar energy serves as an initial and scalable entry point, followed by broader diversification into alternative energy services as market and regulatory conditions evolve. This synthesis provides a structured empirical basis for the discussion of strategic and managerial implications presented in the subsequent section.

This observation corresponds with broader literature on transitional economies, where institutional and market constraints shape the pace and form of energy transition (Our World in Data, 2024).

Regulatory instruments such as the Carbon Border Adjustment Mechanism emerge in the discussion as critical external drivers influencing strategic decision-making. The results suggest that regulatory pressure interacts with technological change by amplifying the costs of inaction, particularly for companies exposed to European markets (Chamber of Commerce and Industry of the Republic of Srpska, n.d.). In this regard, the findings support the argument that early alignment with low-carbon strategies may reduce long-term regulatory and market risks.

Importantly, the discussion does not imply that renewable energy integration represents a uniform or immediate solution for all oil companies. Instead, the findings suggest that a phased and context-sensitive approach is more consistent with both the literature and the realities of smaller energy markets. For companies such as Optima Group, renewable energy integration appears most viable when aligned with existing infrastructure, financial capacity, and gradual business model adaptation.

Finally, the discussion highlights the limitations of the study's review-based approach. While the synthesis provides valuable strategic insights, it does not replace the need for detailed techno-economic or project-specific analyses. Future research could build on these findings by incorporating quantitative modeling, scenario analysis, or empirical case studies to further assess the financial and environmental performance of renewable energy investments in the oil industry.

adoption for oil companies operating under increasing regulatory, technological, and market pressures. The findings of the literature review indicate that renewable energy integration has evolved from a predominantly environmental consideration into a strategic instrument for enhancing operational efficiency, managing risk, and maintaining long-term competitiveness. Among the

available renewable energy options, solar photovoltaic systems emerge as the most immediately applicable solution for oil companies due to their technological maturity, declining costs, and compatibility with existing infrastructure. Other renewable energy pathways, including biofuels and hydrogen, are identified as complementary options with longer-term strategic relevance. The SWOT-based application to Optima Group demonstrates how these general findings translate into a specific national and company-level context. The analysis highlights that Optima Group's existing infrastructure and market position represent significant strengths that can facilitate renewable energy integration. At the same time, high dependence on fossil fuel revenues and increasing exposure to regulatory and technological change underscore the strategic vulnerability associated with delayed adaptation. External pressures, particularly those related to European climate policy and market transformation in the transport sector, further reinforce the importance of gradual diversification toward renewable energy sources and new energy services. The contribution of this paper lies in bridging global energy transition literature with localized strategic assessment. By combining a structured review with a qualitative SWOT analysis, the study provides a coherent analytical framework that supports understanding of how

renewable energy integration can be approached by oil companies in smaller and developing energy markets. Rather than proposing universal solutions, the paper emphasizes the importance of context-sensitive and phased transition strategies aligned with existing infrastructural and organizational capacities.

Several limitations of the study should be acknowledged. The analysis is based on secondary sources and does not include primary data collection or quantitative evaluation of specific renewable energy projects. As a result, the findings should be interpreted as strategic and conceptual insights rather than predictive or prescriptive conclusions. Future research could extend this work by incorporating techno-economic modeling, empirical case studies, or scenario analysis to assess the financial and environmental impacts of renewable energy investments within the oil industry.

In conclusion, renewable energy integration represents a critical component of the strategic adaptation of oil companies in the context of the global energy transition. For companies such as Optima Group, the ability to align renewable energy initiatives with existing assets, regulatory requirements, and market conditions will play an important role in shaping long-term resilience and competitiveness.

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