Research Title

Renewable Energy Policy, Regulatory Frameworks, and Production: A Comparative Analysis of Germany and Oman



Abstract

This paper is a comparative analysis of renewable energy policy and regulatory environment that are currently in place in Germany and Oman. Germany is one of the pioneers of renewable energy sources in the world and policies like EEG and definite financial incentives such as the feed-in tariffs (FITs) have proved to be the pertinent driving forces for the development of wind and solar power in the country. Germany's renewable energy sources such as wind, solar, etc source more than 46% of electricity by 2022. There is still a significant reliance on fossil fuels in Oman even though the country's National Energy Strategy 2040 has an ambition of renewables providing 30% of the country's electricity by 2030. However, Oman has certain barriers such as high capital costs, lack of adequate regulation and policy, and dependence on the subsidies of fossil fuels even after the recent investments in the 500MW Ibri Solar Plant. Therefore, the long-term, sustainable policies formulated, financial rewards offered, as well as public-private collaborations that have been shown by the study have brought success to Germany. Looking at the above strategies Oman could benefit from emulating some of the above strategies in its bid to enhance the use of renewable energy sources. Hence, the research focuses on the policies and the financial instruments for renewable energy and provides the policy implication for developed and developing countries that are aspiring to achieve sustainable development goals. ASHRAF

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CHAPTER I

1. INTRODUCTION

Energy has become a global issue as countries strive to cut their greenhouse emission and adopt sustainable energy systems (Adelekan *et al.*, 2024). Solar, wind, and hydropower energy among others have become major focal areas in the global policies to deal with climate change (Russo *et al.*, 2022). Hence, the contribution of efficient renewable energy policies and regulatory measures as executing nations transition from the use of fossil fuels for power in the execution of their economies but with different results (Falcone, 2023). On comparing developed economyoriented Germany with Oman where the settings are quite different on the economic, geographical, and political fronts, it will be even more relevant to focus on the frameworks of renewable energy.

Germany has been at the helm of renewable power, with policies well-grounded on its long-term environmental plan known as Energiewende (Energy Transition). Energiewende, on the other hand, is an energy policy that focuses on the development of wind, solar, and other forms of renewable energy sources through feed tariffs, prime tariffs, and policy support (Yang, 2022). As of 2022, Germany had achieved more than 46% of its electricity consumption from renewable sources, primarily wind and solar energy, making it a European leader in this space (Enterdata, 2022).





Policies such as the Erneuerbare-Energien-Gesetz (Renewable Energy Act - EEG) have been central to incentivizing renewable energy production through mechanisms like feed-in tariffs and market premiums (Research and Market, 2023). Germany's renewable energy policy framework has been remarkably successful in scaling up renewable energy capacity, particularly in wind and solar power. Germany's installed renewable power production capacity has increased by about 17 gigawatt in 2023 (to some 170 GW total), figures released by the Federal Network Agency (BNetzA) have shown (Wettengel, 2024).

The country took a "major step forward" especially regarding new solar PV facilities. These investments are driving the energy transition forward. Germany's approach has demonstrated the effectiveness of clear, supportive policy mechanisms in scaling up renewable energy production, but has also faced challenges, such as the grid integration, rising cost of electricity and issues related to grid stability and energy storage.



Figure 2: Germany in leading countries in installed renewable energy capacity worldwide in 2023(in gigawatts) (Jaganmohan, 2021)

Oman, by contrast, is an emerging player in the renewable energy sector. Historically dependent on fossil fuels, Oman has taken significant strides in recent years to diversify its energy mix (Mishra *et al.*, 2024). Under its Vision 2040 initiative, Oman aims to ensure that 30% of its electricity is generated from renewable sources by 2030 (WEALTH, 2023). Projects such as the Dhofar Wind Farm and Ibri Solar Plant highlight Oman's potential in leveraging its abundant solar and wind resources (Oman Sustainability Week, 2024). Oman is at an earlier stage of its renewable energy transition. Oman oil and gas industry has been the most dominant source of energy and the country has been over than 96% of the electricity generated from natural gas by 2022 (Häfner, Raimondi and Bonometti, 2023).



Figure 3: Oman's natural gas production, consumption, and exports, 2001-2021 (IEA, 2024)

Nonetheless, Oman has the Vision 2040 of diversifying its energy mix and aims at power generation through renewable sources to be 30 percent by 2030 (Amoatey et al., 2022). The country has a great potential in solar energy, especially in the desert areas and there has been development of several large-scale solar power plants such as Ibri Solar Power Plant which is at 500MW in 2021 (IEA, 2024).

Table 1: Summary of existing and planned renewable energy projects in Oman (IEA,2024)

Name of project	System	Technology	Capacity	Status
Miraah Solar	-	Solar	330 MWt	Online in 2018
Thermal Project		thermal for		
		EOR		
Dhofar I Wind Project	DPS	Wind	50 MW	Online in 2019
Amin Solar	MIS	Solar	125 MW	Online in 2020

Ibri II Solar	MIS	Solar	500 MW	Inaugurated in January 2022
Liwa Solar project	MIS	Solar	100 MW	Estimated operation in 2023
Manah I Solar	MIS	Solar	500 MW	Estimated operation in Q1 2025
Manah II Solar	MIS	Solar	500 MW	Estimated operation in Q2 2025
MIS Solar IPP 2025	MIS	Solar	500 MW	Estimated operation in Q1 2026
Jalaan Bani Bu Ali	MIS	Wind	100 MW	Estimated operation in Q1 2026
Duqm I Wind IPP	Ad Duqm Power System (Rural Areas Electricity Company)	Wind	200 MW	Estimated operation in Q1 2026
Dhofar II Wind Project	DPS	Wind	100 MW	Estimated operation in 2026
Ras Madrakah Wind IPP	Ad Duqm Power System (Rural Areas Electricity Company)	Wind	200 MW	Estimated operation in 2027
MIS Solar IPP 2027	Al Wusta Governorate	Solar	500 MW	Estimated operation in 2027

There has been a progressive shift in the country's regulation through the execution of commensurate market liberalization policies and incentives for foreign investment in renewables. The establishment of Hydrom, a government-led initiative to develop green hydrogen projects, reflects Oman's aspiration to become a regional leader in green hydrogen production and renewable energy exports. Additionally, Oman has

set an ambitious target to produce between 1 and 1.25 million tonnes of hydrogen by 2030, contributing to both its domestic energy transition and global hydrogen markets (IEA, 2024).



Figure 4: Cost comparison of natural gas and renewable hydrogen in the industry (IEA, 2024)

However, Oman still has some major issues to overcome, like their overdependence on oil revenues, local expertise in renewable energy is scarce, as well as underdeveloped regulations in the country. This research in turn seeks to compare Oman with Germany to understand how different policies and regulations affect the progress of different renewable energy projects and markets in different countries (Oman Observer, 2023).

The transition to renewable power sources in Germany and Oman therefore points to the need for policy backing and proper legal frameworks. Germany, with its environmental focus, has been successful in environmental sustainability for years, while Oman is effectively utilising its resources and poised to become a major player in green hydrogen and renewables in the Middle East (Allan, 2024). So, The aim of this thesis is to provide valuable insights for future policymakers by comparing two countries with varving levels of economic development. geographical characteristics, and political systems. It also explores the relationship between economic structure and the environment, and the role of renewable energy development in these variables.

1.1 Problem Statement

Currently, global society is in the process of shifting to the use of renewable sources of energy, and this has yielded mixed results depending on the efficiency of policies and laws. Germany has created sound policies in the renewable energy field and has achieved considerable progress in the energy transition. But there are problems such as integration of renewable energy sources into the electrical power network and acceptance of structures in the field of renewable energy. On the other hand, Oman, which has clearly laid down goals and objectives regarding renewable energy, is still in the process of shifting towards renewable energy sources. The country has challenges such as dependence on fossil fuel revenues and a comparatively less developed regulatory structure. This research seeks to address this knowledge deficiency concerning the impact of various policy and regulatory environment on the promote of renewable energy in countries with different economic, geographical, and political conditions. This research aims at evaluating the drivers and barriers of renewable energy with a view of comparing Germany and Oman's renewable energy policies. The conclusions made in this paper will assist to expand the current discussion regarding the potential of certain policies to contribute to the transition to cleaner energy on the international level.

1.2 Significance of Study

There are a number of reasons why this study is important. First, it gives a clear understanding of the comparison of renewable energy policies, legislations, and another related aspect between two countries with dissimilar economic and geographical characteristics. While on one hand Germany is an industrialised nation with significant renewable energy market, Oman on the other hand it is emerging nation with immense interest in diversifying its energy mix from the conventional oil. Policymakers will gain insights from this comparison to effectively design and implement renewable energy policies tailored to their specific circumstances. The study will offer recommendations on how to design effective renewable energy frameworks, taking into account local economic, geographic, and political conditions. Secondly, the study will fill the gap in the literature on energy policy and identify the achievements and barriers encountered by both countries while transitioning to renewable energy sources. Knowledge of the factors that favored Germany's success and the challenges facing Oman will be useful for any nation—especially the developing ones—that wants to increase renewable energy production. Lastly, the study has policy implications for climate change actions around the world. This investigation affirms the global aspiration for the reduction of greenhouse gas emissions by the tenets of the Paris Agreement; therefore, this study contributes to the discussion of an efficacious regulation of renewable energy.

1.3 Research Scope

This research will focus on a comparative analysis of the renewable energy policies and regulatory frameworks of Germany and Oman. The study will examine how these frameworks influence the production capacities of renewable energy in both countries, considering their distinct economic, geographic, and political contexts. In Germany, the focus will be on the well-established Energiewende initiative and the comprehensive regulations that have facilitated significant growth in renewable energy production, particularly wind and solar. As for Oman, the study will look at the shifting policy framework within Vision 2040 aimed at reducing the reliance on oil and turning to green power, including upcoming green hydrogen projects. The assessment will encompass the financial incentives and subsidies, along with an analysis of the regulatory frameworks in the two countries that promote the growth of renewable energy markets. This study will use data up to 2024, with an emphasis on current reforms in the regulation of countries' industries. The scope will also include the other external conditions at different strategies of the nations like economical and climate agreements. The purpose of the study is to identify the best policy implementing tools and outlines for policy development for the promotion of renewable energy.

1.4 Purpose of study

The main objective of this paper is to undertake a comprehensive comparison of the renewable energy policies and regulations in Germany and Oman. While Germany has already implemented its plans as a world pioneer in renewable energy, Oman is in the process of establishing its renewable energy strategies, according to Vision 2040. Comparing these two distinct national settings, the study intends to reveal how

particular regulatory and policy measures influence the implementation and generation of renewable energy.

Further, the study aims at assessing the impact of the financial incentives including subsidies and tax credit in promoting renewable energy in both countries. It will also evaluate the extent to which these policies have achieved the intended goal of attracting investment and promoting innovation, especially in emerging industries such as green hydrogen in Oman. Policymakers, particularly those in developing countries, will find the findings from this analysis beneficial in understanding the application of renewable energy policies and regulatory measures across various nations. Finally, the study will benefit international attempts to mitigate global emissions of greenhouse gases and shift towards clean energy generation.

1.5 Research Objectives

Objectives of this research are to:

- 1. Analyze the impact of policy and regulatory frameworks on the renewable energy production capacities of Germany and Oman.
- 2. Evaluate the effectiveness of incentives, subsidies, and regulatory structures in promoting renewable energy development in Germany and Oman.
- Compare the renewable energy policies and regulatory frameworks of Germany and Oman to understand how these influence the adoption of renewable energy.
 Z A A S H R A F

1.6 Research questions

- 1. How do the regulatory frameworks in Germany and Oman affect the growth of renewable energy production?
- 2. What role do financial incentives and subsidies play in driving renewable energy development in these countries?
- 3. How do the renewable energy policies of Germany and Oman compare, and what lessons can be drawn from their respective approaches?

1.7 Research Methodology

This study will adopt a qualitative approach, relying on secondary research methods to analyze existing academic literature, government reports, and industry publications on renewable energy policies and regulations in Germany and Oman. A thorough literature review will be conducted to identify key policies, incentives, and regulatory structures that have influenced renewable energy production in both countries. This research will also involve a comparative analysis, drawing insights from national energy reports, case studies, and policy evaluations to assess the effectiveness of different regulatory frameworks.

1.8 Definition of Terms

Renewable Energy	Energy generated from renewable resources which include the solar, wind,
(RE)	hydro and geothermal energy source (Agrawal & Soni, 2021).
Energiewende	Germany had a policy mix to eliminate fossil fuels and nuclear energy by
	2050 and replace it with clean energy (Yang, 2022). These include feed in
	tariffs, renewable energy auctions and subsidies to support the development
	of green technologies.
Feed-in Tariffs	A financial incentive in Germany where renewable energy producers are
(FiTs)	guaranteed a fixed price for the electricity they generate, encouraging
	investment in renewable energy technologies (IRENA, 2013).
Green Hydrogen	Hydrogen produced using renewable energy sources like solar and wind
	(Benghanem <i>et al.</i> , 2023).
	Oman aims to become a global hub for green hydrogen production as part
	of its energy transition strategy.
Vision 2040	Oman's long-term vision of economic diversification with focus on
	sustainable development and hydrogen projects and renewable energies
	dominating the agenda in the years to come (WEALTH, 2023).
Independent Power	Private entities that generate electricity for sale to utilities. Oman has
Producers (IPP)	introduced IPP models to develop large-scale renewable energy projects
	(WorldBank, 1995).

Subsidies	Financial incentives provided by the government to support the development
	of renewable energy projects. In Germany, subsidies have played a key role
	in the rapid growth of the solar and wind industries (Yang et al., 2019).

1.9 Outline of the Thesis

Chapter 1 which is introduction provides the background, problem statement, significance, and objectives of the study, focusing on the need to understand how renewable energy policies and frameworks impact production in Germany and Oman.

Chapter 2- Literature Review will examine existing research on renewable energy policies, incentives, and regulatory frameworks in both countries, identifying gaps, particularly in comparative studies between developed and developing nations.

Chapter 3- Methodology will outline the research design and data sources used for the comparative analysis of the renewable energy policies in Germany & Oman, relying on qualitative analysis of secondary sources.

Chapter 4 - Discussion and Findings will compare and contrast the policies of the two countries and assess the efficiency of the regulatory mechanisms and incentives.

Chapter 5 - Conclusion will review the major observations and offer suggestions on how renewable power can be implemented effectively by learning from Germany and Oman.

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CHAPTER II

2. LITERATURE REVIEW

The expansion of renewable energy capabilities has spurred the development of policy and regulatory aspects related to the renewable energy industry in the last few decades (Hassan *et al.*, 2024). This literature review will seek to examine current relative reformed renewable energy policies and regulations between Germany and Oman, with special emphasis on capacity and level of absorption. This study will thus involve a comparison of these two countries to assess the effect of different policy instruments regarding the development of renewable energy resources. The idea of an emergent renewable energy sector is on the right trajectory for development in both countries, but the policy, institutional framework, and execution instrument are not on the same level.

The comparison of these frameworks reveals both advancements and setbacks in the progression of renewable energy. Specifically focused on Oman, Al Balushi and Matriano (2024) present a discussion on the effects of policy and regulations on existing and future renewable energy projects. In line with these findings, this study establishes that Oman solar and wind energy projects have benefitted significantly from strategic incentives and subsidies. However, the absence of coherent longterm financing forms still remains one of the most significant challenges hindering efficient development of renewable energy sources in the country. This therefore implies that as much as Oman has advanced in policy formulation factors, such as financial and regulatory complexities, it may hamper its further advancement.

A comparative look at the demand for renewable energy along with export prospects is offered in Ersoy *et al.* (2023) article focussing on Oman and other Middle Eastern countries. The study points out that Oman has immense prospects of exporting renewable electricity, particularly green hydrogen. But the main challenges that have been highlighted by the research include the absence of well-defined and advanced regulatory systems and facilities. It is found that this comparative analysis corresponds to Oman's internal issues, where both the domestic and the international policy gaps may hinder Oman in its progress to become one of the leading exporters of renewable energy.

Baker Botts (2023) builds upon this by assessing Oman's policy and regulatory development regarding renewable energy, with emphasis on storage and green hydrogen. The study concludes that although Oman is moving toward the adoption of renewable energy sources, there are still issues with the regulatory regime, especially those related to energy storage. If the Oman government does not have proper rules and regulations for storing renewable power, the growth of renewable energy projects may not be sustainable. This complements earlier findings and underscores a recurring theme in the literature: the importance of building effective legal structures that meet current and future technological needs.

Research by the Authority for Electricity Regulation (2008) assesses the regulatory framework of renewable energy resources in Oman. The research therefore provides the basic premise for the formulation of Oman's renewable energy policies. It identifies the areas of regulation where improvement must be made to accommodate the integration of renewable energy into the national grid effectively. The studies also reveal that while Oman's regulatory arrangements have improved, they still lack policy compatibility and conformity to global best practices. This means that though Oman is on the right track, it needs to develop its regulatory instruments to cater to the complexity and need for the development of renewable energy projects.

Furthering Oman's regulation analysis, Al Hatmi *et al.* (2014) present an assessment of knowledge and attitudes concerning the use of renewable energy in Oman's electrical segment. The present research evidence proved that, while awareness has been improved, there is a definite implementation lag by policymakers. Based on this surveys, it can be deduced that although awareness of renewables is gradually being embraced, there is resistance from conventional industries and lack of skilled manpower in renew energy technologies. These findings clearly indicate the need to address social and institutional barriers alongside policy reforms to facilitate the transition to renewable energy.

Al-Sarihi and Mansouri (2022) established a cross-nation comparative study of renewable energy policies in the Gulf Cooperation Council (GCC) countries, including Oman. The study also highlights that Oman is one of the least progressive

GCC nations regarding renewable energy policy formulation and the implementation of regulatory frameworks compared to Saudi Arabia. One such finding is a poor degree of cooperation between the local and national governments in the development of renewable power projects. Moreover, it has fewer PPP (publicprivate partnerships), which is regarded as a factor of slow development as compared to its GCC counterparts. This study situates Oman within the broader regional context, highlighting areas where the country must improve its regulatory framework to keep pace with regional trends.



Figure 5: Renewable energy installed capacity in the GCC countries, 2011–2021 (AI-Sarihi and Mansouri, 2022)

In contrast, Germany's success in renewable energy, particularly in wind and solar power, can be attributed to its comprehensive regulatory frameworks. Studies like *"30 Years of Policies for Wind Energy"* by IRENA (2013) provide insights into Germany's wind energy policies over time. Germany's use of feed-in tariffs and ambitious renewable energy targets has contributed to the steady growth of the sector. In Oman, the renewable energy sector is still developing. The Renewables Readiness Assessment by IRENA (2014) overviews Oman's national renewable energy plan and its continuous work on creating a legal structure for the use of renewable energy technologies. This paper explores difficulties Oman has in moving

from an oil and gas-based economy to an economy that has a large amount of renewable energy in its energy mix.

Germany's experience in regulating renewable energy sources is more profound and multifaceted. Matuszewska-Janica *et al.* (2021) conduct an analysis on how the changes in policies over the last decade have affected the generation of renewable electricity in Germany. The study reveals that despite these reforms, issues about the grid's adequacy in accommodating intermittent supply systems like the wind and solar systems in Germany persist. The study also notes that regulatory gaps, particularly about offshore wind energy and energy storage systems, have posed a major challenge to further progress. This point to the reality that in as much as there is a superior regulating system, it requires frequent enhancements to address the dynamic requirements of renewable energy systems.

Souza *et al.* (2022) provides more detail on Germany's plans towards renewable hydrogen production. The role of full-load-hour regulation on hybrid energy systems and its effect on the cost-efficiency of renewable hydrogen production in Germany is examined in this paper. This study also notes that the current regulatory model in Germany introduces inefficiencies through the decoupling of supply and demand for electricity with special reference to renewable energy surges. This illustrates how fine details in the Germany's energy regulatory environment have the potential of making or breaking new technologies like hydrogen.

2.1 Key Research Challenges in Renewable Energy Policy

Enhancing Renewable Energy has become a tremendous global trend that faces many difficulties that can be technical, regulatory, economic, and social. These challenges weaken policies aimed at facilitating the deployment of renewal energy. This section will focus on the key issues that affect the implementation of renewable energy policies and regulations as seen by researchers, policymakers, and energy producers.

2.1.1 Challenges in Policy Implementation

The policies and regulations on renewable energy and their implementation face several challenges in both the developed and the developing world. For instance, in

a country such as Germany, a major challenge is the multiplicity of its frameworks and how these may turn around and act as a pull factor to big offshore renewable energy installations even as the country suggests otherwise via set national goals and policies (Moscoloni, 2023). While many renewable resources have benefited from the Renewable Energy Sources Act (EEG) of 2000 – which guarantees fixed tariffs for renewable energy production – this has also taken its toll on the country's economy and market distortions (Sauter *et al.*, 2013).

Oman is a member of the Gulf Cooperation Council (GCC) and since its energy market majorly comprises fossil fuels and hydrocarbon subsidies it is a victim of these challenges. This dependency on hydrocarbons has limited the penetration of renewable energy even though the region offers favorable conditions for solar and wind energy. The lack of distinct renewable energy regulators and highly diversified energy policies remain relevant challenges (AI-Sarihi and Mansouri, 2022). Additionally, there is still policy risk that is prevalent in most countries today. Policy risks like changes and re-trimming of Feed-in Tariffs after the investment decision affect investments in renewable energy. This discourages both public and private investors from putting their money into renewable energy infrastructure (Gatzert and Vogl, 2016).

Balancing Economic Growth with Environmental Sustainability

One of the most complex challenges for renewable energy policies is how to address the trade-off between economic development and green growth, especially in emerging economies such as Oman. Third-world countries are more inclined towards economic growth since they depend on fossil fuels and require industrialization. For instance, Oman continues to rely on oil and gas as the main sources of energy, where renewable energy has hit a record of below 1 percent of the total electricity production (AI-Sarihi and Mansouri, 2022). This hampers the abilities of the country to put in place ambitious sustainable policies given the impact that the same may have on short-run macroeconomic variables.

Germany, for instance, has managed to incorporate sustainability into its economic model through the Energiewende, which targets to make Germany a carbon-neutral country by 2050. Nonetheless, Germany has effectively shown it is possible to sustain industrial growth and increase the addition of renewable energy sources, especially wind and solar power (Riedel and Špaček, 2022). This is because of strong policies and legislative measures as well as long-term visions for the development of the economies, including promoting the use of renewable energy sources. Nevertheless, even Germany has disadvantages of economic liberalisation, including high electricity prices due to the subsidies of renewable energy and costs of grid integration (Meckling, 2018).

Similarly, other world economies, for instance, China and the United States, have also grappled to achieve this balance. Both countries have increased in the production of renewable energy sources, though the same has been experienced at the demise of some regions that relied heavily on fossil energy sources (Steeves and Ouriques, 2016). The current authorities of these countries are expected to balance the social cost of renewable energy technologies while realising the longrun gains of sustainability.

The irregularity and unpredictability of renewable energy sources like wind and solar power make it difficult to incorporate them into existing energy grids. This means that the existing grid systems developed for stable generation using fossil fuel power plants have now to incorporate intermittent renewable energy resources into the grid, which can lead to changes in grid engineering and storage systems within the grid infrastructure. Renewable energy production variability leads to issues such as frequency and voltage fluctuations, which negatively impact the stability of the electrical grid and operational costs (Liang, 2017).

However, managing fluctuating renewable supply against fixed demand and ensuring that the grid remains stable is not easy particularly in highly distributed systems. The identified technical barriers can be eliminated by advancing the technology of effective energy storage, introducing demand-side management, and implementing smarter grids (Bell and Gill, 2018). With the advancement in the usage of renewable energy sources, there is the challenge of energy storage to supplement the grid provision of electricity.

Addressing the Variability and Intermittency of Renewable Energy Sources

Wind and solar power are, in fact, highly stochastic and unpredictable due to their nature to produce power during the day and by wind speed. However, the irregularity of the sun power, which is seemingly because of access to solar resources in Oman, can pose challenges when it comes to the reliability in energy delivery. Thus, Albadi et al. (2020) argue that Oman needs to adopt energy storage like pumped hydro and hydrogen storage systems to address these issues.

Germany has made a lot of progress in addressing these challenges with the incorporation of smart grids and energy storage systems in its energy mix. Renewable energy auctions are also used in the country, and this has improved on the planning and control of energy randomness (Hansen, Mathiesen, and Skov, 2019). However, the growth rate of renewable energy to power in Germany is ambitious, which leads to grid overloading and an enormous number of expenditures in establishing grid improvements.

There is debate as to whether new large-scale solutions such as hydrogen energy storage and demand-side management are viable solutions to the intermittency problem. Germany and Oman see hydrogen as a favourable solution, with both countries focussing on the production of green hydrogen and considering it as a means of storing renewable energy sources to provide a more stable energy supply (Mishrif and Khan, 2023). However, the technology is not fully developed and needs more funding as well as more research to be practical for use.

2.1.2 Regulatory Challenges

Regulatory issues have remained a major factor influencing renewable energy policy after their implementation. This includes fluctuation in government policies such as incentives, subsidies, and regulations, thereby resulting in policy instabilities for investors and developers. For instance, Australia and Canada have identified short-term policy orientations and frequent changes in feed-in tariffs as disadvantages (Byrnes *et al.*, 2013, Holburn, 2012). Another factor that contributes to the failure of companies in determining long-term risks is uncertainty in the regulation of rules. This is especially true for large-scale renewable energy projects, such as offshore wind power projects, where the capital is expensive and the revenues are long-term.

The threat of policy reversals from the past can delay new investments and project development, as seen in Europe and North America, where policy shifts occurred (Held *et al.*, 2016).

Differences in Regulatory Structures Between Developed and Developing Countries

Germany's regulations for the RE sector are quite developed and have been in place over the years as the country places emphasis on sustainable development. Erneuerbare-Energien-Gesetz or the Renewable Energy Sources Act was first enacted in 2000, which has played a significant role in encouraging operating renewable energies by offering feed tariffs and market premiums. Such incentives have promoted private-particular investment and technology improvement, making Germany the world's biggest producer of renewable energy. More than 46% of electricity was produced from renewables, which includes wind and solar, in Germany by 2022 (Pons-Seres de Brauwer, 2022).

Germany's regulatory structure is complex and thus enables frequent updating to meet emerging issues including the integration of variable renewable energy sources like wind and solar power into the grid system as well as its impacts on the consumers' cost. For instance, in Germany feed-in tariffs have been replaced by competitive auctions for renewable energy projects, a move aimed at containing costs of renewable energy and encouraging competitiveness. Signifying Germany as a global model for renewable energy policy, Saurer and Monast (2020) assert that Germanys long-term vision and commitment to the energy transition through Energiewende policies.

However, Oman still lacks a developed legal environment, and its shift away from the reliance on oil and gas is quite problematic. Oil and gas dominate Oman's energy policies, accounting for over 96% of the country's electricity. Nevertheless, under Vision 2040, Oman has been planning to diversify its sources of energy and develop the contribution of renewables, which are expected to be 30% by 2030 (AI-Sarihi and Mansouri, 2022). The legal infrastructure for this change is still emerging; the most important parts, which include financial incentives for the private sector and for foreign investment, are yet to be implemented.

There are more regulatory hurdles in Oman that slow down the pace of renewable energy deployment. For example, the absence of a coherent and easily understandable mechanism for investment hampers international investors' understanding of the legal environment. Another important factor prolonging the process of renewable energy projects is bureaucratic formalities coupled with the absence of local professionals in renewable technologies (Fina and Fechner, 2021; Spasova and Braungardt, 2021). These challenges can be attributed to the need for Oman to have better and more transparent market regulation systems, as are seen in Germany.

Need for Flexible Regulatory Approaches to Suit Different Economic and Geographic Contexts

The structure of the markets in the renewable energy sector presents certain distinct dynamics due to the dominance of fossil fuel power generation systems. Another problem is overcapacity like in Spain and Germany where despite receiving government subsidies, renewable energy pushes the electricity price to negative especially when the energy is being generated in plentiful (Held *et al.*, 2016). Secondly, renewable energy problems, poses other economic difficulties on management of the grid (Stram, 2016).

The continually fluctuating war between renewable and fossil fuels is another noteworthy economic entitlement. Fossil fuel subsidies common in many regions including the GCC countries make renewable energy unprofitable. The cost of renewable energy technologies, especially when there are insufficient subsidies, remains a barrier to the adoption of renewable energy technologies even though they have long-term advantages (Al-Sarihi and Mansouri, 2022).

It is important that policies governing renewable energy are adaptable to the geographic location as well as the economic position of each country. Among the different types of renewable resources, solar power is the most suitable in Oman, given that solar energy is easily accessible. However, sudden fluctuations in the generation of power from solar energy due to Oman's desert-like climate necessitate the incorporation of storage solutions as well as efficient grid management solutions. Because the source of energy is intermittent, Oman's regulatory structure must focus on storage technologies for solar electricity, such as battery systems or hydrogen storage (Albadi *et al.*, 2020).

Germany has tailored its policy to align with the country's geographical preference for wind energy, particularly in its northern regions. They also use wind power extensively since it is their biggest renewable electricity source, as it had power contribution of approximately 27% (Kiunke *et al.*, 2022). Nevertheless, challenges like negative perception of the public towards new wind farm projects and the task of incorporating large quantities of RE power into distribution system has remained a major constraint to wind energy (Reusswig *et al.*, 2016). Germany has thus focused on regulation towards a more flexible grid, efficient storage systems and legal frameworks that can quickly approve projects.

Promotional instruments such as feed-tariffs, renewable portfolio necessities (RPS), and power procurement contracts (PPA) have been the most prominent in different countries. For instance, Germany initially utilised a feed-in tariff system but later modified this method through competitive auctions in order to contain costs and achieve greater efficiency in the deployment of renewable energy sources (Kahles, 2014). However, Oman is still in the process of developing more versatile instruments that could encourage foreign direct investment (FDI) in the kingdom's solar and wind power sectors.

Therefore, to address the change in renewable energy regulation, Oman requires visionary and specific policies that meet its geographic and economic characteristics. This includes installing a firm legal framework that encourages private sector participation, promoting partnerships between the public and private sectors, and upgrading the existing grid framework to support renewable energy. Indeed, by looking at Germany's experience of decarbonising its economy by changing its legal framework over time, Oman must consider its oil and gas export dependency and the need for a transition (Trevisan, Ghiani, and Pilo, 2023).

2.1.3 Policy and Governance Issues

In general, leadership is an important factor in the efficiency of renewable energy policies. owever, many regions lack a comprehensive framework that encompasses national, regional, and local priorities for renewable energy. For instance, the integration of renewable energy is held back by the fact that within the European

Union, the member states have different policies and regulation frameworks, hence diluting the efficiency of policies (European Commission, 2021).

According to research by Al-Sarihi and Mansouri (2022), there is a lack of specialised renewable energy regulators and structures, along with a complex web of energy policies in the case of, for instance, the GCC countries. Published government rules do not always adequately address the peculiarities of renewable power generation, including the necessity to have less rigid market structures and long-term policy guarantees. Furthermore, cooperation between various levels of governments and regulatory bodies is sometimes limited, and this results in time-consuming renewable energy projects.

2.1.4 Social Acceptance and NIMBYism

Another significant issue relates to the perception of renewable energy projects by society, which is described as the "Not in My Backyard" (NIMBY) phenomenon (Carley *et al.*, 2020). This is a particularly acute issue in the two highly populated and geographically compact countries in Europe of Germany and the United Kingdom. Though renewable energy is well accepted all over society, the installation of renewable energy, especially the wind farms, experiences a lot of resistance because of the aesthetics, noise, and wildlife disturbance (Held *et al.*, 2016).

Implementation of renewable energy solutions also depend on the consumer acceptance (Carley *et al.*, 2020). Often communities are not aware of the advantages of renewable energy, or in their view, the drawbacks, including changes in the landscape or disruption of ecosystems, are bigger than the advantages. The public must be consulted in the decision-making process, and there must be an enhancement of awareness to combat these challenges.

In Germany, there is a rather stable environment within which regulations have adapted several times, as revealed in the paper by Dehler-Holland *et al.* (2021). This paper explores the Energiewende policy of Germany to assess the influence of public perception and media framing of policies. Based on the conclusion part of the present research, the typical discourses in media are largely based on such aspects as economic benefits concerning the shift towards renewable energy sources, and difficulties related to infrastructure. The study reveals that though Germany has welldeveloped policies for renewable energy, opposition from rural regions and problems linked with the intermittency of renewable sources have been a concern for the nation (Reusswig *et al.*, 2016). This suggests that though they have sound policies socially and technically, there are major hurdles that must be met to make Germany's energy transition a success.

2.1.5 Financing and Investment Barriers

Obtaining the necessary funds to finance renewable energy projects continues to be difficult to access and achieve, especially in the developing world. Many investors approach renewable energy projects as high-risk because of factors such as capital intensity and unpredictable returns, especially in markets where fossil fuels prevail. Besides, the inadequate availability of cheap sources of funds and the overall weak financial markets for renewables also present a challenge to the deployment of renewable technologies (Meier, Vagliasindi, and Imran, 2014).

Governments have developed new forms of financial instruments, such as feed-in tariffs and tax incentives, to overcome these financial barriers. However, these mechanisms do not always ensure private investment, especially in countries where political and economic stability is in doubt. Legal and regulatory constraints are significantly affecting access to funding for renewable energy projects, including variations in permitting and approval timelines (Aggarwal and Usapein, 2023).

2.1.6 Technology and Innovation Gaps

Lastly, although the renewable energy technologies have improved in the recent past, there are still stiff challenges in technology sort and innovation. Fluctuating nature of renewable energy sources like wind, solar power, etc. remains one of the contentious issues, and store technologies are very important where requirements for basic load power must be met. Moreover, adaptation and modernisation of the grid infrastructure are also required to manage the higher integration of renewable energy (Alizadeh *et al.*, 2020). This also involves not only the design of innovative smart grids but also artificial intelligence and machine learning in the management of the grid as well as the integration of renewable energy technologies.

2.2 Existing Research and Projects

Germany is one of the leading countries in the European Union, covering a large share of renewable energy sources, particularly wind and solar energy. In the country, this feed-in tariff mechanism, known as EEG, has been introduced and has been effective in developing biogas and wind energy at the start (Balussou *et al.*, 2018). This has resulted to the faster growth of such sectors like wind and solar energy by use of policies like the EEG (Meisel *et al.*, 2020). Transition towards more sustainable source of electricity in Germany lowered the electricity prices mostly due to the merit-order effect instigated by the new RE power plant (Lagarde and Lantz, 2018). That is also significant because the EEG feed-in tariffs are being re-sited due to the reasons they are not all equally efficient when it comes to the market environment.

Oman, on the other hand, has not started to tap into its solar opportunities, as reflected in the 1.4 kWp solar power plant at Muscat, to assess the viability of photovoltaic systems in an arid climate (AI-Badi, 2018). However, Oman is still comparatively inactive in large-scale renewable projects, with policy and regulation among the main reasons.

2.2.1 Research and projects in Germany

The ICLG (2022) examines the German renewable energy laws, regulations, and policy support mechanisms. It also shows the increase in support for renewables and Germany has provided subsidies for wind and solar projects. The paper also looks into the current changes in the existing frameworks in Germany when it comes to new technologies like green hydrogen.

Souza *et al.* (2022) examine Germany's legal system towards green hydrogen production with an emphasis on the impact of full-load hours on efficiency and cost. Using a technical-economic model, the study indicates how the German regulation system affects hybrid systems and affirms that improvements of some of those regulations could increase the economic feasibility of hydrogen generation.

The Energy Oman (2023) report also focuses on Oman's opportunity in contributing to Germany & the EU green hydrogen consumption. Now, Germany has been

seeking more imports of hydrogen from Oman and this report discusses the international legal frameworks needed for this cooperation. The findings indicate that Germany's green hydrogen regulation is set up adequately, however, there are areas of concern regarding energy transmission and storage.

Germany's Energiewende Initiative:

Energiewende (energy transition), is a German long-term strategization plan to replace nuclear and fossil fuel energy dependency, with wind and solar or renewable energy system. The Energiewende was launched with the help of several incentives such as, firstly, global warming and climate change secondly, energy security and thirdly, the rapidly growing opposition to nuclear energy after the disaster that occurred in Fukushima in 2011(Rechsteiner, 2020). Some of the key objectives include eliminating nuclear power by 2022, cutting down on greenhouse gas emissions by 80 - 95% by 2050 and making renewable energy sources form at least 80% of the energy mix by 2050 (WNA, 2021).

Feed-in tariffs (FiTs), which were initially used to encourage the production of renewable energy through the provision of fixed prices for renewable energy producers and later through auctions for the allocation of renewable energy projects for competitive prices and efficiency, are policies under the reforms of the Energiewende. The key part of this process has been the Erneuerbare-Energien-Gesetz (EEG), or the Renewable Energy Act, which has been instrumental in the expansion of wind and solar capacities in Germany. State and federal governments are involved in promoting the Energiewende by making local policies reflect national goals of transitioning to renewable energy sources for industrial and domestic use. Wind Energy Development:

Germany's wind energy is one of the most advanced in the world. A similar study conducted in 2014 examined the legal regime governing wind power projects in Germany to analyze the effect of policy on real options valuation. Key points of the study focused on the importance of government policies for the viability of wind energy projects (Barroso and Iniesta, 2014). Furthermore, offshore wind energy is fast enhancing Germany's energy power source.

Solar Energy Progress:

Germany has been among the leading countries in the development of solar energy. The government has encouraged the deployment of solar photovoltaics (PV) at utility scale throughout the country. Solar researchers in Germany have continued to work towards improving both the efficiency and cost of energy, with headway discovered regarding incorporating energy into homes and offices (Wirth, 2017).

Effectiveness of Feed-in Tariffs (FiTs) and Market Premiums:

Feed-in tariffs have been the key driver for Germany's early adoption of renewable energy sources. Research shows that FiTs have progressed in using renewable power sources, especially wind and solar energies, since they offer long-term profits to investors and reduce risks for investments (Leiren and Reimer, 2018). FiTs were responsible for getting over 40% of electricity in Germany generated through renewables by the year 2018, the highest percentage recorded. Nonetheless, as tariffs for producing renewable energy reduced and renewable energies neared grid parity, the usefulness of FiTs diminished. Competitive auctions replaced the system, which has been credited for lowering costs while retaining impressive levels of renewable energy capacity.

Using auctions has made the costs more efficient due to market competition in the renewable energy sector. Grashof *et al.* (2020) investigation of the early rounds of auctions for onshore wind projects found that though the initial prices were still below FiTs, prices were soon to surpass initial auctions and transitional FiT schemes because of some vices such as legal complaints and the absence of public acceptance for new projects. This underlines the experience of auctions compared to FiTs and topics such as sustaining the project in the conditions of potential protests.

Challenges Faced in Germany's Renewable Energy Policy:

Germany has faced some tough problems in implementing its Energiewende, including an electricity price increase and grid integration problems. Certain research has revealed that the cost implication of the renewable energy subsidies financed through the EEG levy positively impacts household electricity tariffs (Winter and Schlesewsky, 2019). Second, grid integration continues to be an issue as Germany saw a drastic increase in its renewable energy generation without a corresponding

improvement in the grid network. Integrating wind and solar generation in the modernized grid was a major financial and coordination challenge.

Another reason is that the community rejects renewable energy structures such as onshore wind power plants. Science has pointed out that local hostility and legal challenges have hindered the progress of many wind energy projects, which is a major stumbling block to the Energiewende. Renewable energy generation has been characterized as decentralized and weather-dependent, which has led to public debates on land use and the environment (Rechsteiner, 2020). Germany's commitment to phasing out nuclear and relying on coal until 2038 has exposed it to energy insecurity, mostly because wind and solar production is low (Rinscheid and Wüstenhagen, 2019). Studies also explore Germany's capability of integrating Renewable energy into its electricity mix as it phases out nuclear and coal.

2.2.2 Research and projects in Oman

Hassan *et al.* (2023) have elaborated on Oman's big green hydrogen plan, one of the world's most ambitious. Wind and solar power will be used for hydrogen production, and Oman plans to export green hydrogen out of the country. The article also covers the relevant legislation for these initiatives and stresses that while Oman's legislative environment has been enhanced, it has problems with financing and technological capacities.

Ersoy *et al.* (2023) research on Oman's capability for exporting renewable energy, emphasizing green hydrogen. It states that the country's global energy demand and renewable energy export opportunities are escalating. Still, at the same time, the regulations on energy storage and transportation have not been adequately developed. The study also stresses that Oman still faces constraints to infrastructure and unsuitable policy formulation and implementation compared to other similar countries like Morocco.

Energy Oman (2023) has published an industry report capturing Oman's push in the global green hydrogen market, particularly targeting the European Union market. Europe is on Oman's list of targets for exporting energy solutions, with Oman having signed declarations of intent to export renewable energy to Europe to produce hydrogen. The report's Oman analysis outlines the favorable conditions it presents

to renewable energy but argues that there is still a substantial need to improve the regimes to support these projects so that they are sustainable and competitive on the global stage.

Ibri Solar Plant:

Oman has a range of solar and wind energy and has been developing its renewable energy potential slowly but steadily. However, it has its challenges stemming from the use of fossil energy, especially natural gas. A significant number of projects and research have been undertaken to explore its renewable energy capacity. Ibri Solar Plant is a big solar project in Oman for generating electricity; it has a capacity of 500MW was started in 2018. The project, that was constructed under a build-own operate basis, will enhance Oman's share of renewable energy power. Other studies have also been carried out to study the impact of the Ibri Solar Plant on Oman's electricity market particularly on the reduced utilization of gas-fired power plants (Albadi *et al.*, 2019). It has predicted that it will reduce carbon emission by nearly 340,000 tonnes per annums and is a model example of future solar power plants in the area.

Indeed, among countries of the world, Oman has quite good solar and wind potentials. The research has shown that Oman receives almost 6000Wh/m² of solar radiation annually depending on which month of the year it is. In this paper, several categories of studies that are available and hold promises for CSP (Concentrated Solar Power) and PV (Photovoltaic) systems used in utility-scale solar power plants are presented. A cross-sectional study was conducted by Coyle (2017), analyze Oman's electricity network and its preparedness for solar integration. The study concluded that the regulations in Oman are not only dynamic but also dynamic at a pace that affirms the country's readiness for incorporating renewable energy sources into Oman's national grid.

Dhofar Wind Power Project:

Some pilot projects have been initiated for example 50MW Dhofar Wind Farm, developed in partnership with international investors, is a testament to the success of the renewable energy sector in Oman. It is the first large-scale wind farm in the GCC region, located in the southern Dhofar region. Completed in 2019, it has been

praised for its ability to harness the strong winds along the coast. Research on the Dhofar Wind Farm highlights its success in mitigating energy variability and improving grid stability through advanced power management systems (Marzouk *et al.*, 2019). Oman aspires to achieve 10% energy generation from renewable sources by 2025 (ESFC, 2020). According to the literature, solar, wind, and fuel cell hybrid system can replace diesel generators for remote area applications, thus cutting cost and CO2 emissions (Al-Badi *et al.*, 2022).

Challenges Faced in Oman's Renewable Energy Policy

Even though Oman has growth potential, achievements could have been made faster. Yet another study in 2014 attributed this to a lack of awareness among government departments as they continue to rely on natural gas and fossil fuels. This has lagged behind the increased utilization of renewable energy sources (AI Hatmi *et al.*, 2014). Oman's high levels of fossil fuel dependence give renewable energy policies a difficult operating context. Instabilities in the price of oil and the effects of adopting cuts in the amount of fossil fuels could be the main challenges to a transition (Hereher and El Kenawy, 2020). Currently, Oman has a limited amount of legislation governing the use of renewable energy. Research shows that both issues of short-termism, which entail the absence of certain investment policies and bureaucracy that hinder efficient project approvals, still present hurdles. For example, Al-Sarihi & Cherni (2018) highlight the lack of adequate consideration of socioeconomic and institutional factors of the RE projects in current policies.

Nonetheless, Oman's renewable power plant infrastructure is still underdeveloped, and implementing renewable sources into the national grid also has technical issues. Moreover, the Dhofar Wind Power Project study demonstrates that wind energy generation is inherently inconsistent and needs grid management solutions to balance supply and demand (Riyami *et al.*, 2019). The investment in Oman's renewable power plant such as Ibri Solar Plant and Dhofar Wind Power Project has led to employment creation and technological development in areas. Additionally, the effectiveness of these projects put a spotlight on foreign investment, making Oman a likely contender for becoming the leader of renewable energies in the region. However, more advancement will call for increased policy reforms, alongside infrastructure enhancement, to address the given objectives for 2030.

2.2.3 Research Gap

While both the Germany and Oman are integrating more renewable energy into their system, both contexts differ due to geographical, economic and political structures. The structure of Germany's renewable energy framework is well-developed with strong feed-in tariffs policies, research funded by the German government, that have greatly contributed toward the competitiveness of wind and solar energies (Barroso and Iniesta, 2014). This is accompanied by increased public support and a robust energy market indicative of developed countries.

On the other hand, Oman's renewable energy industry is in an embryonic stage, facing challenges such as high dependence on oil revenues and a developing policy framework. Nevertheless, the shift to solar power in Oman is gradual, where lack of awareness and institutional framework hinder the process (Coyle, 2017). Renewable power sources convey less headway due to complex legal requirements, and few authorities support policies (Al Hatmi *et al.*, 2014). When it comes to reserve sharing, pilot projects such as the ones in Dhofar indicate that the hybrid system is feasible; nonetheless, the strategy to develop such initiatives at a large scale is still wanting (Al-Badi *et al.*, 2022). It is evident that this sector requires a more effective and stronger form of regulation and governance (Charabi and Al-Badi, 2014).

These deficits can be seen as questions apparent in non-Western settings where applying Western policies like the ones utilised by Germany may not pay off in a similar manner or with the same level of success without the necessary adjustments. It is clear that there is a requirement for country-specific research to support policy formulation as well as the need to improve awareness and investment conditions in order to advance the uptake of renewable energy.

As for the technical and social issues, there are also some difficulties in implementing the renewables into the grids of both nations. Oman needs to address issues of grid stability and integrate smart technologies, while the ongoing energy transition in Germany known as the Energiewende is facing challenges in balancing the variable renewable sources and public perception that result in opposition such as that against wind farms (Hansen, Mathiesen, and Skov, 2019; Carley *et al.*, 2020; Reusswig *et al.*, 2016).

Therefore, in conclusion, Germany has useful lessons to teach Oman about renewable energy policies but Oman needs to find ways and means appropriate to its circumstances to advance its energy transition strategies.

2.3 Summary of Literature Review Findings:

Germany and Oman are both progressing in terms of renewable energy investment but hold disparities. Germany is one of the countries which have a very progressive context but are having problems with the public opinions and infrastructure especially in the integration of renewable energy and storage. While Oman is quite recent to establish its economic landscape, it has a few issues. It has no framework for energy storage and financing in the long-term and heavily depends on fossil energy sources. Germany has a mature system compared to Oman in terms of market segmentation and grid coherence, while Oman is in the process of establishing the system based on the market and grids. The German experience can therefore be useful to show how it has successfully promoted new incentives and achieved regulatory stability, but these changes must fit within Oman's socioeconomic context. It is important for the research to look at ways that Oman can incorporate some of the positive aspects of German policies since Oman relies heavily on fossil fuels and lacks the necessary technology to shift towards renewable energy.

Recent studies suggest that both countries have potential gaps. For Oman, therefore, there is a requirement for improved legal and regulatory frameworks and policies to back renewable energy and phase out fossil fuel. Feed-in tariffs and smart grid technology investments serve as necessary mechanisms for niche policy creation for Oman. While Germany is a leading country in renewable energy, it still faces issues of energy storage. Current challenges must be addressed by future research on storage technologies as well as community engagement to make this a reality. Filling these gaps through a collective policy approach, application of modern technologies, and involving relevant stakeholders will play a significant role in achieving the goal of the transition to renewable energy in both Germany and Oman.

CHAPTER III

3. METHODOLOGY
3.1 Research Framework

This research employed the comparative case studies research methodology to assess and compare the renewable energy policies, regulatory regimes, and production levels in Germany and Oman. The case study approach was chosen because it made it possible to focus on the examination of the policy environment in both countries and its effect on the formation and effectiveness of renewable energy initiatives. Much emphasis was given to the comparison of existing and new renewable energy policies in Germany and Oman separately (Miah, Rahman and Mamoon, 2021).

Hence, comparing the outcomes of the two countries with different energy profiles Germany as a renewable energy hub, and Oman which is heavily dependent on fossil fuels, offered a broad perspective in demonstrating how varying policy approaches affect the usage of renewables. The comparison identified areas of excellence, policy improvement, and issues, thus allowing the research to provide information on how each country manages the development of renewable energy that fits within the politics, economy, and environment of each country (Jawad and Scott-Jackson, 2016).

Since the study was conducted on qualitative data, a qualitative method was used in the study. This was necessary to get a crucial insight into the policies and regulatory frameworks that govern renewable energy production in both countries. Qualitative analysis was more suitable than quantitative methodologies because the former enabled the understanding of contextualized, policy-related issues and regulatory subtleties that are not measurable (Jawad and Scott-Jackson, 2016).

3.2 Data Collection

The study used only secondary data collected from government reports, policy documents, scholarly materials, and other industry publications. Secondary data was used rather than having to conduct primary research to get information on both countries' plans for renewable energy. Such an approach enabled the research to carry out subsequent analysis based on the compiled knowledge and analysis from various professional sources.

The primary data was collected mainly through documents available through government reports and policies, research articles, journals, magazines, and international research databases. Official publications and documents called Government Reports and Policy Documents were instrumental in identifying the prescribed renewable energy policies, legislation, and guidelines for both Germany and Oman. The findings of the research included how each country has rationalised its stance on the advancement of renewable energy by reviewing the national energy policies, strategic plans, and regulatory guidelines (Action, n.d.). Scholarly articles were also consulted to give theoretical background and elaborate analysis of the impact of renewable energy policies in Germany and Oman. These sources assisted in situating the policy decisions in the broader perspectives on energy transformation and sustainability (Frondel *et al.*, 2010).

It could have been the information from the reports from industry organizations and think tanks since they contain the actual need for renewable energy policies. These publications offered practical information on actual investment activity, deployment of renewable energy projects, and market reactions to policies in both countries. Renewable energy production statistics compared to developed countries were obtained from global organizations including the International Renewable Energy Agency (IRENA) and the International Energy Agency (IEA). These sources enabled the research to assess the actual generation capability of renewable energy in Germany and Oman and the way these have been supporting the policy objectives of each country (The White House, 2021).

The data collected addressed the three main research objectives. The comparison of the legislative measures regarding renewable energy in Germany and Oman was made out of the given information in the existing policy and legislation materials. This afforded an understanding of how the various countries used in the process navigated. In the same manner, the articles concerning the subsidies, tax credits and feed-in tariffs were analyzed with the predominant purpose of assessing the effectiveness of the support for renewable energy. These reports highlighted the manner in which the various countries settled on its respective financial regimes to underpin investment in renewable energy. The information regarding the renewable energy generation was accumulated from the official websites of the particular country and has been cross-checked with the global data to evaluating the policy and regulations impact on renewable energy production. It allowed making an assessment of the generating capacity of renewable energy resources in Germany and Oman.

3.3 Data Analysis

Document analysis was completed through a process of a qualitative content analysis where the documents gathered were reviewed to reveal the findings on policy and regulatory systems of renewable energy. This method was useful in the research to get themes out of text sources like policy language as well as the motif used in the regulatory mechanism in the two nations so as to sort them for comparison (Nowell *et al.*, 2017). Data analysis was conducted using thematic coding, which categorizes the data concerning a set of themes. Potential themes like policy efficacy, subsidies and promotional measures, integration of the marketplace, and production increase were observed. These themes aligned with the major conceptualizations of the policy settings in each country towards the deployment of renewable energy as described by Nowell *et al.* (2017).

Policy Effectiveness: This theme mainly concerned the degree to which policies of different countries promoted the use of renewable energy. The effectiveness of policy frameworks in achieving their objectives as proposed in the policy goals such as; increasing the share of renewable energy and decreasing the dependence on fossil fuels was also analyzed.

Subsidies and Incentives: This theme focused on the different ways and instruments of financial incentives, that the two countries applied in fostering investment in renewable energy. Questions that arose while studying the impacts of subsidies, tax exemptions, and other encouragements of renewable energy projects were intensively discussed.

Market Integration: This theme focused on how renewable energy was incorporated into the national energy markets of Germany and Oman. The specific regulatory measures that were enabling or discouraging grid access and participation in energy markets were analyzed.

Production Growth: This theme covered the aspects of renewable energy output in both countries and involved the statistics of actual production from various renewable sources including wind energy, solar energy, and hydro energy.

By using this thematic analysis, the study was able to establish the unique and comparative ways Germany and Oman embraced renewable energy. The comparison showed that although Germany had well-developed and long-standing rules, that allowed stable development of renewable energy, Oman was in the initial stages of policy development and had certain difficulties in increasing the production of renewable energy (Nowell *et al.*, 2017).

3.4 Ethical Considerations

One of the key advantages of the study was the complete lack of ethical issues regarding the use of secondary data only. There was no direct primary data retrieval in this research and therefore did not engage with any human subjects, which removes questions of informed consent, anonymity, or confidentiality. Nevertheless, the researchers identified the following few ethical considerations to make the research even more ethical (Nowell *et al.*, 2017).

Purposively, this research only used information gathered from secondary sources with both published and records available from the government, industries and journals being included. It is important to note, however, that when using this research approach, several ethical concerns exist because of the use of secondary data particularly in terms of credibility and reliability of the sources. This is particularly the case since only information procured from credible sources such as research institutions and organizations was used in the conduct of this study and in arriving at the results.

To support the overall claim of writing in an academic tone all the data and source in this work have been sources accordingly. On the same note, this was useful in that the authors and providers of the data were accredited in their work and no one was found to have cheated in their work. It also improved the citing and the following of any information got from previous studies in the future easier was made easier. Accordingly, utmost effort has been made to conform to positivist paradigm in the execution of the study and data analysis.

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Since this research is a comparative study, there was always a risk of inclining towards a particular country's policy regime more than the other (Nowell *et al.*, 2017). In this regard the study used an equal sample size of data from both sources and the findings were made in order to provide a fair conclusion on the policies in renewable energy in both Germany and Oman.

Thus, the approach adopted in this research allowed one to study the policies, regulations and production of renewable energy in Germany and Oman.



CHAPTER IV

4. Findings

4.1 Introduction

This chapter aims at evaluating and comparing the effects of renewable energy policies in Germany and Oman with regard to its contribution to electricity generated from renewable resources. It compares Germany's experience on widely-known policies and subsidies with Oman that still heavily depends on fossil fuels. The paper provides an understanding of how policies affect the promotion of renewable energy. Sources of this information included reports and other publications by government and policy makers institutions that were used in this research. The data of the renewable energy production were based on the international energy databases such as IRENA and IEA. In addition, there is an attempt made to use academic journals in order to assess the general background of the renewable energy policies, and regulations.

Qualitative content analysis was applied in the analysis since it allowed categorical coding of collected data under divergent themes like policy impact, subsidies, market liberalization and production increase. By this cross-sectional comparison, it was possible to observe the changes in the renewable energy policy of Germany and Oman with regard to the renewable energy capacity and market circumstances.

As presented in this chapter, there is a structured section to present the findings such as the evaluation of the renewable energy policies, subsidies, incentives, incorporation into national energy markets, and the growth in the production of renewable energy. This structure helps in observing how a specific set of regulations or policies from each country affects the production of renewable energy.

4.2 Impact of Policy and Regulatory Frameworks on Renewable Energy Production in Germany and Oman

4.2.1 Germany: Overview of Policy and Regulatory Framework

Germany is one of the leaders in renewable energy generation recognized worldwide mainly due to its reasonable policy and framework. This has been attributed to the feed in law, the renewable energy sources act (EEG) which was enacted in 2000. This was done with the help of EEG which made sure that the renewable energy producers get to access the grid and also, it put into place feedin tariff (FIT) system which kept the prices of renewable energy projects for the longterm. This legislation promoted leasing of the solar, wind and other types of renewable energy through offering fixed remunerations for electricity that was discharged into the grid (Appunn, 2020).

Besides the EEG, the German government also established national renewable energy targets that are in tandem with the EU's ideal of greenhouse gas emissions reduction by 55% in 2030 from the level of 1990 (European Commission, 2021). The Bundesnetzagentur or Federal Network Agency has some of its major functions of regulating the grid and enabling the integration of renewables into the electricity market.

Overall, these policies have led to increased renewable energy capacity in Germany in the following ways. According to current figures, in 2022 more than 46% of electricity consumed in Germany was generated from renewable sources, the most significant amount of which was produced by wind and solar energy. For instance, it has revenue from wind energy exceeding 29 percent, while that from solar energy is slightly over 10 percent (IRENA, 2023). Germany had installed more than 66 GW of wind power along with 63GW of solar power, marking an improvement from the early 2000s (IEA, 2024).

Year	Wind Energy (GW)	Solar Energy (GW)	Hydro Energy (GW)	Biomass (GW)
2005	18.4	6.2	4.1	3.5
2010	27.2	17.5	4.1	6.5
2020	55.4	53.1	4.5	8.5
2022	66.1	63.3	4.6	9.1
Source: IRENA (2023)				





4.2.2 Oman: Overview of Policy and Regulatory Framework

On the other hand, Oman has depended on the fossil energy source in which more than 95% of its energy comes from the oil and gas (MEED, 2013). Nevertheless, in the recent years Oman has slightly started moving towards developing renewable energy sources due to the necessity to diversify its energy mix. Most important among them are National Energy Strategy 2040 which targets the share of renewable energy sources in total energy generated to be 30% by 2030.

The regulatory authority for Oman is the Authority for Public Services Regulation (APSR) that encourages and enables the adoption and deployment of renewable energy programs. The Omani government has also supported the private sector towards the development of the renewable energy directives, especially through the PPP (Public Private Partnership) (Apsr. om, 2020). There are several utility-scale PV and wind projects in the pipeline; for instance, the Ibri Solar Project with 500MW capacity is one of the largest in the region (IRENA, 2023).

Still, Oman has some challenges such as substantial capital costs required in the implementation of renewable power equipment, inadequate legal measures, and the continued dependency on fossil fuel revenue. In 2022, renewable energy production in Oman has been estimated to be approximately one. 1.1 GW of the renewable electricity generation with most of the capacity being generated by solar power

projects. Wind energy is substantially lower particularly due to scarcity of wind resources as compared to Germany (IRENA, 2023).

Year	Solar Energy (GW)	Wind Energy (GW)	Fossil Fuel (GW)
2015	0.1	0.01	9.0
2020	0.8	0.06	10.5
2022	1.1	0.1	10.7
Source: IRENA (2023)			



Figure 7. Renewable Energy Production (Solar, Wind, Fossil Fuel) in Oman (2015-2022)

4.2.3 Comparison and Analysis

As it can be inferred from the above discussion, the renewable energy policies of Germany and Oman are quite different in terms of both strategy and success. Germany has been one of the first countries to implement sound policies including the Renewable Energy Sources Act (EEG) and their feed-in tariffs which created a successful march towards the increase of the capacities of renewable energy sources. Nonetheless, Oman's renewable energy policy development is still in its infancy, and its target falls under the greater umbrella of its Oman's National Energy Strategy.

This means that there is a central understanding and focus of both nations that there is a need to diversify the kinds of energy. Germany has committed itself for climate neutrality by the year 2045 while Oman has committed a target to generate 30% of renewable electricity by the year 2030. However, there are certain disparities identified with regards to the structures specially those concerning regulatory bodies. Germany has traditional regulatory authorities including Federal Network Agency that have offered stability in renewable energy progression while Oman authorities for large scale renewable projects are still developing.

Looking at the industrial capabilities, especially in wind and solar technologies, Germany is way ahead of Oman. Germany now hosts about 166 GW of installed renewable energy power while Oman has only 1.1 GW. This divergence partly is attributed to Germany's policy support, as well as Oman's continued dependence on fossil fuels as well as difficulties in shifting towards renewables. Oman is in a position which still relies on the fossil fuel revenues, and therefore cannot afford to fully devote resources for the development of renewable energy sources, whereas Germany has the financial and institutional predispositions that are essential for continued expansion of renewable energy sources.

Country	Key Legislation	Main Energy Sources	Renewable Energy Share (2022)	Challenges
Germany	Renewable Energy Sources Act	Wind, Solar, Biomass	46%	Grid integration, intermittency issues
Oman	National Energy Strategy 2040	Solar, Wind (nascent)	1.1 GW	High fossil fuel dependence, cost issues
Source (Apsr.om, 2020); IRENA (2023)				

Germany and Oman are different learning examples of how renewable energy is supported, promoted, and advanced depending on the policy instruments and energy strategies, economic concerns and energy mixes in each country. While Germany has a comprehensive and well developed set of regulations that has created a booming renewable energy industry, Oman is still in the early stages of transitioning. Each country has issues that it has to deal with regarding renewable energy, but the long-term vision developed in Germany contains ideas that Oman can possibly incorporate to advance its renewable energy transition.

4.3 Effectiveness of Incentives, Subsidies, and Regulatory Structures in Promoting Renewable Energy Development

4.3.1 Germany: Incentives and Subsidies

Germany's policy of incentives and subsidies has been core to the helm of the nation's success in renewable energy investment. One of the key financial policies that was put in place by Germany was the feed in tariff commonly referred to as FIT which was initiated in the year 2000 under the renewable energy sources act also known as EEG. The FIT entailed long-term price certainty for producers of renewable energy as the government agreed to pay the producers a predetermined price per unit of electricity generated by the renewable energy facilities and fed into the grid thereby minimizing on risks for investors (Appunn, 2020). This approach stimulated development of renewable energy business especially wind and solar energy industries.

Germany also provided tax incentives for the renewable energy projects and investment in the similar. They focused on both the utility scale renewable power generators and distributed renewable energy generation like rooftop solar systems. The government also cut down on the taxes or tariffs imposed on renewable energy; this went a long way in fostering investment in this sector (IRENA, 2023).

Nonetheless, there is still some challenges that Germany encounters when implementing the renewable energy sources. One such challenge is public rejection of infrastructure projects; especially for wind turbines, noise pollution, and the aesthetics of the units have been a subject of concern thereby inciting public uproar (Morris et al., 2012). Another issue comes with storage since most renewable sources of power such as wind and solar energy are inconsistent. Currently, there is a challenge when it comes to the mini-storage of energy, which makes it difficult to maintain a stable flow of power in the grid (IEA, 2024).

ncentive	Description	Impact on Renewable Energy

Feed-in Tariff (FIT)	Guaranteed payments for renewable energy fed into the grid	Significant increase in wind and solar power installations
Tax Credits	Reductions in taxes for renewable energy infrastructure	Encouraged investment in decentralized solar projects
Investment Subsidies	Financial support for large-scale projects	Accelerated the development of utility- scale renewable energy projects
Source: (Appunn, 2020)	·	·

4.3.2 Oman: Incentives and Subsidies

Subsidization in Oman's energy sector is still prevalent and mainly focused on fossil fuels. The government is still offering significant support to the oil and gas sector, which remains the dominant power source; contributing more than 95% of the country's energy resources (MEED, 2013). However, owing to the increasing interest in renewable energy, Oman has in the recent past considered undertaking the necessary policy changes and provision of subsidies for renewables.

One such measure is the National Energy Strategy 2040 which includes the proposed measures and plan for subsidies and incentives regarding renewable energy projects. As we have seen Oman does not have the off-grid feed in tariff system of the Germany but there are ongoing debates on the potential form of feed in tariffs or other incentives that could be used for supporting investments into solar and wind (Apsr.om, 2020). Furthermore, the government has launched a policy of investment promotion for the private sector for developing renewable energy projects through the PPP framework. Some of these partnerships have since facilitated the commencement of projects like the Ibri Solar Plant, which has been quite encouraging in the quest to diversify the energy mix in the country (IRENA, 2023).

However, Oman continues to experience several difficulties in advancing the use of renewable energy; largely because the country depends heavily on the sales of fossil energy. These subsidies support fossil fuels many times more than renewables thus the inability of renewable energy to penetrate the energy market. The problem skews them against large scale investments in renewable energies thus hampering the efforts to transition to sustainable energy (MEED, 2013).

Subsidy Type	Fossil Fuel Sector (USD)	Renewable Energy Sector (USD)	
Fossil Fuel Subsidies	5.8 billion	N/A	
Solar Energy Incentives	N/A	Limited	
Wind Energy Incentives	N/A	Minimal	
Source: (MEED, 2013)			

4.3.3 Comparison and Analysis

The comparative analysis of the role of financial incentives in development of renewable energy sources in Germany and Oman. Specific examples include the Feed-in Tariff system in Germany along with tax credits and subsidies making the country the most conducive for renewable energy investments. These incentives have facilitated the energy transition process in Germany with renewables constituting over 46% of electricity consumption in 2022 according to IRENA (2023).

Oman on the other hand is relatively new in offering incentives to renewable energy sources and has a heavily slanted bias towards fossil fuel subsidies. The relative absence of such financial incentives for renewable energy has dampened the growth of the Oman's renewable energy industry, which contributes less than 1% of the country's total energy mix in 2022 (MEED, 2013). While Oman has recently introduced legal provisions for taxation incentives for renewable energy investment activities, the lack of appropriate subsidy policy and measures, including feed-in tariff and tax incentive mechanisms, has posed constraints to the ability to attract more private capital investments in the sector.

The third way subsidies impact on the growth of the renewable energy market is by lowering the risk associated with such investment. This provided certainty and stability in support for the long-term capital required for investment for long-term project in the renewable energy industry and helped to turn Germany into a global leader in wind and solar energy (Appunn, 2020). This is especially the case where, as in Oman, the perverse incentives for renewable energy provision are dominance by fossil fuel subsidies that make it difficult for renewable energy projects to compete with heavily subsidized fossil fuels.

Country	Incentive Type	Renewable Energy Share (2022)	Fossil Fuel Dependency	Challenges
Germany	Feed-in Tariffs, Tax Credits, Investment Subsidies	46%	Minimal	Public opposition, energy storage issues
Oman	Investment Incentives (nascent), PPPs	<1%	Over 95%	Heavy fossil fuel subsidies, lack of comprehensive incentives
Source: (Appunn, 2020); (MEED, 2013); IRENA (2023)				



Figure 8. Incentives and Subsidies in Germany and Oman

In conclusion, it has been evident that Germany has enjoyed the effects of putting financial incentives on the renewable energy sector, comprising of feed-in tariffs and tax credits in a way that triggered investment within the wind and solar energy.

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However, Oman increased its energy subsidies for fossils, which has hampered the country's prospects for renewable power generation instead. While Oman has proposed certain measures such as utilizing private sector partners and providing different investment incentives for the promotion of renewable energy, its promotion remains rather restricted in comparison to the extent of subsidies in Germany's system. Thus, more ambitious financial incentives and decreasing the reliance on the fossil fuel subsidies are necessary to advance the renewable energy shift in Oman.

4.4 Comparison of Renewable Energy Policies and Regulatory Frameworks: Lessons for Adoption

4.4.1 Germany: Key Success Factors

Germany has a well-developed framework of renewable energy policies due to its stability over the years, conformity with the EU energy policies, and significant improvements in the technology. Long-term stability of German Renewable Energy Sources policy where the Renewable Energy Sources Act (EEG) is the most outstanding element for outlining long-term financial support for renewable energy projects. This stability has made investors put down their money in large scale wind, solar, biomass projects to have continuous growth in the overall market (Appunn, 2020).

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Also, extending the membership of Germany into other EU regulations concerning energy has enabled the country to scale up the objectives of renewables in harmony with the EU's challenging carbon emissions. For Climate change mitigation, Germany in its European green deal set a target of 55% of greenhouse gas emission reduction by 2030 and climate neutrality by 2045 (European Commission, 2021). In addition, this integration with EU policy frameworks hasn't only offered Germany monetary support but also an open collaboration with other EU states in order to develop inter-connector renewable power projects.

Technological development has also been noted to have significantly supported renewable energy in Germany. Improvements in the design of wind turbines and enhancements in the performance of solar panels that paved the way to cheaper renewable resources in the energy consumption portfolio. Similarly, investment in grid modernization coupled with energy storage has been boosted through public private partnerships (PPPs) that are deemed necessary because of variability inherent in renewable energy (IEA, 2024).

4.4.2 Oman: Challenges and Opportunities

The energy sector of Oman, on the other hand, experiences some challenges mostly because of overdependence on the fossil fuels resources. They supply more than 95% of the energy needs of the country and are major contributors to the country's export earnings (MEED, 2013). The aforementioned issues indicate that Oman has not diversified its energy mix; hence renewable energy has not grown at a fast rate.

One of the concerns of Oman is the lack of adequate energy storage system required to incorporate renewable energy forms such as solar and wind energy. Unlike Germany, Oman has no technological foundation in storage technology and management of power grid that could accommodate large scale renewable energy systems. This in turn put a constraint on the use of renewable energy and hampers efforts to decrease the reliance of the nation on fossil energy sources (IRENA, 2023).

Another issue is the problem of technology transfer. Currently Oman has embarked on renewable energy projects especially in solar energy though it is still importing the technology. The problem of weak domestic innovation and manufacturing capabilities in renewable energy technologies hinders Oman's prospects for expanding renewable energy generation. Thirdly, Oman has high regulatory risks that make it difficult to integrate renewable energy into Oman's energy mix. Others include bureaucracy, uncertainty, and a generally insecure investment climate that remains more conducive to investing in fossil fuel extraction than renewable energy sources (Apsr.om, 2020).

4.4.3 Lessons Learned and Opportunities for Oman

The case of renewable energy in Germany should be looked at to draw lessons for Oman. The two studies have several implications, one of which is the need for regulatory reforms. Overall, Germany has developed an extensive package of supporting policies for renewables with a strong and consistent base in the Renewable Energy Sources Act (EEG). It is suggested that Oman should follow the same long-term polices with financial incentives like FITs, tax credits or subsidies for renewable energy projects. Such incentives would assist in attracting investment from the private sector together with encouraging the production of renewable electricity (Appunn, 2020).

The other lesson is the market structure require structural reform. Germany's integration with the EU energy market has given it a chance to engage in cross border energy trading, thus assisting it to reduce supply fluctuations of renewable energy. Oman may consider opening up bilateral relations with other nations in the region like the members of the GCC in order to create a larger common energy market. This would enable Oman to sell surplus renewable power and connect with bigger energy networks, thus systematizing its renewable power production.

Another area that Oman should expand is the capacity building and the technology transfer. Setting up local research and development or R & D facilities with emphasis on renewable energy technology would provide a shift from imports of such technology. In addition, Oman could collaborate with other nations such as Germany in technology cooperation especially in energy storage and management of the grid (IRENA, 2023).

The final practical strategy includes public private partnerships or PPPs which presents the viable way for Oman to increase the scale of its renewable energy projects. Germany's PPP experience in the development of renewable energy infrastructure including electricity grid infrastructure, and storage systems indicate the possibilities of such partnerships. Some of the opportunities are as follows: Oman could partner with private companies to finance and develop utility scale solar and wind plants, which is needed capital and know how (IEA, 2024).

Lesson	Germany's Experience	Potential for Oman
Long-term policy stability	EEG provided consistent incentives for investors	Oman could implement similar FITs and subsidies for renewable energy

Integration with regional energy markets	EU collaboration enabled cross-border energy trade	Oman could explore regional partnerships within the GCC
Investment in energy storage infrastructure	Germany invested in energy storage to manage renewable intermittency	Oman needs to invest in storage to support renewable energy integration
Technology transfer and innovation	Germany focused on domestic R&D and public-private partnerships	Oman could establish R&D centers and collaborate with foreign partners

Source: (Apsr.om, 2020); (Appunn, 2020); IRENA (2023); IEA (2024); (MEED, 2013)

Some of the major lessons that can be learnt from Germany's renewable energy policies includes the following as Oman endeavours to diversify its sources of energy. Long-term strategic approaches to regulatory changes, market connection, technology acquisition, and public-private partnership make Oman capable of diversifying beyond hydrocarbon resources and advance the use of renewable energy resources. If Oman aligns its policy to the socio-economic context of Germany then the nation can realise its renewable energy objectives and support international sustainable development.

4.5 Summary of Findings NZA ASHRAF

An evaluation of Germany and Oman's comparative renewable energy strategies, policies, and capacities for localized generation has provided valuable lessons for energy transition. Germany with an experience of having an established regulatory framework and significant financial incentives has been able to build a strong renewable energy industry. On the other hand, Oman is still at this nascent stages despite the growth opportunities available, there are lots of challenges.

The German feed in tariff policy in the renewable energy act (EEG)has greatly impacted on long term investment in renewable energy especially wind and solar energy. Policies that signify the country's determination to containing the emission of greenhouse gases as well as clear policies and regulations whose goal is the promotion of renewable energy sources and technologies have seen renewable energy supply the country's electricity demand by more than 46% of in 2022. This has enabled Germany to have impressive increase in renewable energy installations where wind and solar power constitutes a considerable energy mix in the country. Having highly-qualified regulatory authorities such as the Federal Network Agency enable renewable energy sources to be incorporated effectively into Germany's grid to serve the country's energy policy transformation well into the future.

On the other hand, Oman has always depended on the fossil fuel sources with the oil and gas contributing to more than 95% of Oman's energy mix. Nevertheless, under the National Energy Strategy 2040, Oman has started the process of diversification of energy mix and has set the goal of obtaining 30% of energy from renewable sources till 2030. Some of them include the Ibri Solar Project, which shows the country's seriousness in renewable energy sources. However, some of the challenges include; very high reliance on fossil fuel, inadequate regulatory framework for the promotion of renewable energy, and poor financial incentives that differ greatly from the German FIT system. Currently, Oman has a very limited capacity of renewable energy with a combined capacity of only 1.1 GW as of 2022.

The experience of Germany teaches one important lesson for Oman. For instance, the deployment of stable financial incentives including FITs and enhancement of regulations can produce remarkable outcome particularly in Oman. Further, the actions Germany has taken to commit to energy storage and grid management are a way Oman could offset the intermittency factor of renewable energy sources such as wind and solar.

Altogether there can be concluded that Germany has developed a consistent policy which has made it one of the world leaders in the field of renewable energy. While Oman is not a major player in the renewable energy sector, it has a relatively large capacity for growth if the correct reforms are put in place as well as learning from the German experiences regarding a coherent set of regulations, incentives and communities.

CHAPTER V

5.Discussion

5.1 Introduction

This chapter discusses the findings of the study titled "Renewable Energy Policy, Regulatory Frameworks, and Production: Germany and Oman." The study had several objectives, one of which was to compare and contrast the effects of the policy and regulatory environment on renewable energy generation in Germany and Oman. Extending from this, the study aimed at assessing how the policy instruments such as incentives, subsidies and/or regulatory frameworks has supported renewable energy developments in both countries and comparing the renewable energy policies of the two countries to determine how these factors affect the use of renewable technology.

Comparing the findings of the two countries the differences on the implementations of the policies and the renewable energy developments of Germany and Oman are clearly brought out. Again, the discussion turns to the staking of Germany in Renewables and Policies for instance the much-celebrated Renewable Energy Sources Act also known as EEG. Thus, by 2022, renewable powers, especially wind and solar, accounted for more than 46% of Germany's electricity production as a result of stable long-term policy and favorable financial policies.

However, there is still a significant reliance on fossil fuel with Oman's energy sector getting over 95% of its energy from oil and gas. While Oman has started some projects like the Ibri Solar Plant, the country still has an immature policy structure and does not have adequate impetus for the use of renewable energy. A major challenge faced by it is the dominance of fossil fuels in its energy mix which remain heavily subsidised.

A comparison between Germany's successful regulation for renewables and Oman's emerging policies points out lessons for Oman's renewable energy future. Sound policies, subsidies, and cooperation in regions—such as EU requirements followed by Germany—remain essential prerequisites that can support the expansion of renewable energy solutions on the world market. These findings also stress the vital role of Oman in transforming its dimension of the regulation to improve the private investment and shifting towards the sustainable energy sector.

5.2 Impact of Policy and Regulatory Frameworks on Renewable Energy Production in Germany and Oman

5.2.1 Summary of Findings

Germany and Oman have diversified in the development of renewable energy sector due to the differences in their policy goals, economic strategies and industrial maturity levels. Germany has more elaborate and earlier policies which played a significant role in placing Germany among the leading countries in the renewable energy with more than 46% of electricity derived from renewables electricity mix by 2022. On the other hand, the development of renewable energy policies in Oman is rather young, though the current renewable capacity is estimated to be around 1.1 GW in 2022 mainly through solar energy based on its National Energy Strategy 2040. This strategy is meant to transform Oman's sources of energy, but the transition has been slow and gradual.

The feed-in law of Germany which is known as EEG was initiated in the year 2000 and has a significant role in the growth of renewable energy sources in Germany. The EEG assured grid connection for renewable energy producers and implement feed-in tariff (FIT) based mechanism that offered long-term price certainty to renewable power projects (Balussou et al., 2018). This laid down good acceptable circumstances for the investors; therefore, wind and solar energy started expanding tremendously within a very short time. Hence, in 2022, wind energy was able to provide more than 29% of the electricity consumed in Germany while solar energy was in a position to provide roughly 10% (IRENA, 2023).

On the other hand, Oman has numerous challenges which hinder the growth of renewable energy as highlighted by the following factors High initial cost in infrastructural development; a constantly changing regulatory framework. The country has embarked on a big solar projects including the 500 MW Ibri Solar Project, but most of it still depends on the fossil energy sources, where more than

95% of the total generated energy in the country comes from oil and gas (Apsr. om, 2020).

5.2.2 Comparison with Past Research

It is important to note that the disparities between Germany and Oman mirror trends that have been established in the global renewable energy shift. Similarly, in the literature, there is a strong argument indicating that the earlier the policies are implemented and the more effective they are; the higher the probability of increased renewable energy generation. For example, the success story of Germany's renewable energy expansion is consistent with the theories that claim that stable long-term polices encouraging and risk most-reducing financial. The EEG which offered a feed-in tariff of fixed payments for the renewable electricity that was fed into the grid, reduced market uncertainties and were a definite signal to private developers on where to invest (Lehr and Ulrich, 2017).

However, the case of Oman exemplifies the outcome arrived at in the studies that focus on the challenges that countries within the emergent economy category have regarding their efforts to diversify their sources of energy. Research shows that the investment in renewable energy sources is a challenge in these countries because of the following reasons: policy instability, absence of incentives for investments in renewable energy as well as being heavily dependent on fossil energy. Similar to these challenges, Oman has not made significant strides toward increasing the amount of renewable capacity either, suggesting that improved policy frameworks and regulatory enhancements are required to encourage investment (Siswantoro and Mahmud, 2023).

5.2.3 Importance of Findings

These findings reveal that Germany has proven efficient in the application of renewable energy deployment where policy support is strong, mandate for regulation well defined, long-term targets are clear. It can be named Feed-in tariffs, which the EEG introduced, as one of the major causes that let Germany augment renewable energy generation in a rather short time. Therefore, ensuring stable and predictable money returns, the EEG evoked numerous large-scale investments in wind and solar

power. In addition, the Federal Network Agency in charge of the grid integration ensured that renewables were integrated well into the electricity market in Germany without any hitches including fluctuations and the issue of grid balance (Madlener, Glensk and Gläsel, 2019).

This can be seen in the case of Germany where renewable energy has fortunately expanded because of the government set objectives and incentives. Thus, when the installed capacity has risen, the cost of renewable technologies declines and becomes more affordable than those other traditional sources of power. This is best explained by an example such as the Germany case where cost of solar energy has reduced in the last ten years thus increasing the uptake of the energy (Madlener, Glensk and Gläsel, 2019).

So, the outcomes aim to illustrate that regulatory change is critical for Oman's development of an economy when it must diversify to beyond the reliance on fossil fuels. Despite a fair progress in the large-scale solar project development, the installed renewable energy capacity of the country is still small. Due to Oman's over-reliance on revenues from its fossil fuel resources, the country has been unable to effectively prioritize investment in renewable energy because the continued subsidization of the supply of oil and gas competes against the demand for supplies of intermittent and clean sources of energy. Continued absence of a well-coordinated feed-in system like the one tendered in Germany and other selective financial incentives therefore poses additional challenges for the private sector investment in renewables (Alola et al., 2019).

5.2.4 Recommendations

Given the contrast between Germany's success and Oman's challenges, several recommendations can be made for Oman's energy policy:

1. Implement Long-Term, Clear Policies with Dedicated Renewable Energy Targets: Oman should set measurable targets for renewable energy which are legally enshrined like the case with the German EEG. This would give more predictability in investors' eyes as well as show the government's commitment in the long-term shift away from fossil fuels. This could involve percentage of energy from renewable energy as the case was in the National Energy Strategy 2040 that targeted a 30% share by 2030 (Alola et al., 2019).

2. Introduce Financial Incentives to Attract Investment: Thus, if the same result is to be achieved in Oman, the equivalent financial stimuli, such as feed-in tariffs or tax credits, should be applied to RE projects. They would assist in reducing risks on such investments and increase private sector investment on renewable energy transition. Policies that include the removal of fossil fuel subsidies and the addition of subsidies for renewal resources would help level the playing field to allow renewable resources to gain a competitive edge against the traditional energy resources (Madlener, Glensk and Gläsel, 2019).

3. Strengthen Regulatory Institutions to Support Renewable Energy Integration: The regulatory bodies for instance the Authority for Public Services Regulation (APSR) in Oman require capacity to enable large scale generation and incorporation of renewable energy into the grid. It could mean adopting lessons from Germany's Federal Network Agency under which it lies to oversee the grid stability and adequate exercise of the renewable power distribution. There is much untapped potential in Oman, such as stepping up grid infrastructure requirements and coming up with policies at managing the variableness of solar and wind energy like storage systems (Siswantoro and Mahmud, 2023).

4. Future Research: More research has to be done to determine how regulatory instruments facilitate the implementation of renewable energy in the emerging economy of Oman. These may cover impact of different strategies of financial reward, policies and laws, and cooperation between the government and the private sector for developing use of renewable energy in countries having similar GDP (Lehr & Ulrich, 2017).

Therefore, based on the examination of Germany's and Oman's cases, policy and regulation remain the significant factors for the transition in RES cases. While they moved early and implemented sound polices thereby recording a remarkable growth rate in the renewable energy sector, the Oman's largely unexplored regulatory structure demonstrates the challenges which fossil fuel-based economy face in energy transition. Thus in the long run Oman can employ long term polices and can

use the tools of financial incentives for the change to the renewable sources and low reliance on the fossil fuel.

5.3 Effectiveness of Incentives, Subsidies, and Regulatory Structures in Promoting Renewable Energy Development

5.3.1 Summary of Findings

Germany and Oman are two countries that show that incentives, subsidies, and a stable credit system accelerate the development of renewable energy. Germany likewise boosted its renewable energy industry by means of Feed-in Tariff policy with tax credits and investment subsidies, predominantly to wind and solar energy industries. Renewable energy Feed-In Tariffs (FITs) were established through the EEG in 2000 and provided both long-term price predictability to renewables producers by ensuring fixed prices for electricity generated by renewables technology. This minimized risks in investment and set the stage for substantial rise thus achieving 46 percent fixation on renewable energy in electricity usage by 2022 (IRENA, 2023). Besides the FITs, the Government of Germany also adopted tax credits and investment subsidies which applied to both utility-scale and small-scale RE projects including the residential solar power.

On the other hand, Oman has few policies supportive of financial incentives for renewables; energy subsidies are fairly dominated by fossils. While it is possible to see the prospects for the development of renewable energy in the National Energy Strategy 2040, specific stimuli are still meager. Oman has launched investment promotion and embrace the adoption of PPPs hence projects like Ibri Solar Plant. Nevertheless, only the subsidies to fossil fuels which were estimated at around USD 5.8 billion consistently outweigh any support for renewables it makes it very difficult for any renewable energy projects to take off (MEED, 2013).

5.3.2 Comparison with Past Research

The result obtained from Germany literature is consistent with the large body of studies on the effectiveness of using financial incentives to mitigate investment risks and enhance the deployment of renewable energy. Research has further depicted that incentives such as FITs help in reducing the risks originating from renewable

energy projects especially in the fossil fuel dominated markets. In the case of Germany, the FIT system gave investors definite cues about tariffs and thereby avoided the uncertainties which are associated with fluctuating market prices and the prices of electricity. This in turn encouraged domestic and foreign investors resulting in increased private sector participation in renewable energy infrastructure. Furthermore, it is evident from literature that tax credits and investment subsidies are effective policies in the deployment of smaller scale renewable energy systems, as present in the German decentralized energy strategy (Nicolini and Tavoni, 2017).

On the other hand, the findings revolving around Oman's fossil fuel subsidies are in line with authorities ailing in transitioning to renewable energy as observed among the emerging economies. In many nations such as Oman, fossil fuel subsidies make it very difficult for renewable energy sources to penetrate the market. Research shows that these subsidies have a negative impact on Renewables by artificially inflating the demand for fossil-fuel which hampers their development. As the absence of feed-in tariffs or tax credit support mechanisms for renewable energy sources shows, this generates a high level of risk for long-term renewable projects, which leads to investors' inability or unwillingness to finance such projects in such an environment (Poudineh, Sen and Fattouh, 2018).

5.3.3 Importance of Findings

The case of the Germany effectively demonstrates fact that, the financial incentives power a very crucial element of financial risk mitigation of renewable energy investments. It was therefore the requirement of long-term revenue stability for the FIT system for renewable energy in Germany that incentivized participation from private sector companies, local co-operatives and individual households. Germany through feed-in policy created a market accessible by a fixed price for the renewable technologies hence providing ground for great adoption of the systems, especially focusing on wind/solar power solutions. Moreover, the provision of tax credits and lowered taxes on renewable energy systems also contributed to the advancement of decentralized renewable and located Germany in a vanguard of renewable electricity generation. This strategic plan has made the deployment of renewable energy as one of the cornerstones for energy transition process in Germany to achieve the energy transition and climate neutrality by 2045 (Malik et al., 2019).

One of the major challenges of attracting private players towards Oman for investment in renewable energy is the absence of such similar financial carrots. This question is tackled by the other two arguments, which show that while renewable energy sources offer many benefits they are outweighed by the dominance of fossil fuel subsidies which causes an uneven and unfair market competition between the two covering this area. As the economic disparity that once ensured adequate support for renewable energy projects is no longer in place through mainly FITs or tax incentives, Oman's efforts are limited in this area. Some investment incentives and PPPs, as positive phenomena, are not sufficient to shift the spending significantly, although there are still numerous subsidies to the fossil fuels. This imbalance limits the country's capacity to diversify its energy sources and withdraw from the use of fossil energy resources (Shrimali et al., 2017).

5.3.4 Recommendations

To address these challenges and accelerate the transition to renewable energy, Oman should consider implementing the following recommendations:

1. Gradually Phase Out Fossil Fuel Subsidies: It was also pointed that Oman's huge fossil fuel subsidies remain one of the major challenges for the development of renewable energy. elimination of these subsidies gradually would help to stop the manipulation of the prices at which fossil fuels are currently sold thus promoting a level playing field for renewable energy technologies in the market. This strategy has been tried in other countries of the world to encourage conservation of renewable energy and Oman stand to benefit from the same (Schrimali et al., 2017).

2. Introduce Comprehensive Financial Incentives for Renewable Energy Projects: It may be highly advisable for Oman to pursue some of the effective financial structures used in other markets for instance feed-in tariffs or tax credits. Holding similar principles as Germany's FIT system, it will lock-in price and puntivise long term investment intention for renewable energy projects. There could be tax credit bonuses for large-scale renewables and local development, including roof-top solar systems. These incentives would facilitate the reduction of risk on renewable energy projects and encourage the private sector participation (Malik et al., 2019).

3. Expand Public-Private Partnerships (PPPs): Although Oman has started some PPPs in the renewable energy the door to partnership should be opened more and involve international investors as well as technology providers. As it was established earlier, PPPs are in a position to attract private capital and skills to support the expansion of renewable energy system. The Oman government could therefore expedite the implementation large scale renewable energy projects through increased cooperation between the public and the private sectors (Poudineh, Sen and Fattouh, 2018).

4. Balance Fossil Fuel Dependence with Renewable Promotion: Paradoxically, as Oman eliminates fossil fuel subsidies it needs to promote renewable energy in a manner that does not disrupt its key development goals. The government needs to seek strategies with efficiency as a way of enhancing the take-up of renewable energy without impacting energy security or economic stability. For example, investing in renewable energy by transferring a portion of the subsidies in fossil fuels for the development of renewable energy resources may act as a middle ground between supporting fossil fuel-based energy generation and incorporating clean energy production (Nicolini and Tavoni, 2017).

In Germany for instance, the success that has being achieved in the development of renewable energy sources can be attributed to the fact that the country has in place a good system of financial incentives, grants and subsidies that have been put in place to support the development of renewable energy. The FIT system together with tax credits and investment subsidies paved the way for renewable energy investment which witnessed a bright baron wind and solar power. While, on the other hand, Oman's heavy dependence on fossil fuel subsidies effect the development of renewable energy sector. While the country has tried to develop the right approach of introducing investment incentives, all these initiatives continue to appear less than adequate when compared to the elaborate financial structures adopted in Germany.

In order to transition to renewable energy sources, subsidies to fossil fuel need to be removed while the country needs to design a better financial incentive structure to provide impetus to private players. Germeny's case can serve as a good example for Oman to set up the right regulatory and financial environment to advance sustainable energy market and decrease the country's dependence on oil and gas.

5.4 Comparison of Renewable Energy Policies and Regulatory Frameworks: Lessons for Adoption

5.4.1 Summary of Findings

Comparing Germany and Oman's re-newable energy policies let to understanding two different approaches that were utilized. Germany's regulatory policies are wellreasoned, stable, have a long-term vision and correlate with the EU's policies, thus making it possible for the country to offer favourable conditions for fast development of renewable energy. The policy framework detected here is built up by the EEG whose stable policy environment leads to the investors' confidence. Germany's success in increasing wind, solar, and other forms of renewable power is also linked with the EU energy laws to which Germany is a member thus has access to funding and regional collaboration in energy (Appunn, 2020).

On the other hand, Oman is in its early stages of developing its regulatory policies and these are not coherent or supportive of renewables integration. Another drawback for Oman's growth of green energy is the government reliance on fossil fuels, as well as the regulation system that is more beneficial for conventional power sources. The country had not put in place overarching national policies or rebates/ incentives that will popularize RE as seen in Germany. Thus, Oman's renewable energy industry remains in its infancy and stands to contribute very little to the overall energy mix in the country (MEED, 2013).

5.4.2 Comparison with Past Research

Many studies stress the crucial role of having stable and long-term policies, pointing to the fact that this is the main hallmark of successful transitions towards renewable energy sources. As the result of the policy consistency and predictability, there has been a considerable amount of foreign direct investment for the sustainable development of renewable energy particularly in Germany. A good example is Germany's EEG which used financial FITs giving investors long-term revenue assurance hence the ability to plan for long term'. It supplemented investments and eradicated risks to make Germany the pioneer of the development of renewable power facilities (Inês et al., 2020).

Lack of long-term policies and a stable political environment also pose a significant challenge for Oman and emerging economy, and this hampers private investment in the renewable energy sector. Research points to the fact that, in such economies, regulatory reform could be instrumental in addressing these challenges. It is stressing that adopting models borrowed from Germany's policy framework, Oman among other nations can develop regulations that give certainty and encourage investment in clean power technologies. Other emergent economies with similar fossil fuel demands have to understand that issues like regulatory constraints – including long administrative procedures or insufficient financial encouragement – have to be solved in order to move towards sustainable energy (Torres et al., 2023).

5.4.3 Importance of Findings

The results reveal how consistency and certainty of policies are crucial in the promotion of investments in the renewable energy industry. The consistent EEG policy of Germany has unleashed a deluge of investments from both the public and private sectors. Through favourable policies, Germany was able to draw both domestic and international investments towards renewable energy projects in large scales. This process benefited from the involvement of PPPs whereby improvement in the grid modernization and energy storage systems necessary for infrastructure of renewable energy was acquired (Poudineh, Sen and Fattouh, 2018).

On the contrary, the lack of clear regulations in Oman deters investors. For instance, the lack of long-term financial incentives or policies to support renewable energy undermines the private sector's involvement in the country. The absence of coherent regulation is also reflected in cross-border trade and integration of the energy markets. Through participation in the EU energy market, Germany has been able to provide security and flexibility in energy trading with the integrated system even with high levels of variability of renewable resources. Integration of such systems enables the excess energy produced by renewable resources to be either sold or exported to other areas with variation in supply (European Commission, 2021). Likewise,

through partnering with other GCC countries for regional market integration, Oman could stand to gain from trading in energy and stabilization of grids (Bosman, Brinker and Walz, no date).

5.4.4 Recommendations

1. Regulatory Reforms in Oman

In the case of Oman, the ministries need to focus on legal changes that will ensure investment in renewable energy infrastructure. The main recommendation is to set up a comprehensive policy where these structures resemble Germany's FITs or tax credits of some sort. These incentives would support renewable energy projects by reducing the high first cost of renewable technologies, and give investors long term revenue guarantees. In addition, there is need for more reforms in dealing with regulation as it affects several bottlenecks that slow down decisions concerning project development for the private sector to get involved. This could be done through the elimination of complex approval systems and bureaucracy, which at the moment work in the favour of fossil fuel investors (Bosman, Brinker and Walz, no date).

2. Investment in Energy Storage and Grid Modernization

Another shocking discovery was that Oman has little energy storage which plays an important role in incorporating the intermittent renewable energy power plants in Oman such as the solar and wind. Germany has invested a lot in energy storage systems and grid management technology so as to address the issue of intermittency of renewable energy. Thus, Oman should also support grid stabilization technologies to support its supply of renewable energy. Integrating the renewable energy into the grid which require modernization would enhance energy security besides decreasing the dependency on fossil energy sources (Poudineh, Sen and Fattouh, 2018).

3. Exploring Regional Energy Market Integration

The effectiveness of operating across the border in energy trade as could be observed with Germany within the EU can well serve as an important lesson for Oman. It can also engage Oman in regional energy markets that can help the country to trade energy commodities with other countries in the region especially in the GCC region. This would enable Oman in being able to sell excess renewable energy whenever the solar or wind power is abundant; and at the same time buy power when the renewable energy cannot support the supply. This would be in addition to the fact that regional energy market integration would assist Oman in managing the intermittency of the supply of renewables into its energy grid by giving the country access to a larger and more diversified energy portfolio, (Torres et al., 2023).

4. Capacity Building and Technology Transfer

In light of the above, Oman should concentrate on developing capabilities by investing in research and development concerning renewable energy. Creating R&D centers focused on renewable energy technologies could decrease Oman's reliance on external knowledge and promote local development. Thus, it can be suggested that Germany had benefited from domestic focus on technological innovations especially on wind and solar energy. Some of the strategies that Oman could engage in include developing a partnership with countries such as Germany to enable the transfer of technology especially in future technologies such as energy storage and the management of the grid. This would help Oman to greatly increase renewable energy share and at the same time decrease fossil fuel dependency (Inês et al., 2020).

5. Public-Private Partnerships

Public-private partnerships (PPPs) have been a major driver of Germany's renewable energy investment strategy. A similar model should be adapted for Oman to tap the private capital and expertise for large scale renewable energy projects. In this regard, PPPs will help Oman to attract the required funds for implementing such initiatives as the modernization of the grid or large-scale solar or wind powers. Such an approach would help mobilise much needed financial resources and technical know-how to address the technical and financial hurdles of renewable energy deployment (Inês et al., 2020).

The overall strategies to promote the renewable energy in Germany can provide several significant insights to the sultanate of Oman when it is on the process of diversifying its electricity portfolio. By adopting long-term measures to initiate regulatory changes, financing energy storage facility and integration of Oman's electricity market, capacity building, Oman can progress from relying mainly on the fossil fuels to adopt more efficient energy policy. Stability in regulations will enable private sector investment as observed in Germany on the way towards massive uptake of RE technologies. Implementation of these lessons could assist Oman to attain its renewable energy objectives in addition to supporting the international efforts toward combating climate change.

5.5 Overall Recommendations for Stakeholders

Based on Germany's success, the analysis provides information on recommendations for stakeholders such as Governments, private sector, and researchers on how to support renewable energy development in Oman.

5.5.1 Governments: Implement Feed-in Tariffs (FITs) and Financial Incentives

There is need for Oman government to adopt Feed-in Tariffs (FITs) or tax credits as Germany has implemented through its Renewable Energy Sources Act (EEG). Such financial instruments may help to minimize investment risks and ensure long term commitment from the private parties. In addition, FITs would ensure a stable price feed to renewable energy producers, thus promoting both utility scale and distributed generation, which would help Oman expand its renewable energy generation portfolio. If fossil fuel subsidies will be reduced over time that will also provide a fair competition to other renewable energy sources in the market and bring a more equalized ecosystem (Abuzayed and Hartmann, 2022).

5.5.2 Private Sector: Strengthen Public-Private Partnerships (PPPs)

The development of Oman's renewable energy is therefore expected to benefit from Finance and expertise from PPPs partnerships. The private sector should invest in the large scale programs such as solar/wind; electricity grid upgraded and energy storage facilities in partnership with the government. Drawing lesson from Germany, these collaborations will source for the needed capital, spur innovation plus fast track the projects in question. Further development of PPPs will foster greater foreign investment, as well as technology suppliers, which in turn enables the spread of technology (Abuzayed and Hartmann, 2022).

5.5.3 Researchers: Explore Regional Energy Market Integration and Technology Transfer

Latterly, researchers should examine possibilities of regional energy market integration in the context of the Gulf Cooperation Council (GCC). It is also important to note that like Germany's engagement in the EU, Oman could also stand to profit from cross border energy barter and cooperation. There is also a need to find out ways of advancing technology transfer especially in the energy storage and grid management systems areas. The development of local R&D centers will thus improve Oman's innovation ecosystem, decrease its dependence of imported technology, and strengthen its renewable energy projects (Hereher and El Kenaway, 2020).

The above measures will enable Oman to gradually wean off the country's dependence on fossil fuel and embrace a more diversified and renewable energy mix. Thus, the cases of Germany and Oman show that policy and regulatory environment is one of the key determinants of renewable energy shifts. Germany has profusely backed renewables in the early years and strongly supported it, whereas Oman is in its developing stages and portrays the difficulties of a fossil-fuel based economy. Therefore, for Oman, to launch itself fully into this vital sector, it should implement long-term policies and financial incentives like those of Germany such as the Feed-in Tariffs (FITs) and tax credits. With the discontinuation of the subsides of fossil fuels and with the right investments put in storage and market integration, Oman has the chance of coming up with a conducive environment for the development of renewable energy thus supporting the global sustainability addresses and pulling out from the dependency on fossil fuels.

CHAPTER VI

6. Conclusion

6.1 Brief Thesis Summary

This thesis has explored the "Renewable Energy Policy, Regulatory Frameworks, and Production: Renewable energy policy environment research paper; Policy comparison of Germany and Oman: "Comparative analysis of renewable energy of Germany and Oman" The overall goals of this research were as follows: To assess the effects of policy and regulatory systems on the generation of renewable electricity resources in both nations, To determine the efficacy of the financial incentives, and To compare the modulation impact of policies on renewable electricity utilization.

This study also made a comparison between the development of renewable energy in Germany and Oman where the two countries' different paths were demonstrated. Germany has well developed policies including, the Renewable Energy Sources Act (EEG) and its financial incentives including Feed-in Tariffs (FITs) have contributed to increasing level of renewable energy production. However, Oman with its oildependent economy is at the developmental stage of diversification of energy sources under the recently launched National Energy Strategy 2040, which, of course, comes with a number of challenges, but also opportunities for growth. Consequently, the evidence presented here provides useful lessons on how policy and legal environment can either support or frustrate the use of renewable energy.

6.2 Key Conclusions

The findings from this comparative analysis offer several key insights into the role of policy and regulatory frameworks in renewable energy development.

Germany's EEG or the Renewable Energy Sources Act came into force in the year 2000 and has been quite crucial in defining the renewable energy market in the country. The EEG, especially through its FIT system ensured long-term price stability of electricity and the grid access to the renewable energy producers. These policies greatly reduced the cost of financing renewable energy projects by providing considerable insurance against the fluctuations in the renewable power prices and

thus encouraged both private and public stakeholders into investing in large-scale wind and solar energy. On this basis, the use of renewable energy in German increased and by the beginning of 2022, 46 percent of electricity used in the country was generated from renewable sources with a wind energy of 29 percent and solar power of 10 percent. This serves as confirmation of what long-term, precise policies can do to support lasting growth and creating a country as a manufacturer of renewable energy sources.

The success of Germany implies that there is the need to put in place a coherent legal policy which corresponds to some general objectives, including reduction of greenhouse gas emissions and sustainable development. Another prominent institution has been the Federal Network Agency that has played a critical role in achieving elaboration of renewable energy into the national grid, managing grid stability, and solving the problem of intermittency by increasing investments on energy storage systems.

Oman is still in the process of renewable energy transition even though the process is part of the ongoing modern trends. Traditionally Oman has depended on the hydrocarbon sources where upstream or oil and gas make up beyond ninety-five percent of the total energy mix. However, under its National Energy Strategy 2040, Oman's plan is to diversify its energy sources with the intention of making 30% of energy generation from renewable sources by the year 2030. Measures such as the large-scale plan of Ibri Solar Project show the direction of the country to this shift. However, Oman encounters a number of challenges such as high capital investment in advancing infrastructure, low financial incentives and weak policies that continue to support fossil energy sources compared to renewable energy sources.

The regulatory and policy framework of Oman far from that of Germany which has huge vision and financial backup. The lack of a substantial financial support such as FITs or tax credit hinders the possibility of mobilizing private capital for the development of renewable energy systems. Also, the use of fossil fuel subsidies hampers Oman's energy transition since they offer unequal competition to RE technologies. The elimination of these subsidies and introduction of new batch of
financial incentives could further spur Oman's renewable energy and new project opportunities may entice the private sector to invest in the renewable energy sector.

The feed-in tariff (FIT) system of Germany – supported by other forms of incentives such as tax credits and investment subsidies – has played a major role in Germany's renewable energy programme. These financial tools lowered risks associated with invest in renewables, offered long-term revenue guarantees, and stimulated both centralised and distributed generation schemes. Nevertheless, Oman has not introduced the same attractive financial incentives as the first type which is required to encourage the private sector to invest and to overcome the key obstacles that hinder development of new generation renewable energy resources. Introducing mechanisms that are close to the goals of FIT systems of Germany's could help Oman to attract private investments and facilitate the expanded use of renewable energy sources.

Political stability and policies in the Germany have played a significant role in development of renewable energy sources by guaranteeing investors of a stable and predictable environment. It is therefore advisable that Oman emulated these reforms which emphasized on long-term targets and approvals of renewable energy projects with clear reformation processes. Public Private Partnerships (PPPs) could also again have a major role in Oman's transition within initially having to mobilise investment domestically and internationally in Renewable Energy Infrastructure.

DISSERTATION HELP

6.3 Limitations of the Study

Despite the valuable insights generated by this research, there are several limitations that must be acknowledged.

6.3.1 Data Availability

One major constraint is the issue of integrating sufficient and updated information especially in Oman where renewable energy plans are relatively new. Therefore, some aspects of Oman renewable energy may have not been fully covered due to the relative early stage of development in Oman, and the constant changes in its energy policies.

6.3.2 Focus on Two Countries

Despite the fact that this research comparison was made between Germany and Oman, it is important to note that the findings of this study may not necessarily hold true for other countries that operate in different economical, politically and environmentally endowed or challenged countries. Germany and Oman, are extraordinary cases, one being one of the leading actors in the transition to renewables, the other a country heavily dependent on fossil fuels currently making initial gradual changes.

6.3.3 External Factors

The study also fails to capture factors outside the choice of renewable energy including the volatility of oil prices; political and other diplomatic factors; and the global climate change treaties. All these factors may therefore bring about shifts in energy policy decisions and rate of turnover to the use of renewable energy in both nations.

6.4 Suggestions for Future Research

Future research could build upon the findings of this study in several ways.

6.4.1 Longitudinal Studies

More comprehensive analysis of policy reforms in Oman would be achieved by monitoring the effects of reforms over the time, in the context of renewable energy transition. It planning research could evaluate and determine the changes in the regulatory frameworks, key developments in the financial structure, and trends in energy markets shifting renewable energy production in the forthcoming years and decades.

6.4.2 Regional Energy Cooperation

Future studies on cross-border integration of the regional power market, especially the GCC, may examine how Oman's renewable energy advancements might be hastened by trade and cooperation. The EU energy market and more specifically experiences from Germany could provide guidelines for any such integration.

6.4.3 Emerging Technologies

For future research, the integration of new technologies such as energy storage systems and smart grid systems should be the focus of the renewable energy technologies implemented in their respective nations' energy policies. These technologies will be quite useful especially when it comes to dealing with the intermittency issues with renewable energy sources such as wind and solar.

6.4.4 Comparative Studies

Lastly, future studies could also generalize this comparative evaluation to other countries with the comparable level of economic development, including other GCC countries or developing nations moving towards post-oil economy. This would give a broader perspective on how various policy climates impact on the utilization of renewable energy around the world.

Therefore, this research is significant in establishing the linkage between policy and regulatory frameworks and renewable energy transitions of Germany and Oman. Implementing the long-term variable policies, applying financial incentives, and following the experience of Germany, Oman can speed up renewable energy perspective and join global shift of sustainable energy.

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