University of Piraeus

Department of International and European Studies

Master Program in

Energy: Strategy, Law and Economics

Master Thesis

Title	**Energy Transition and its Impact on Middle East Countries**
Student Name	**Perpirakis Konstantinos-Marios**
	MEN22036
Supervisor	**Athanasios Platias**

ATHENS, FEBRUARY 2024

Το έργο που εκπονήθηκε και παρουσιάζεται στην υποβαλλόμενη διπλωματική εργασία είναι αποκλειστικά ατομικό δικό μου. Όποιες πληροφορίες και υλικό που περιέχονται έχουν αντληθεί από άλλες πηγές, έχουν καταλλήλως αναφερθεί στην παρούσα διπλωματική εργασία. Επιπλέον τελώ εν γνώσει ότι σε περίπτωση διαπίστωσης ότι δεν συντρέχουν όσα βεβαιώνονται από μέρους μου, μου αφαιρείται ανά πάσα στιγμή αμέσως ο τίτλος. / The intellectual work fulfilled and submitted based on the delivered master thesis is exclusive property of mine personally. Appropriate credit has been given in this diploma thesis regarding any information and material included in it that have been derived from other sources. I am also fully aware that any misrepresentation in connection with this declaration may at any time result in immediate revocation of the degree title.

(υπογραφή)

Τριμελής Εξεταστική Επιτροπή

(υπογραφή)	(υπογραφή)	(υπογραφή)
Όνομα Επώνυμο	Όνομα Επώνυμο	Όνομα Επώνυμο
Βαθμίδα	Βαθμίδα	Βαθμίδα

Contents

Abstract:

The energy landscape in the Middle East has been predominantly reliant on fossil fuels for decades. However, with the global push towards sustainable development and the need to mitigate climate change, energy transition in the region has become an urgent priority. This thesis aims to explore the challenges, opportunities, and strategies associated with the energy transition in Middle East countries. Through a comprehensive analysis of the region's energy sector, policies, and socio-economic factors, this research will provide valuable insights into the potential impacts of transitioning to renewable and sustainable energy sources in the Middle East. The below thesis focus also on two key players in the region the United Arab Emirates and the Kingdom of Saudi Arabia.

Chapter 1: Introduction

1.1 Background and context of energy sector in Middle East countries

In the early 20th century the discovery of large amounts of oil and natural gas in the Middle East changed the entire landscape of the region. The first that started the production of oil was Iran in 1908 and then Saudi Arabia followed with the creation of Arabian American Oil Company (Aramco). This transformed Saudi Arabia into one of the world's largest oil producers. Over the years, many other Middle Eastern countries, including Iraq, Kuwait, the United Arab Emirates, and Qatar, also discovered and developed their oil fields. The development of these fields significantly increased the region's oil production and led to creation of OPEC in 1960 in order to coordinate the production of oil and help the party members to control the oil price. In the second half of the 20th century also vast amount of natural gas where found especially between Qatar and Iran with Qatar becoming a major player in the energy market especially through the transport of Liquefied Natural Gas (LNG).

The Middle East, a place known for its oil money and big energy decisions, is at an important turning point in the time of changing how we get our power worldwide. This beginning study looks at why energy shift talk is extra important in the Middle East area. It shows how this part of world plays a special role with global power happenings. In history, the Middle East has been at the center of world oil business. Big countries like Saudi Arabia, the UAE, Qatar, and Iran have been important in deciding how much energy we get around the world because they own a lot of oil and gas. The control these countries have in the energy area has not only changed how money and politics work there but also affected world power markets a lot (Yergin, 2020).

The money from oil sales in the Middle East has been important for a long time. This gives funding for roads, charities to help people and makes countries richer. But this use of oil and gas has made these economies weak to the changes in world prices for them. Fluctuations in oil prices cause doubts about the economy, affecting money spent by governments and overall balance of finances in that area (Amran et al., 2020).

Adding to the money problems are big worries about how we care for nature. The Middle East has major problems like not enough water, turning lands to deserts and the effects of changing weather conditions. This is made worse because they use fossil fuels a lot. This trust leads to high individual carbon emissions, creating environmental problems in the area and worldwide. Switching to renewable energy for fighting climate change provides a special chance for the Middle East as it has lots of power from sun and wind resources (Darwish et al., 2018).

In the Middle East, there is a need for change in how we get energy. This comes from problems and chances that are available. In one way, the world moving towards using more renewable energy puts pressure on old oil-based economies of that area. Instead, it gives these countries a chance to mix up and update their economies. This helps lower the amount of carbon they use and matches with efforts around the world for green living. Notable programs such as the UAE's Mohammed bin Rashid Al Maktoum Solar Park and Saudi Arabia's Vision 2030 show how this area is moving toward change (Alnaqbi & Alami, 2023; Amran et al., 2021).

Spreading out the types of businesses is very important for Middle East countries to deal with changes in world energy markets. Moving from an economy centered around oil to one with many different parts, and putting lots of money into renewable energy and other areas is important for long lasting growth. This plan not only helps with ups and downs in the oil market, but it also lines up nicely with world goals for long-lasting energy. This makes a strong chance for Middle East to lead change in worldwide power use (Sgouridis et al., 2016).

Working together with other countries is very important for helping the Middle East switch to new ways of getting energy. Working together with big worldwide groups to share technology, put in money and help policies is very important for growing the area's renewable energy business. For example, working together globally on solar and wind energy projects has been important for helping to push forward renewable energy plans in the area (International Energy Agency. 2023).

Furthermore, changing to green energy in the Middle East has major social impacts. The move from old oil-based economies to new ones calls for change in jobs. Many chances are coming up in the renewable energy area now. This change could lead to more jobs, better skills and improved social services. This helps an area grow stronger and be stable overall.

So, changing energy in the Middle East is not just a matter of nature or money. It's about big and important things such as politics, people groups and tech stuff - it goes beyond those areas too. The area's special place in world energy actions makes this change very important and difficult. As the Middle East goes through this big change, its success or failure will have deep effects not just for itself but also for the world energy situation.

1.2 Significance of the energy transition in the Middle East

The Middle East, long characterized by its immense wealth in fossil fuels, is undergoing a profound and pivotal shift as it embraces the transition to renewable energy sources. This shift, while sparked by global imperatives such as climate change mitigation and sustainable development, carries unique significance for the Middle East, transcending mere adaptation to global trends. The region's commitment to diversifying its energy portfolio reflects not only environmental concerns but also strategic economic and geopolitical imperatives.

Historically, the Middle East has been synonymous with vast oil reserves, playing a central role in global energy markets and geopolitics. However, the era of unchecked reliance on fossil fuels is waning, as the world grapples with the urgent need to mitigate climate change. In response, Middle Eastern nations are navigating the complex terrain of transitioning from being major oil producers to becoming leaders in the renewable energy sector. This transition represents a paradigm shift with far-reaching implications for the region's economic prosperity, geopolitical influence, and environmental sustainability.

At the heart of the Middle East's energy transition is the recognition of the finite nature of fossil fuels and the environmental toll associated with their extraction and consumption. The region, like the rest of the world, is witnessing the tangible impacts of climate change, from rising temperatures to more frequent and severe droughts. By embracing renewable energy sources, particularly solar and wind power, Middle Eastern countries are taking proactive measures to address these environmental challenges and contribute to global efforts to reduce carbon emissions. (International Energy Agency (IEA))

Beyond the environmental imperative, the energy transition holds profound economic implications for the Middle East. Historically dependent on oil exports as a primary revenue source, countries in the region are now strategically diversifying their energy mix to reduce vulnerability to fluctuating oil prices. This diversification not only ensures a more stable and resilient economy but also opens up new avenues for economic growth and job creation. The renewable energy sector, with its potential for innovation and technological advancement, offers Middle Eastern nations the opportunity to position themselves as pioneers in the emerging global green economy.

The strategic economic significance of the energy transition is further underscored by the potential for enhanced energy security. By reducing dependence on finite fossil fuel resources, Middle Eastern countries can insulate themselves from the geopolitical uncertainties and market fluctuations that have historically characterized the oil industry. This shift towards greater energy independence enhances the region's resilience and fosters economic stability, contributing to a more secure and sustainable future.

Geopolitically, the Middle East's commitment to renewable energy transforms it from a passive player in global energy dynamics to an influential and proactive participant. As countries in the region invest in renewable technologies and infrastructure, they position themselves as key players in the international energy arena. This newfound influence not only reshapes existing geopolitical power structures but also allows Middle Eastern nations to contribute meaningfully to shaping global energy policies and fostering international collaboration on sustainable development.

In conclusion, the significance of the energy transition in the Middle East extends far beyond the imperative to address climate change. It represents a multifaceted transformation that touches on economic diversification, enhanced energy security, and geopolitical influence. As the region embraces the opportunities presented by renewable energy, it charts a course toward a more sustainable and resilient future, redefining its role in the global energy landscape. The Middle East's commitment to the energy transition not only aligns with global environmental goals but also positions the region as a dynamic and forward-thinking leader in the pursuit of a more sustainable and equitable world.

1.3 Research objectives and scope

The research objectives and scope of this thesis on "Energy Transition and its Impact on Middle East Countries" are critical elements that guide the study and define its boundaries. The overarching goal of this research is to comprehensively investigate the dynamics of the energy transition in Middle Eastern nations, focusing on the transformative effects on their economies, societies, and geopolitical positions.

Understanding the Energy Transition Landscape:
The primary objective is to provide a nuanced understanding of the energy transition landscape in the Middle East. This involves a detailed examination of the policies,

initiatives, and technological advancements driving the shift from conventional fossil fuels to renewable energy sources within the region.

Assessing Economic Implications:
One key focus is to evaluate the economic implications of the energy transition for Middle Eastern countries. This includes analysing the diversification of energy portfolios, the impact on traditional oil-dependent economies, and the emergence of new economic opportunities in the renewable energy sector.

Analysing Social and Cultural Dimensions:
The research aims to explore the social and cultural dimensions of the energy transition. This involves examining how the adoption of renewable energy technologies influences local communities, livelihoods, and societal perceptions. Understanding the socio-cultural factors that facilitate or hinder the transition is crucial for effective policy recommendations.

Investigating Environmental Sustainability:
An essential research objective is to assess the environmental sustainability aspects of the energy transition. This includes evaluating the reduction of carbon emissions, the mitigation of environmental degradation, and the overall ecological impact of transitioning to cleaner energy sources in the Middle East.

Examining Geopolitical Implications:
Geopolitical dynamics play a pivotal role in the energy transition, particularly in a region historically significant for its oil resources. The study aims to examine how the energy transition influences geopolitical relationships, regional power structures, and the international standing of Middle Eastern countries in the context of global energy governance.

Comparative Analysis Across Middle Eastern Countries:
The research scope includes a comparative analysis of the energy transition experiences among different Middle Eastern countries especially Saudi Arabia, Qatar and the United Arab Emirates. Examining variations in policy approaches, technological adoption, and socio-economic impacts will provide a comprehensive view of the region's diverse energy transition trajectories.

Policy Recommendations for Sustainable Transition:
Ultimately, the research seeks to formulate informed policy recommendations for a sustainable energy transition in Middle Eastern countries. This involves synthesizing the findings into actionable strategies that can guide policymakers, industry stakeholders, and communities toward a more sustainable and resilient energy future.

In conclusion, the research objectives and scope for this thesis on the energy transition in Middle East Countries are designed to offer a holistic understanding of the impacts of transitioning to renewable energy sources. By addressing economic, social, environmental, and geopolitical dimensions, the research contributes valuable insights to the ongoing discourse on sustainable development in the Middle East.

Chapter 2 Energy Landscape in the Middle East

2.1 Middle East countries' energy policies and their role in the transition

The Gulf region is home to some of the largest global reserves and the economies most over dependent on hydrocarbon rents (in the form of export revenue in exporting economies and foreign remittances in importing economies from nationals working in exporting states).Thus, reduced global demand for hydrocarbons has long represented an existential threat to the region, especially for wealthy hydrocarbon-exporting Gulf Cooperation Council (GCC) states like Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the UAE.

Before the COVID pandemic most of GCC countries where opposed in taking measure regarding the climate change a stance that was very logical as they are hugely dependent on Oil and Gas revenues. However after the COP21 two key players in the region changed their attitude in the matter. United Arab Emirates set a highly ambitious goal of achieving a net zero economy by 2050 and also Saudi Arabia set the exact same goal but by 2060. After these moves by the two countries almost all GCC countries set similar goals. But the most impressive thing that we should into consideration is that especially UAE and Saudi Arabia have are leading the energy transition efforts with huge investments in renewable projects like solar parks or bio manufacturing and many others.

Although the global energy transition has emerged as a solution to the problem of climate change, the motives of the GCC states are primarily economic. In particular, these transitions secure hydrocarbon exports while generating new export revenues, which are necessary to maintain political balance and the role of the state, as well as to finance socio-economic development. As a result, domestic energy transition projects (such as renewable energy and energy efficiency) are being postponed, while export-promoting projects (such as hydrogen and carbon capture technology) are being accelerated. These developments are transforming GCC economies from specifically hydrocarbon exporters to general energy exporters, while hydrocarbons remain at the center of their economies without changing existing economic rigidities. This transformation perpetuates the current economic policy regimes and associated challenges — an unsustainable situation that jeopardizes the viability of the energy transition. An integrative reform of energy, economic, industrial and regulatory policies is therefore necessary.

United Arab Emirates

More specifically the United Arab Emirates which have taken the leading role in the energy transition in the Middle East have set some ambitious goals. In order to achieve them they have a very clear and detailed strategic plan which is based in some key regulations and policies. The UAE Minister of Energy and Infrastructure recently revealed the details of the policy regulating the market of energy in order to achieve the UAE Energy Strategy 2050 and the UAE Water Security Strategy 2036.

The policy has set objectives for the next five years, including:

- Reducing water use by 23%.
- Cutting down operational costs by 20% in federal buildings.
- Contributing to clean energy by 5%.
- Promoting the sustainability of buildings by an approximate 5-10%.
- Raising awareness of energy and water conservation and the importance of behavioral change.

The UAE Energy Strategy 2050 will place the UAE at the core of the global energy transition and support the target of achieving a grid emigration factor of 0.27 kg CO2/ kWh by 2030, which is lower than the global average. It enhances international partnerships to support sustainability projects in the energy sector. The published strategy outlines a public program to balance meeting the rising energy demand and sustaining natural environment for generations to come. In the first phase, which will run till 2030, the strategy aims to support the target of reaching 0% contribution of clean coal in the energy mix. It also aims to reduce carbon emissions from electricity generation by 100 % and increase individual and institutional energy consumption effectiveness by 42- 45%.

By 2030, the strategy will contribute to creating 50,000 new green jobs, achieving fiscal saving of AED 100 billion, and marshaling investments between AED 150- 200 billion to insure energy demand is met and to sustain profitable growth is feasible. Also, it'll contribute to tripling the share of renewable energy, adding the installed clean energy capacity from 14.2 GW to19.8 GW, and surging the share of installed clean energy in the total energy blend to by 2030 to insure the country is on track to achieve its climate change mitigation targets. (UAE Minister of Energy and Infrastructure 2020)

Saudi Arabia

The Kingdom of Saudi Arabia has plentiful natural resources, notably hydrocarbons still, the main goal in its Vision 2030 is to diversify the economy by utilizing all resources and using the full potential of clean technologies. The Saudi Vision 2030 is the plan for the country’s long- tenure economic and environmental success. In extension to the

thing of profitable diversification, Saudi Arabia's plan achieves environmental sustainability and climate revise. Energy- related institutions cooperate through a dynamic ecosystem, and new programs controlled by the Ministry of Energy leading the efforts of creating a circular carbon economy, hydrocarbon sustainability, and hydrogen market growth. The Kingdom has been heavily investing in R&D and leading the evolution of technologies that support circular carbon economy in which carbon footprint is downgraded, reclaimed, reused, and removed, avoiding the release of carbon dioxide and other greenhouse gasses in the atmosphere while generating profitable value and supporting sustainable evolution.

Toward this targets, the Kingdom has taken measures to replace domestic hydrocarbon liquid consumption. It aims to meet 100 % of domestic electricity generation to be produced by natural gas and renewable energy resources by 2030. The petrochemical industry which is the foundation of Saudi Arabia Economy will contribute to the sustainable use of hydrocarbons by transforming excess production capacity into high value and zero-emission hydrocarbon-based products, Saudi Arabia also aims to be the world's leading hydrogen provider. It's calculating million metric tons of pure hydrogen annually by 2035. While blue hydrogen is currently the focus of the Kingdom's current efforts, it also wants to obtain a significant market share in green hydrogen and lead new energy markets.

2.2 Overview of current energy production and consumption patterns

The GCC countries have similar energy and economic structures characterized by an over-reliance on hydrocarbons for energy use and export. Hydrocarbons account for over 95 percent of energy consumption in the region. In 2021, the contribution of hydrocarbon export revenues to GDP in each GCC state ranged from 40 percent to more than half, while hydrocarbon exports accounted for between 55 percent (in the UAE) and 92 percent (in Kuwait) of exports. Importantly, hydrocarbon exports are also the most important contributor to government revenues. In 2021, they accounted for 60 percent of government revenues in Saudi Arabia, 63 percent in Bahrain, 74 percent in Oman and between 80 and 84 percent in the UAE, Qatar and Kuwait. (IEA 2021)

Despite emerging efforts to gradually phase out fossil fuel dependence, external factors such as Russia's invasion of Ukraine have prevented any significant progress. With Russia being the second largest supplier of natural gas in the world after North America, the sanctions imposed on Russia have forced the rest of the world to look for other sources instead, which will lead to an increase in natural gas production in Middle Eastern countries in the coming decade. Meanwhile, oil-fired power generation

capacity is expected to decline by almost 30% by 2030. This discrepancy is due to the increasing demand for lower-carbon fuels, with natural gas being favored over oil and coal.

Consumption patterns

There are four key factors that control the consumption patterns not in the Middle East globally. The first one is the population change. The Middle East has seen a huge population boom over the past half century. According to United Nation the region has an increase of over 60% in the total population between 1990 and 2010. According to the same data the average population growth is at 1.56% per year in contrast to the global average of 1.1%. The above change has led to significant increase in the energy demand. The second factor is energy intensity. An economy's energy inefficiency is measured by its energy intensity. Units of energy per unit of GDP (Gross Domestic Product). High energy intensities are a sign of high GDP conversion costs or prices for energy. In contrast, low energy intensity is a sign of a lower cost or price at which GDP is produced from energy. Middle East energy intensity is predicted to rise by 1.5% a year between 2010 and 2030. In this region, there are variations in energy intensity among different regions. It is anticipated that Saudi Arabia, Iran, and Iraq would all raise their energy intensity, while the UAE continues to expand steadily. It indicates that a considerable increase in population takes into account the rise in energy demand. The energy intensity of the Middle East region is expected to rise until 2030, although due to a lack of efficiency improvements, it will only reach over 1.1 times that of 2010. (Oxford Business Group. (2016). The report: Dubai 2016)

The third is the energy price. As for every commodity the price has probably the most significant role regarding the demand. A high price may lead to reduced demand from countries due to economic difficulties. On the other hand a low price may cause a phenomenon where the demand is high but the supply cannot follow this pattern. For example if the price of oil is too low many producing countries have to choose between producing oil with significant less profit or cutting the production. This is a story that we have seen many times in the past with an economic “war” between producing countries and consuming countries.

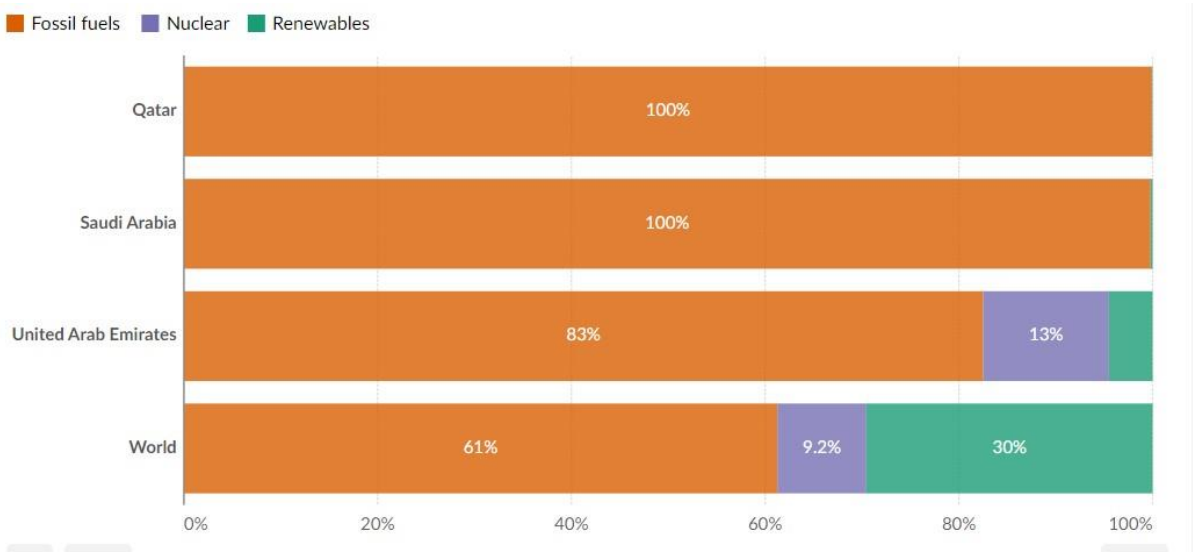
The fourth factor that has a significant role in oil and gas demand is the economic growth of consuming countries. In the Middle East the projection from the International Monetary Fund (IMF) shows global gross domestic product growth by around 2 % in 2023. The GDP of the region is projected to grow significantly over the next year. The projection from the IMF show a growth of 3.4 % for 2024. These numbers indicate that the local economies even with some setbacks they are increasing their wealth

which means that people have increased income, they consume more and of course they need more energy.

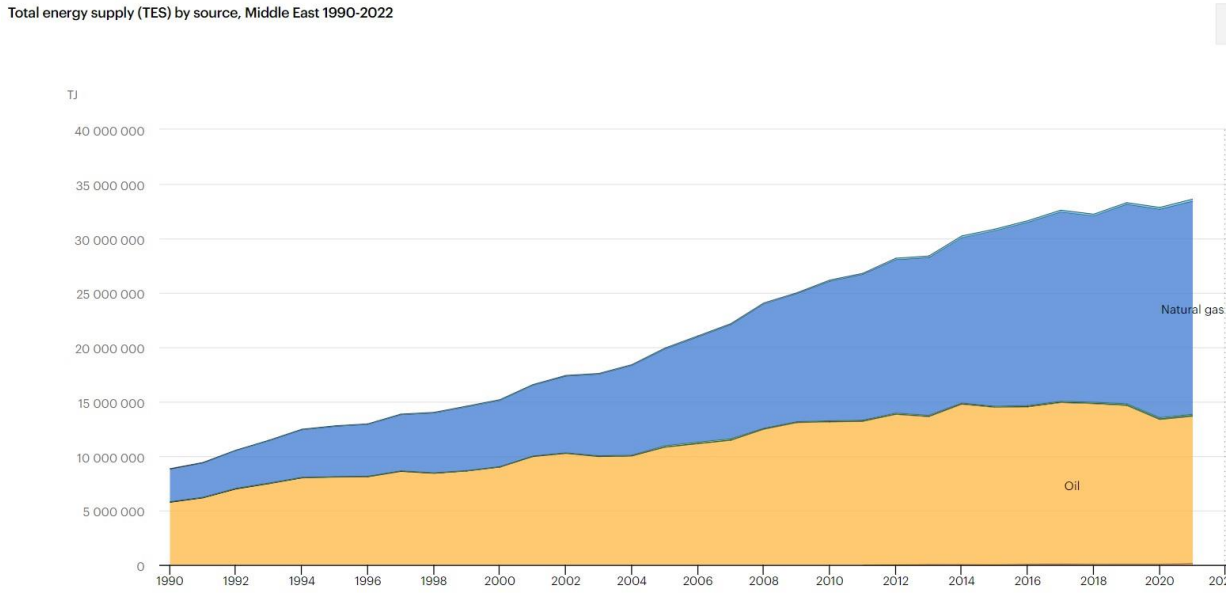
According to recent finding the energy demand in the Middle East region has an average growth of 2% each year. Gas continues to be the most common fuel used in the region to produce electricity, making up 72% of total generation in 2022 and projected to rise to 77% by 2025 as gas absorbs market share from coal- and oil-fired generation. By 2025, renewable energy is predicted to account for more than 5% of all generation, having increased by 50% from 2022. By the conclusion of the projected period, nuclear generation will have doubled from 2022 to 2025 and reached 50 terawatt-hours, or 3.5% of total generation.

Energy production in the Middle East

Whether countries are net importers or exporters of gas and oil, the Middle East is a region that has almost total dependence on oil and gas. It is amazing how dominant these two hydrocarbons are in the primary energy and electrical mix of the region. Their participation is almost 100% in nations like Saudi Arabia and Kuwait. In terms of the primary energy mix, the Middle East is the region with the least diversity worldwide. The below graph shows exactly how dependent is the region on fossil fuels and especially the three key countries of Saudi Arabia, Qatar and UAE.



(https://ourworldindata.org/electricity-mix 2023 Energy Mix)



(IEA 2022 Total Energy Supply in the Middle East)

2.3 Analysis of fossil fuel reserves and production trends

According to the US Energy Information Administration five of the top ten countries globally in terms of oil production are based in the Middle East. The Middle East countries are responsible for almost the 30% of global oil production. The most important oil production countries in the Middle East are Saudi Arabia, Iraq, Iran and the United Arab Emirates.

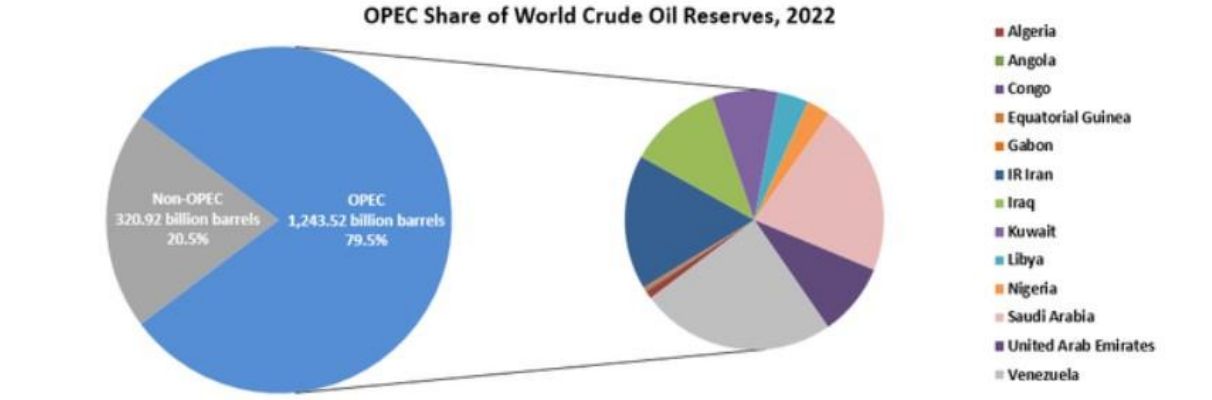
According the global stats Saudi Arabia produces almost 12 million barrels of oil per day that is equal to almost 12% of world output. The country ranked as the largest oil producer in the decade from 2003 to 2012, after which it fell to second place due to the increased oil production of the USA due to the vast growth of sail oil exploitation. Saudi Arabia remains the world's largest petroleum exporter. With proven oil reserves of about 337 billion barrels and relatively low production costs, the country is expected to stay as a global production power for the coming decades.

Iraq has a daily production of around 5 million barrels of oil. After the Iraq war the production has increased but due to the internal issues of the country it very difficult to predict the future of oil industry. Iraq has is a very unstable with most of oil production equipment to be outdated. This demand huge investments in the sector but the country is unable to fund this investments at the moment.

Iran is the ninth-largest oil-producing nation in the world, at nearly 3.2 million barrels per day, but the effects of economic sanctions placed on Iran have kept production levels below true potential. According to the U.S. Energy Information Administration (EIA), sanctions have had especially severe effects on upstream oil and gas investment, including numerous canceled investment projects.

UAE produces just over 4 million barrels per day to rank as the world's seventh-biggest producer. The state-owned Abu Dhabi National Oil Company (ADNOC) controls oil production operations in Abu Dhabi under the direction of the emirate's Supreme Petroleum Council. Most oil production in Abu Dhabi is organized under production-sharing agreements between ADNOC and international oil companies. Other emirates use similar production-sharing agreements and service contracts to organize oil production. Some of the biggest international companies involved in UAE oil production include BP, Royal Dutch Shell, Total S.A., and ExxonMobil.

On the other hand the region has also a significant role in the gas production as they are responsible for around 10% of the global gas production but most importantly they control 37% of the global gas reserves. The most important player in this market is Qatar followed by Iran.



OPEC proven crude oil reserves, at end 2022 (billion barrels, OPEC share)

Venezuela	303.22	24.4%	United Arab Emirates	113.00	9.1%	Algeria	12.20	1.0%	Equatorial Guinea	1.10	0.1%
Saudi Arabia	267.19	21.5%	Kuwait	101.50	8.2%	Angola	2.55	0.2%			
IR Iran	208.60	16.8%	Libya	48.36	3.9%	Gabon	2.00	0.2%			
Iraq	145.02	11.7%	Nigeria	36.97	3.0%	Congo	1.81	0.1%			

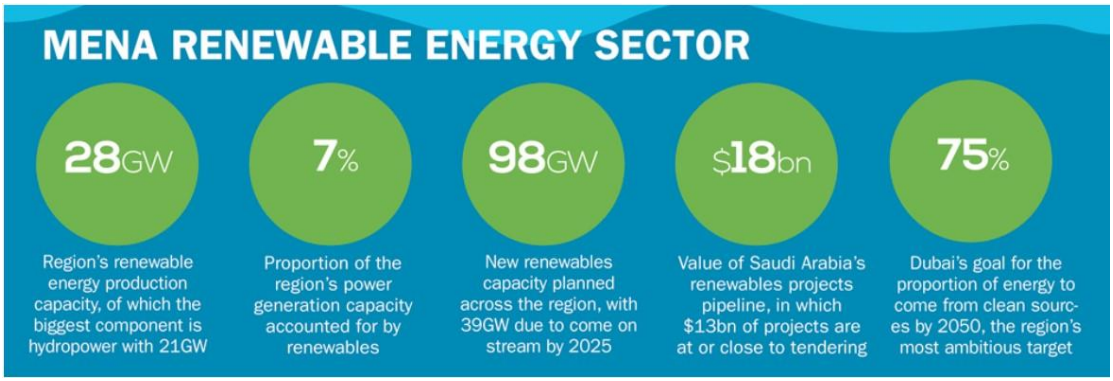
(OPEC Countries Share of Global Oil Reserves, OPEC Annual Statistical Bulletin 2023)

2.4 Renewable energy potential and initiatives in the region

The majority of energy produced in the Middle East nowadays comes from steam-based power plants that run on natural gas or oil; some of these facilities can produce both heat and electricity. The Middle East currently uses relatively little in the way of renewable energy, but because of both economic and environmental benefits, more and more of the region's nations are looking into alternatives to importing natural gas and oil to generate electricity. Over the next twenty years, Saudi Arabia is expected to have a potential of about 28 GW for photovoltaics and concentrated solar power (Boretti and Castelletto 2021; Boretti, 2021). By 2035, the Energy Information Agency projects that 15–25 GW will come from each of the three main renewable energy sources in the Middle East: solar, wind, and photovoltaics. The governments of the United Arab Emirates (UAE) and the Kingdom of Saudi Arabia (KSA) are embracing more sustainable forms of energy, such as solar energy. All GCC countries except Qatar are committed to reducing emissions as part of their Nationally Determined Contributions (NDCs). The energy sector accounts for 83% of total emissions, 37% comes from electricity and heat generation. Each GCC country is defining its own decarbonization path, including integrating renewable energy, improving energy efficiency, carbon capture and storage (CCUS), and developing a hydrogen-based economy.

The initial focus will be on increasing renewable energy for domestic use, which will allow more fossil fuels to be exported. As a next step, these countries want to integrate

green energy into their export portfolios. Such multilevel strategies aim to maintain the existing political and economic landscape, which is primarily supported by external rents. Recent geopolitical events, such as Russia's invasion of Ukraine, are adding nuance to the narrative surrounding the Gulf Cooperation Council's green transition. Such events highlight the importance of fossil fuels in the current global energy matrix. GCC countries emphasize the importance of innovative solutions and rely heavily on CCUS (carbon capture, utilization and storage) technologies. Although the region has some of the most important carbon capture facilities, it accounts for only 10% of the world's carbon capture capacity, leaving significant room for growth.

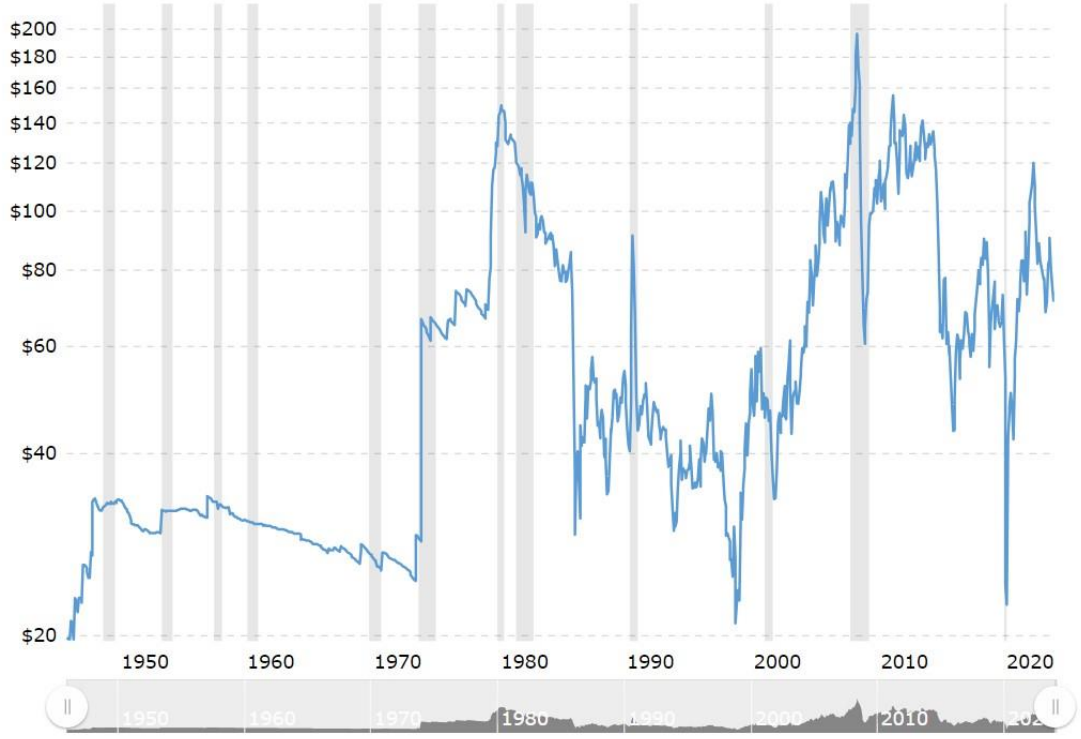


MENA Region Renewable Energy Goals (MEED 2021)

Chapter 3: Economic Challenges, Environmental and Social Impacts of Energy Transition in the Middle East

3.1 Impact of fluctuating oil prices on the region's economies

For many years, especially in Gulf Cooperation Council (GCC) nations of the Middle East, the money systems are deeply tied to oil. The area's richness, mostly from its huge oil supplies, has allowed quick growth and progress in business matters. But relying so much on oil also makes these money systems weak to changes in worldwide oil prices. This is something that has often shown it can strongly affect these countries.



Fluctuation of oil prices between 1945 and 2023 (macrotrends 2023)

Historical Dependency on Oil Revenues

Since about the middle of last century, countries in the Middle East - like Saudi Arabia, Kuwait and United Arab Emirates (UAE) have shaped their money-making system around oil making and selling. For example, Saudi Arabia, the biggest oil seller in the world, gets a big part of its overall economy and spending plan from money made by selling oil (Amran et al., 2020). This reliance makes a clear tie between the well-being of these countries and the worldwide oil trade. When oil costs a lot, these countries get big money which makes it easier for them to invest in buildings, help programs and things around the world. On the other hand, if oil prices are low, it can make a country

have less money. This might cause them to cut down on spending and their economy could shrink (Yergin, 2020).

Impact of Oil Price Volatility

The changing and unpredictable cost of oil has always brought a lack of balance to the finances in Middle East nations. The sudden fall in oil costs in 2014, because there was too much oil all around the world and a big spread of this kind of drilling called shale oil boom happened mainly America. This made problems for money plans serious cuts to balance budgets happen quite few rich countries like (Darwish et al., 2018). Also, in 2020 the COVID-19 problem made a record drop for how much oil people wanted. This pushed prices down fast. These changes make Middle Eastern money systems quickly change to match shifting world market states. Many times, they need less spending and financial fixes, so their budgets are even (Dechamps, 2023 from the year on).

Economic Diversification Strategies

In answer to this weakness, a lot of countries in the Middle East have started plans to spread their money around. Saudi Arabia's Vision 2030 is one of the biggest ideas, wanting to cut down how much it relies on oil by growing other industries like travel-based businesses and fun activities along with tech (Amran et al., 2020). The UAE, mostly Dubai and Abu Dhabi, has also taken big steps to make its economy less focused on one thing. They're putting money into things like real estate (buying or building property), tourism (people visiting for fun) and renewable energy (clean power that can't run out), Alnaqbi & Alami said this in 2023. This work shows that more Middle Eastern leaders are seeing they can't rely on just one thing in the future.

Social and Political Challenges

The reliance on money from oil has also caused social and political effects. In the past, countries in the GCC have often used their money from oil to give a lot of public services, help pay for things and offer jobs with the government to people living there. But changing oil costs and the resulting money problems have made these rulers think again about these advantages. Cuts in help money and starting to take taxes, like what happened in Saudi Arabia and the UAE, have been needed but not liked. From time to time this leads people feeling unhappy (Darwish et al., 2018). These governments find it difficult to balance the need for money with people's happiness.

Thoughts about nature and world trade changes

The world's move to use more green energy and worries about changes in weather are making the oil trade even harder to understand. More money is being put into clean energy in the Middle East partly because of these world changes. Places like the UAE and Saudi Arabia are putting money into clean energy projects not only to protect themselves from changing oil costs, but also to place their names in the growing world market for green power (Salimi et al., 2022). This change, though needed, is full of difficulties because it needs a lot of money and turning around business systems that have been focused on oil for many years.

Future view and big changes in plan

In the future, Middle Eastern countries have to deal with the key problem of adjusting to a world that might need less oil. This situation is pushed by better tech in green energy, electric cars and the whole world working hard to fight changes in weather patterns. The 2023 World Energy Outlook from the International Energy Agency shows that oil use might go down in future years. This stresses why these countries need to spread out their businesses and make new ways of getting money (International Energy Agency, 2023).

In the end, changes in oil prices really affect Middle Eastern money systems. This shows that they need to spread out and change with different things too. Even though these nations have done better in the last years, they still have a long way to go. How well Middle East countries handle the ups and downs of world oil trade, along with changes to a more lasting broad money-making plan will decide their future in terms of steadiness (Griffiths, 2017).

3.2 Diversification of economies and its relation to the energy transition

The change to different types of businesses in the Middle East, especially those that depend a lot on oil and gas, is an important plan connected tightly with wider energy movement strategies. This change is important to make sure the economy can last for a long time and be strong even when world oil markets go up and down. It's also needed because we need to take care of our environment more than ever before.

The Imperative for Economic Diversification

Countries in the Middle East, especially those within the Gulf Cooperation Council (GCC), have usually depended on oil and gas as their main ways to make money. This trust has made these systems open to the ups and downs of worldwide oil value changes, as seen during two big drops in oil prices - once in 2014 and again in 2020 (Yergin, 2020). The final money risks have shown the need to make our economy more varied - a plan to grow other parts of business so we don't rely too much on income from oil and gas.

Regional Diversification Efforts

Saudi Arabia’s plan for 2030, led by Prince Mohammed bin Salman, is a top example of these efforts to make things different. This big plan wants to make Saudi Arabia not rely on oil as much, grow its other businesses also and build up public services like health care, learning areas, roads and buildings fun spots for everyone's enjoyment along with travel (Amran et al., 2020). In the same way, through its Vision 2021 plan and later strategies, the UAE has taken big steps to spread out its economy. It's done this by putting money into areas like buildings and land selling business or hotelling services for travellers , tourism activities as well renewable power resources (source from Alnaqbi & Alami in year 2023).

Using different energy sources to increase options.

The move from making and using energy with things like coal and oil to using power that comes naturally, we call it 'energy transition'. It is now more looked at as an important part of plans to make money in different ways. As an example, the UAE has put a lot of money into solar power because it knows this could lead to new businesses, jobs, and chances for selling goods abroad (Salimi et al., 2022). This not only cuts down our need for oil but also matches with worldwide aims to keep the environment clean.

Challenges and Opportunities in Transition

Moving to an economy that uses many different types of renewable energy brings both problems and chances. In terms of money, it needs a big spending on new tools and structure. In a social and political sense, it means shifting jobs and popular views from usual oil-focused ways of making money. But this change also creates new paths for

making money, coming up with fresh ideas and building a future that can be kept going (Griffiths, 2017).

Regional Cooperation and Integration

Working together in a region is very important for doing well when it comes to making our money sources and energy change. The countries of the GCC can use their common money and culture bonds to make group plans that help them better spread out efforts. Working together to study, make better and use more green energy tools can show a way for combined local growth (El-Katiri & Husain, 2014).

International Partnerships and Investment

Working together with other countries is also very important in pushing for a change and shift to cleaner energy sources. For these plans to work well, we need money from other countries, help with technology partnerships and the chance to sell our products around the world. The fact that big energy firms and investors from around the world are part of Middle Eastern green power plans shows this method is good (Sgouridis et al., 2016).

Sustainability and Environmental Considerations

Keeping our world clean and safe is important for the change to cleaner energy sources in making more ways to make money. The Middle East, especially the GCC nations, have some of the most carbon emissions per person in the world. Moving to clean energy not only spreads the job types but also helps in dealing with the serious need for work on weather change right now (Darwish et al., 2018).

The Future Outlook

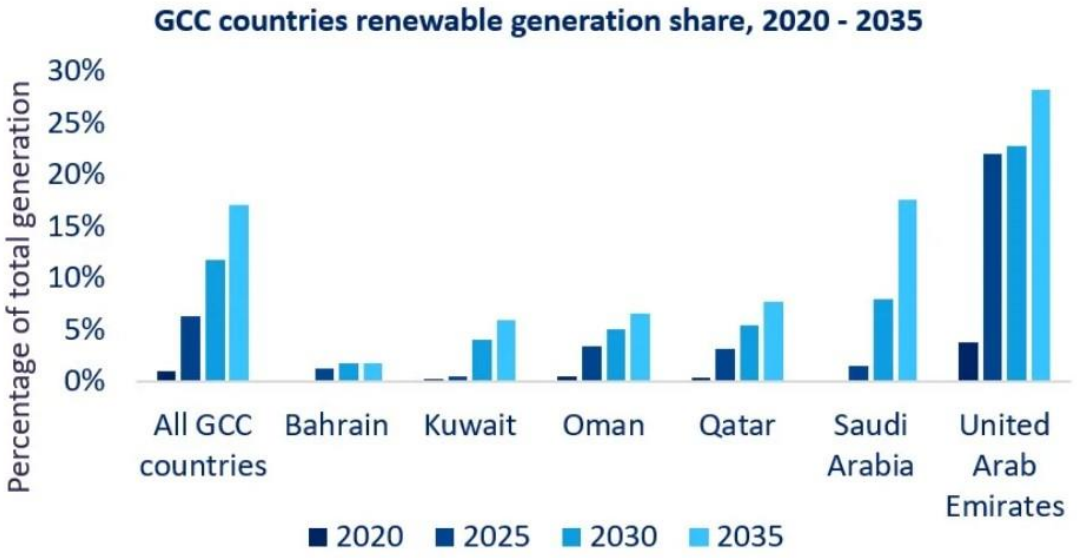
These moves to change and use more varied forms of energy are very likely going to greatly shape the future money situation in the Middle East. The World Energy Outlook 2023 by the International Energy Agency says that people all over the world are moving more towards using natural energy instead of old-style fuels. This highlights how important these plans also known as strategies can be for Middle Eastern countries (International Energy Agency, 2023).

In the end, Middle Eastern economies need to spread out their focus in various ways. This is especially true for those that heavily depend on oil and gas resources. Making these changes ties closely with how this area of the world switches over its energy

sources. Although there are problems, it's very important for the future growth and steadiness of this area to switch over to a more mixed up economy that lasts. These efforts will work if we can put in place plans to mix things up, work together with other places around us, team up with different countries and have a real promise of taking care for the future (Griffiths, 2017).

3.3 Opportunities for renewable energy investments and economic growth

The Middle East, an area known for oil and gas in its past, is now seeing possible benefits from putting money into renewable energy to boost their economy. This change is not just because the world is moving to clean energy, it's also due to this area having special location and weather benefits. These things make it a perfect place for different types of power that can be renewed again.



Renewable generation share targets for Middle East (Global Data 2023)

The Middle East has a lot of potential for using renewable energy.

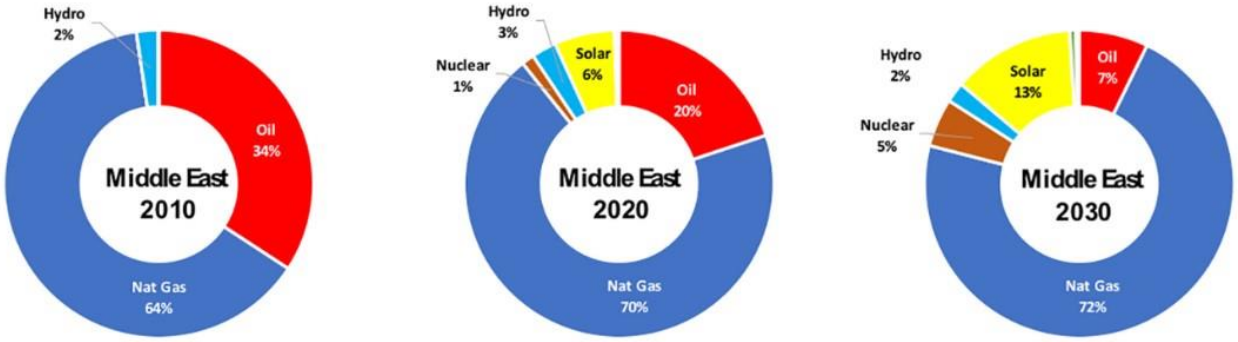
The Middle East has a lot of the world's sun power. Places like the United Arab Emirates (UAE) and Saudi Arabia get a lot of strong sun all year round. This gives them a big chance to make use of solar energy, as shown in research from 2022 by Salimi et al. Also, areas like the Saudi Arabian Red Sea shoreline and some parts of Oman and Jordan have a lot of energy from wind (Sgouridis et al., 2016). Using these resources offers a big chance for putting money into renewable energy.

Economic Growth through Renewable Energy

Putting your money into clean energy can help the economy grow in many ways. At first, making new energy structures like groups of sun panels and areas with lots of wind machines leads to working chances in building these things, running them once they're done, as well as keeping everything up to date. For example, the UAE's big plans for solar power have made thousands of new jobs and brought in money from around the world (Alnaqbi & Alami, 2023). Also, green energy plans can boost the growth in linked areas such as making things, services and studying for more.

Diversification of Energy Sources

It is very important for the Middle East to use many kinds of energy so it can stop needing old, buried plant material and build a stronger power system. By putting money into renewable power, countries can make their energy mix more varied. This makes them safer when it comes to having enough energy and they won't be so affected by changes in global oil prices (Griffiths, 2017). This change is very key for countries that sell oil in the area. It lets them send more of their oil and gas outside instead of using it at home.



Diversification of energy sources between 2010 and 2030 (eia.gov)

Technological Innovation and Development

Putting money into clean energy also pushes forward new technology. The Middle East can become a top world place for clean energy tech, mostly in the sun's power. For instance, Saudi Arabia's plan for the future, Vision 2030 aims to grow renewable energy sources and skills in their own country (Amran et al.,2020). These efforts can put the area at the top of world clean energy technology growth, drawing in more money and increasing business development.

Environmental Benefits and Global Commitments

The move to clean energy also matches with worldwide promises to lessen the release of harmful gases. Countries in the Middle East have often had high amounts of carbon emissions per person. They can help a lot with worldwide attempts to reduce climate change by putting money into things like wind or solar power (Darwish et al., 2018). This change not just helps the earth, but also makes the area look better around the world and follow worldwide environment rules.

Financing and Investment Opportunities

There are huge chances for investors, both in and outside the Middle East, when it comes to putting money into projects that create renewable energy. More and more, governments in the area as well as private businesses are putting money into renewable energy. Work with big energy and money groups from all over the world is very important. This brings in cash and skill to the area (Sgouridis et al., 2016).

Challenges and Strategic Approaches

Although there are many chances, it is not easy to see all the good that can come from putting money into clean energy. These are challenges from rules, the need for power grid updates, and growing a trained group of workers. Key methods, like helpful rules set by the government, rewards for private company spending and learning plans to grow local know-how are needed to beat these problems. (Griffiths, 2017).

The Role of Regional Cooperation

Working together in a region is very important to get the most advantage from investing in clean energy. Countries like those in GCC can use their combined money and political power to make a helpful space for the growth of clean energy. Working together on tasks like making green power that can be used in different countries and joint studying programs can make things work better and get bigger (El-Katiri & Husain, 2014).

Future Outlook

The Middle East has a bright future when it comes to using renewable energy. As the world pays more attention to keeping things going and this area has great weather for making clean energy, there's a lot of opportunity for growth in these types of businesses. The 2023 World Energy Outlook from the International Energy Agency

focuses on how renewables are becoming more key in our world's energy plans. It stresses that this area is very important for Middle East countries (International Energy Agency, 2023).

In the end, there are many chances to put money into sustainable energy in the Middle East. These can lead to large growth and change our economy greatly. Even though there are problems, smart spending, new tech advances, help from nearby areas and helpful rules can let the Middle East use its clean energy chances. This way it could become a top voice in the world's move to safe power (Griffiths, 2017).

3.4 Social implications, including job creation and workforce transition

The move to clean energy in the Middle East brings about important changes for people, mainly when it comes to making new jobs and helping workers switch their careers. This change brings chances and problems for the area, which in history has mostly relied on oil and gas work.

Creating work in the clean energy industry

The sector of clean and reusable energy is a strong source for new work chances. When countries in the Middle East spend on projects for solar, wind and other clean energy types, they create a need for many jobs. This can include things like engineers, workers who fix these systems when broken or needed to be upgraded by installing more panels which generate electricity from sunlight as well others such as sellers of this new service with customer support staff managing orders etc. (Salimi et al., 2022). For example, the UAE's big sun plans like Mohammed bin Rashid Al Maktoum Solar Park have not only made more of their clean power but also given thousands of people jobs. (Alnaqbi & Alami, 2023). Saudi Arabia's Vision 2030 also has big plans for renewable energy projects, which are thought to create a lot of jobs (Amran et al., 2020).

Workforce Transition and Retraining

The change to clean energy needs a move in the abilities needed by people working with power. People who used to work in oil and gas jobs may need new training so they can find work in the clean energy field. This change brings a big problem but also gives chances to help workers grow and make their skills better. Programs to teach and improve worker skills are very important. They help make sure that people in jobs now can take advantage of new chances made by the fast growth of clean energy sources like wind or solar power (Griffiths, 2017).

Socio-economic Benefits

The growth of the clean energy industry can bring big benefits to society and economy. By making work and increasing money flow, spending on renewable energy can help make living better and cut down how many folks are poor. Also, making the economy more varied by working on renewable energy can give better steadiness and strength against changes in oil business. This way it offers a more lasting growth for our money matters as well as society's good (Darwish et al., 2018).

Women and being fair in the clean energy area

The reuse power field can also be a chance to push for more men and women working together. In the old days, more men worked in oil and gas than women. But now with renewable energy jobs coming up, we can use this chance to make sure job opportunities are balanced for both genders. Encouraging women to take part in science, technology, engineering, and math’s fields plus making sure they have the same chances as men in green energy jobs could help our economy grow better for everyone (Sgouridis et al., 2016).

Educational and Training Programs

To help workers change jobs, we need teaching and learning plans. Schools and technical centers in the Middle East are starting to give classes and titles that focus on energy which can be used again. These programs are very important for giving the young workers of today the right skills they need in green energy jobs. Also, job skill learning programs can aid workers now working in oil and gas to shift their jobs into clean energy sources (Griffiths, 2017).

Community Engagement and Public Awareness

Getting the community involved and making people aware of why using green energy is good are key to make sure everyone backs up the change in our way of getting power. This means teaching people about the good things for nature and money that come from using energy we get again and again, as well dealing with worries over old-school job cuts in power areas. Good talking and taking part in society can help people see the change to renewable energy as a good thing (El-Katiri & Husain, 2014).

Policy Framework and Government Support

Rules set by the government are very important in helping us move towards using more renewable energy for our society. This means rules that push for putting money into green projects, help with training and teaching again programs of workers, as well as boost the making of new jobs in areas using renewable energy. Also, government plans can make sure that the change to clean energy includes everyone and helps a large part of our community (Worldwide Power Group, 2023).

Challenges in Transition

Even with chances, it's hard to move towards an economy based on clean power because there may be job losses in old energy areas. It's important to handle this change so that we cut down on bad effects for people, like losing jobs and money problems. A good switch, backed by right rules and plans can ease these problems and make sure a easy move to an economy based on green power (Darwish et al., 2018).

Long-Term Social Implications

In the future, changing to clean energy is believed to deeply affect our society. Apart from making more jobs and adding to the economy, this change can bring about a way of living that is better for our environment. This could be good for everyone's health, happiness as part of community life, how we feel about things in general (Yergin 2020). In the end, changing to clean energy in the Middle East has a lot of effects on people's lives. Even though the change gives a lot of chances to make new jobs and grow the economy, it also needs careful handling of moving workers around and teaching them again. Good rules, teaching plans, people taking part and a push for everyone to get involved are important to make sure that switching to clean energy helps all in society. This should also help us have long-lasting and fair growth across the area (based on Griffiths' work in 2017).

3.5 Carbon emissions and climate change concerns in the region

Even though the Middle East is known for making a lot of oil in history, it now has big problems linked to dirty air and changes in weather. Worry about how much the area's pollution adds to world weather changes is getting bigger, with moving from old ways of making energy becoming key in dealing with these problems.

The amount of carbon being let out into the air in the Middle East

The Middle East has some of the most carbon emissions per person in the world, mainly because it uses a lot of fossil fuels to make energy, carry out works at factories and run places that turn salt water into fresh. Places such as Saudi Arabia, the UAE and Qatar have always made a lot of greenhouse gases because their industries use much energy and they depend on selling oil and gas (Amran et al., 2020). This trend is not just a worry in one area but also seriously adds to the world's greenhouse gas pollution, making the problems of weather changes even worse.

How weather change is affecting the area

The Middle East is at great risk from the effects of climate change, which could directly harm it. As temperatures go up, water gets scarce and wild weather events happen more often. These things are meant to really change the place's nature, money matters and how people live together. For example, higher heat and less rain can really hurt farming, causing problems with having enough food. Moreover, the areas near the sea in this place might deal with higher water levels and saltiness. This can put important city spots and living environments for plants and animals at danger (Darwish et al., 2018).

Shifting to new forms of energy as a way to reduce negative impacts

Realizing the quick need to tackle climate change, many countries in the Middle East are looking at changing their energy as a main way to lessen its effects. The change from non-renewable fuels to green energy like sun and wind power is very important in lowering harmful air waste. For instance, the UAE has put a lot of money into solar power. This not only makes its energy choices different but also helps to lessen how much carbon it puts out (Alnaqbi & Alami, 2023). In the same way, Saudi Arabia's plans for 2030 include aims to grow clean energy sources. This is important as it will help cut down on how much harmful air stuff comes from this country (Amran et al., 2020).

Challenges in Reducing Carbon Emissions

Cutting down on the release of harmful gases in the Middle East is hard because this area makes a lot of money by selling oil and gas. Many countries in the Middle East make a lot of money from selling fossil fuels and changing these needs big changes to their economy. They also need to put lots of cash into other industries (Griffiths, 2017). Moreover, most of the energy set-up in this area is mostly centered on natural fuel that

comes from fossils. Changing to new ways of generating power needs a lot of money and advanced technology put into it.

Role of International Cooperation

Working together across countries is important to help the Middle East in its work to cut down on harmful emissions and switch over to clean, reusable energy sources. Partnerships all around the world can give needed tech, money, and rule help to make this change easier. For instance, when groups from around the world get involved in projects that focus on using new types of energy here can bring knowledge and money. This help builds a system for lasting power sources (Sgouridis et al., 2016).

The shift towards clean and renewable energy sources can bring a lot of good things for society and the economy

The changing energy use in the Middle East gives important social and money-related advantages apart from lowering carbon waste. It can make more work chances; help build a lasting strong money system and boost health for all by cutting down on bad air stuff. Also, mixing up the types of energy we use can make our power supply more steady and able to handle changes in world oil costs (El-Katiri & Husain, 2014).

Policy Frameworks and Government Initiatives

Good rules and plans from the government are very important for changing to cleaner ways of using energy and cutting down on harmful smoke in the Middle East. Rules that support making more clean energy, using less power, and cutting down pollution are important. Also, governments can help make people know more about climate change and why using energy in a way that lasts is important (International Energy Agency, 2023).

The job of new ideas and tools

Coming up with new ideas and using advanced tools are key to dealing with changes in weather risks in the Middle East. Improvements in green power methods, energy saving plans and ways to catch and store harmful gases can greatly help cut down the area's effect on our climate. It's very important for the area to put money into studying and growing in these places so that it can use top ideas to lessen problems from weather changes (Yergin, 2020).

Future Outlook

Looking forward, how the Middle East works on cutting its dirt in air and fixing climate problems will be important to see what happens with nature, money matters and people's lives there. Getting projects for clean energy to work, along with good rules and help from other countries will be very important in reaching our aim for long-lasting success (Darwish et al., 2018).

Final, dealing with air pollution and weather changes in the Middle East is a hard job that needs work together across money-focused, skill-related, and rule areas. Changing to clean energy is very important in this work. It gives a way to cut down on the amount of carbon we put into the air while also helping our economy and people's lives. The Middle East needs to keep working hard, come up with new ideas and join hands around the world so it can make its way through this change in a good manner. This will also help them do their part for cutting down climate problems that affect everyone on our planet (Griffiths, 2017).

Chapter 4: Roadmap for a Successful Energy Transition in the Middle East - Policy and Regulatory Frameworks

4.1 Review of existing energy policies and regulations

The Middle East, which is famous for its massive oil resources, is moving towards renewable energy. The transition is being driven by countries such as Saudi Arabia, the UAE and Qatar. For instance, driven by stranded oil assets and global decarbonization forces, Saudi Arabia is moving toward renewables especially in electricity generation. Through Energy Plan 2050, the UAE is focused on clean coal, as well as nuclear and renewables in forms of solar or wind energy (Cms.law 2019; Sim 2022).

Traditionally, the Middle East has strongly focused its energy policies upon oil and gas because of this vast wealth in terms of natural resources. But in the last few years, there has been a paradigm shift. Such a change is mainly influenced by diverse factors such as environmental concerns, needs for economic diversification and global trends towards using sustainable sources of energy. This movement towards the sustainable approach is reflected in Green Building and Sustainable Building Standards of UAE initiated since 2010 (Cms.law 2019).

Compared internationally, Middle Eastern countries can be considered as new comers in the renewable energy domain. But they are moving quickly. For example, the World Bank ranks Oman first in MENA region and sixth worldwide for its best renewable energy legal framework. This represents a major evolution from the region's reliance on fossil fuels (Clynch Harry 2023).

With Saudi Arabia's recent drive towards renewable energy resources, Vision 2030 seeks to cut its reliance on oil. In a major policy change, the kingdom is investing in big-scale solar and wind projects. This is one of several measures aimed at diversifying the economy and reducing carbon footprint (Sim 2022).

The energy transition strategy of the UAE is diversified beyond mere advancement to renewable sources but rather incorporates sustainable practices in buildings and transport systems. The Dubai Autonomous Transportation Strategy seeks to make 25% of transportation autonomous by the year 2030. Furthermore, programs aimed at promoting the use of electric vehicles suggest sustainability adoption holistically (Cms.law 2019).

Natural gas wealth of Qatar shapes its strategy in renewable energy field. The nation is slower in its transformation, signaling global doubts about the entire future of natural

gas. Yet initiatives such as the alliance formed by Nebras Power with global renewable projects reflect a step towards expanding energy generation beyond gas (Sim 2022).

It is noteworthy that the Middle East presents its own set of challenges due to concerns about governance, regulatory frameworks and the existing high dependence on fossil fuels. Although these challenges, the region has huge opportunities for renewable energy development thanks to factors such as solar power potential abundance, economic diversification objectives and sustainable commitments from around the world (Obeid and Shatila 2022a; Al-Sarihi 2023).

Evolution of the renewable energy infrastructure in the Middle East is very rapid. This includes solar parks, wind farms and even unique initiatives such as those which use the sun to produce clean water. Not only do these advances impact the energy mix but give birth to new industries, provide jobs and technological developments (Jaiswal et al. 2022; Dourian 2023; Nicholson 2023).

Markedly, Middle Eastern countries are rapidly embracing international partnerships and drawing foreign investments in the renewable energy industry. Increased reliance on partnerships with global energy companies, participation in international consortia as well as investments from multinational corporations are contributing to the rapid development of renewable projects across the region. These partnerships frequently contribute to high technologies and skills, making the area even stronger in terms of renewable energy (FitchRatings.com 2023).

Many policy incentives and regulatory reforms are being implemented by governments in the Middle East to promote renewable power generation. These comprise feed-in tariffs, tax incentives, and supportive regulatory regimes for renewable energy projects. These policies seek to increase the attractiveness of renewable energy investments, both for local and international investors (Cms.law 2019; Clynch Harry 2023; Dourian 2023).

Furthermore, another critical aspect of the region’s energy transformation is promoting public awareness and education on renewable energies sustainability. Renewable energy benefit awareness campaigns through educational programs, public information campaigns and community engagement initiatives are being initiated to develop sustainable behaviors among the general populace (Alnaqbi and Alami 2023).

Renewable energy in the Middle East is transforming both security of supply and geopolitics at a regional level. Through the elimination of reliance on fossil fuel consumption, these countries are dealing with environmental issues and creating energy security and reducing risk to global oil market variations (A. Paravantis and Kontoulis 2020).

Investment in research and development is critical for the development of the renewable source industry within Middle East. Governments and private organizations are investing in R&D projects aimed at enhancing the performance of renewable energy technologies by improving efficiency while reducing costs. This innovation focus is vital to keeping competitiveness in the worldwide renewable energy market (Jamil et al. 2016; World Investment Report 2023 2023).

Thus, the Middle East's shift to renewable energy is a multifaceted process involving policy reformations, infrastructural developments, international relations as well as public participation. However, as these countries broaden their energy mixes in due course they are both helping the world to achieve environmental sustainability and also transforming economic landscape and geopolitical architecture of those nations. The region's commitment to a sustainable and secure energy future is underscored by the ongoing efforts in renewable energy development.

4.2. Analysis of government incentives and support for renewables

Incentives Overview

United Arab Emirates (UAE):

The sustainable energy vision of the UAE is driven by several initiatives, such as Dubai Clean Energy Strategy 2050 with a goal to reach up to 75% clean fuel by that date and Abu Dhabi's targeting renewable capacity production at least for seven percent until 2020 (installed capacity). The rollout of renewables at an early stage was hastened by a paucity in domestically-produced natural gas, which resulted to major public–private collaboration for the deployment of utility scale renewable projects (Sim 2022).

Saudi Arabia:

Saudi Arabia continues to shift its energy focus on renewables as part of the Vision 2030. The targets that Solar has introduced for 2023 and 2030 have been revised up phenomenally, with quotas of approximately 20-40 Gigawatts. The kingdom is also targeting 50% electricity generation from renewable sources by the year 2030, and initiatives like National Renewable Energy Program and National Infrastructure Fund support such movement (Kiyasseh 2022).

Qatar:

The way Qatar approaches renewable energy is counterbalanced by its huge deposits of natural gas. Despite Qater being less aggressive in renewables compared to its neighbors, the emirate is diversifying its energy portfolio, solar power interests are pursued with Nebras Power as one of the leading global wind projects (Sim 2022).

Effectiveness of Incentives

UAE's Strategic Partnerships

The UAE has also shown a strategic position in paving the way to renewable energy development, largely via public-private partnerships PPPs. These partnerships have been integral in accelerating the commissioning of major renewable energy projects. The UAE has been able to avoid some of the conventional weaknesses that had traditionally come with government-led initiatives by juxtaposing state-driven policy directives and agility as well as capital from private sector. Such as the Dubai Clean Energy Strategy 2050 and Abu Dhabi's energy targets are absolute proof of how well UAE has utilized PPP in achieving its renewable goals that required high ambitions. This method has not only increased the renewable capacity of the nation but also made it a leader in sustainable city development within this region (AstraZeneca 2022; Kiyasseh 2022; Sim 2022). The success of such partnerships in the UAE can be viewed as a collaborative model that other countries would follow to balance between private participation and governmental control towards achieving renewable energy goals.

Saudi Arabia's Ambitious Targets

The recent developments, which include Saudi Arabia's Vision 2030 and the revised solar energy goals are a clear departure from its oil-based economic status. Thus, the government's commitment to reach out to 20 and 40 Gigawatts for solar energy until the years of 2023-2030 is a clear indication that they will embrace cleaner forms of energies (Kiyasseh 2022). This strategic transformation is supported by significant government subsidy, especially project financing in the solar domain. These efforts form a larger project seeks to end the historical dependency of Saudi Arabia on oil and also aims at making it an engineered and active collaborator in global decarbonization. The solar energy focus, along with government backing of these projects, is poised to make a major contribution in changing the nature of economy for kingdom by lessening carbon footprint. It is easy to note the efficiency of these goals and measures in terms of rapidly increasing capacity for solar, also indicating a great determination on fostering sustainable use of energy.

This action by the UAE and Saudi Arabia demonstrate that there are well-structured governmental incentives for driving growth of renewable energy industries in the Middle East. Through the implementation of sustainable strategies in line with global sustainability trends, and harnessing their diverse resources as well as capabilities these nations are setting an example for renewable energy development within this region.

Comparative Analysis with Other Regions

Middle East vs. Europe and Asia

The Renewable Energy landscape in the Middle East, largely state-led initiatives and sovereign investments is a dark picture from that followed by Europe or Asia. This dissimilarity stems from the specific economic and political environments in these areas.

Europe's Decentralized Model: In Europe, renewable energy development is mainly driven through decentralized market-based approaches. European countries usually use subsidy-based models like feed in tariffs, tax credits and renewable obligation certificates. These incentives are meant to encourage private investment as well as create competitive energy sector. The European Union has concentrated on reducing carbon emissions and achieving energy independence, thus leading to the development of a diverse renewable landscape alternative that is slowly advancing in wind solar and biomass (Banja M. et al. 2017).

Asia's Hybrid Approach: The approach in Asia, especially to the emerging economies like China and India is an amalgamation of government support as well as market dynamics. These nations use massive industrial manufacture strengths and exporting-led strategies to stimulate their renewable energy sectors (Planetarysecurityinitiative.org 2023). For example, China has emerged as a world leader in solar panels and wind turbines production largely owing to the government support of domestic manufacturing through subsidies. India, as opposed to this, links the government actions including national solar mission with attempts of private investments and technology transfer.

Role of State-Owned Enterprises

Middle East's State-Led Strategy: In the Middle East, state-owned enterprises (SOEs) are essential in renewable energy. This brings SOEs involved in renewable energy projects closer to national strategic objectives, thereby ensuring that these projects contribute towards achieving broader economic and energy security goals. Such organizations as Saudi Arabia’s ACWA Power and the UAE’ Masdar play a significant role in developing renewable energy projects both nationally and internationally (Kiyasseh 2022; Sim 2022). This model provides a high degree of control and coordination in energy policy at the state level which is essential for ensuring large scale implementation and integration of renewable energy into national grids.

Contrast with Private Sector-Led Projects: On the contrary, this strategy differs from those seen in Europe and Asia where renewable energy development is led by private

sectors initiatives that were characterized as a more fragmented approach propelled by market forces (Banja M. et al. 2017; Planetarysecurityinitiative.org 2023). In these areas, many private firms compete and innovate to bring about a vibrant market for renewable energies that is diverse in nature as well as dynamic. This may, at times, prove problematic in policy coordination and long-term strategic planning.

Impact Assessment on Renewable Energy Growth

In the Middle East, renewable energy infrastructure development has increased significantly in recent years mainly through solar and wind power. These have led to this rapid expansion as a result of different government incentives and supporting policies. This has helped develop renewable energy capacity to increase the diverse sources of supply and improve on energy security in this region. Big projects including solar parks and wind farms have helped to raise the share of renewables in the energy grid and demonstrated a willingness by this region towards sustainable solutions (Jamil et al. 2016; Kiyasseh 2022; Alnaqbi and Alami 2023; FitchRatings.com 2023).

New economic sectors emerge in the Middle East driven by renewable energy projects, which open a great number of employment positions. This trend is in line with the expansion of efforts at economic diversification, particularly if people talking about countries that have traditionally relied upon oil revenues. The growth of the renewable energy industry is growing new skills and expertise in local labour force, which results to a fresh economic reign (Jamil et al. 2016; Kiyasseh 2022; Alnaqbi and Alami 2023; FitchRatings.com 2023). The development of the renewable energy sector therefore proves to be essential in transforming regional economies from oil-dependence into a more resilient and diversified system.

The shift to renewable energy in the Middle East plays a major role as part of environmental sustainability (Alnaqbi and Alami 2023). These countries are effectively limiting their emissions of carbon because they depend less on fossils, which is especially significant given the region’s reputation in oil producing. It is noteworthy that the use of renewables is rectifying other climate change issues, like air pollution and water conservation and proving the fact that this energy transformation has myriads of environmental benefits.

Although significant advancements have been achieved, the region still has to tackle certain challenges such as a more profound regulatory reform and integration of renewable sources into developed energy networks. These issues must be overcome for the renewable energy sector to continue its development and sustainability. Nevertheless, the future outlook for renewable energy in the Middle East is still

optimistic. With constant governmental assistance and developing international alliances, the region is poised for continued growth in renewable energy that makes a significant contribution to global efforts aimed at reducing climate change.

Finally, the shift to renewable energy in Middle East is being fueled by incentives and government support which are gradually changing how power source should be viewed. This shift, however different from any other region of the world successfully catalyzes renewable energy growth with respect to economic diversification, sustainability for environment and secure power supply. In doing so, these countries address environmental concerns and become leaders in the global energy transformation by providing a model for other oil-dependent economies.

4.3. Barriers and challenges in policy implementation

The GCC region is a very complicated one with many different factors playing a significant role regarding the implementation of a green energy policy. The most important barriers that most of the Gulf countries face are institutional obstacles, economic obstacles, cultural obstacles, infrastructure obstacles and regulatory obstacles.

The primary institutional obstacle has been the protracted approval process for securing long-term licensing, permits, and authorization for the installation of renewable energy projects. Each of these procedures involves consultation, review, and approval from multiple government agencies and levels, lacking effective streamlining. The complexity of governance processes, stemming from the presence of numerous agencies overseeing renewable energy project implementation, contributes to delays. Inadequate coordination among these entities, coupled with the absence of a dedicated renewable energy entity in some cases, compounds governance challenges and extends the overall approval timeline. Additionally, limited collaboration between various government bodies or between government entities and business and academic sectors hinders the deployment of renewable energy in certain GCC states (Al-Sarihi, 2018). Another factor prolonging the approval process is the shortcomings in the design and implementation of regulatory frameworks for renewables (Ferroukhi, R., Ghazal-Aswad, N., Androulaki, S., Hawila, D. and Mezher, T. (2013)). Despite GCC states setting targets to increase renewable energy shares in their energy profiles, regulatory frameworks that effectively facilitate and incentivize renewable deployment are mostly absent or require enhancement. Renewable energy lacks sufficient legislative and regulatory backing compared to conventional power generation modes. In certain instances, power sector laws, predominantly supporting

conventional power generation, lack regulatory and institutional elements supporting renewable energy deployment.

A second institutional barrier is an inconsistent national energy policy due to the presence of multiple agencies, resulting in the separate consideration of energy-related aspects, including oil, gas, electricity, water desalination, greenhouse gas emission reduction, and renewable energy. This inconsistency can be attributed to persistent hierarchical, top-down governmental decision-making and, in some cases, the insufficient representation of renewable energy interest groups in high-level decision-making, limiting their influence on or contribution to state law changes.

A third institutional barrier has been a lack of experience with renewables and knowledge among officials, causing delays in initiating new policies, strategies, and project approvals. This factor also explains the delayed governmental response to international environmental agreements, approval of new renewable energy targets, or modifications to existing laws.

Oligopolistic Economic Landscape

Another major obstacle in Gulf economies revolves around the prevalence of oligopolies in the private sector, compounded by the presence of sizable publicly owned enterprises. This scenario significantly constrains the growth of non-hydrocarbon industries crucial for economic diversification. A handful of companies dominate the majority of non-energy sectors, and stand to gain significant advantages from any upturn in oil prices. A very clear example of this is the Saudi Aramco case. Saudi Aramco nowadays is considered by many as the strongest energy company that ever existed. It controls the oil production and reserves of Saudi Arabia and of course it is a state owned company. Saudi Aramco in an effort to adopt to the changing energy landscape is investing huge amounts of money in alternative fuel but at the same is it almost impossible for any other company to have access to Saudi market. The reason behind that is that the Kingdom has enormous profits through Aramco and I has zero incentive of allowing foreign companies to take part of this market. Aramco in 2022 had a profit that not only exceeded the combined results of Shell, BP, ExxonMobil, and Chevron, but it was also the largest profit recorded by any company in the world, in any business. The total profit was over 160 billion dollars. But even with the huge investments in renewable energy the exploitation of fossil fuels remains the top priority for Saudi Aramco. Saudi Aramco has invested more in oil field expansion in 2022 than any other company in the world. The same pattern is visible in all GGC oil producing countries. So even if most of these countries invest money in renewable energy the

priority remain to protect the National Oil Companies and increase their profits through higher investments in exploitation and trading of fossil fuels.

Another significant barrier to the transformation of energy at Middle East is technical aspect especially in incorporating variable renewable energy (VRE) system into power networks. Energy storage systems (ESS) are necessary for increasing power system flexibility and stability though the shortage of encompassing regulatory guidelines pertaining to ESS. This increases investor risk aversion, undermining energy storage and making it impossible to manage the intermittence of other renewable sources like solar or wind (Obeid and Shatila 2022b).

Furthermore, financial factors pose great challenges. Due to under-investments and high financing costs for the renewable energy projects, along with some countries subsidising fossil fuel industries, this shiftover ceases being economically beneficial. Moreover, the high cost of moving energy infrastructure represents another hurdle, particularly for oil- and gas-reliant states (Obeid and Shatila 2022b).

Regional politics and intra-regional rivalry may hamper the uniform adoption of renewable energy policies. For example, the high pace of renewable energy adoption by the UAE was motivated mostly due to lack if domestic natural gas. On the other hand, states such as Qatar and Saudi Arabia that have a longer time horizon for choosing their fuel supplies remain reluctant to implement renewable energy strategies. Ultimately, geopolitical factors and inter-state competition within the Gulf Cooperation Council - GCC contribute to how country leaders handle renewable energy policy and development (Young 2021; Sim 2022).

Case Study: Lebanon's Decentralized Renewable Energy Models

In Lebanon, the electricity sector has barriers that are based on political bottlenecks and vested interests to trample power reforms. And it has also resulted in large public debt levels due to the county’s dependence on imported fuel and centralized generation systems. In the case of decentralized renewable energy models such as rooftop solar systems or solar microgrids, this could be an option. These systems may furnish low-cost electricity and help decrease the dependence on imported fuel, thereby eliminating political issues and economic bottlenecks (Obeid 2021).

Solution Framework

Defined and comprehensive regulatory structures are crucial to ensuring that the region’s renewable portfolio is integrated well into the energy mix of Middle East. It is important to have clear energy storage systems (ESS) regulations as well as

integration of variable renewable energy (VRE), attracting investments and reducing uncertainties. Steady policies which would foster the design and use of renewable technologies are likely to contribute towards steadiness in the market while encouraging both local as well as foreign investors. This requires more than just developing new regulations but also rewriting those that already exist to account for the specifics of renewable and storage technologies (Seznec and Mosis 2021; Obeid and Shatila 2022a).

It is also necessary to ensure decreasing of the financing costs for renewable energy projects, offering financial incentives and subsidies in order to make these initiatives economically sustainable. The high start-up costs of renewable energy projects can be subsidized by government intervention through the form of income tax rebates, grants for low interest loans or direct funding. Such an approach is especially relevant in the Middle East where transition to renewable energy resource has competition with long-established and well financed fossil fuel industries. More importantly, improving financial conditions to promote private investments in renewable energy can contribute towards the development of this sector (Obeid and Shatila 2022a; Sim 2022).

It appears that promotion of distributed renewable energy patterns is a workable option, particularly for countries in political and financial difficulties on their centralized power systems. Such decentralized models, such as rooftop solar installations or community micro-grids offer more resilient and sustainable energy options. In addition to eliminating bottlenecks in the area of energy production, these models also enable local communities and strengthens their independence from traditional centralized suppliers as well they offer more rapid implementation than large-scale projects. Decentralized systems can also help greatly in minimizing dependence on imported fuels, which is a pervasive problem for many Middle Eastern nations (Obeid 2021).

Knowledge is necessary on the geopolitical and economic terrain of Middle East for implementing such policies uniformly. The specific political, economic and social settings of each country in the region influence their renewable energy strategy. Recognizing these variances and utilizing collaborative regional approaches can contribute to a more well-aligned renewable energy policy in the Middle East. This approach does need national initiatives and also must involve regional coordination and dialogue on policy harmonization and best practice (Young 2021; Sim 2022).

In conclusion, although the Middle East is moving towards renewable energy in transition, addressing technology as well as economic political and geopolitical challenges plays a key role for effective policy implementation. A regional approach that takes into account specific national challenges, a robust regulatory framework and

investments will define the successful transition to renewable energy policies in this region.

4.4. Strategies for enhancing renewable energy deployment

A balance between short-term and long-term strategies is necessary for the success of renewable energy deployment. In the short term, immediate focus could be on introducing incentives that spur rooftop solar installations and small scale renewables as these can quickly contribute to the energy mix. Also, programs such as energy efficiency and grid modernization should be advanced for an immediate result. When long-term planning is concerned, the spotlight should be changed towards mega infrastructure projects such as utility scale solar parks or wind farms and slow withdrawing subsidies for fossil fuels. This necessitates a holistic national energy policy that integrates renewable goals and deadlines, guaranteeing sustained as well as long-term dedication to the utilization of sustainable sources (Obeid and Shatila 2022a; Sim 2022).

The participation of the private sector is a key facilitator to scale up renewable energy application. PPPs can be very effective as they create a synergy between government intervention (support and regulatory framework) and the efficiency, innovation ability that private sector provides together with available funds. This approach has proven to be successful in the Middle East, especially UAE and Saudi Arabia where PPPs have made significant contributions towards rapid deployment of massive renewable projects. Incentives to attract private investment and business-friendly policy environment will be important in ensuring further participation from the private sector (Obeid and Shatila 2022a; Sim 2022).

The incorporation of the most up-to-date technological innovations is essential for improving renewable energy expansion. This incorporates also the application of sophisticated renewable technologies, solar photovoltaics and wind turbines, energy storage devices and smart grid technologies. The adoption of these technologies can be accelerated through investing in research and development, and by fostering public-private partnerships that are oriented towards technological innovation. In addition, technology transfer and shared research projects coordinated at the regional level can result in more economical renewable energy options (Seznec and Mosis 2021; Obeid and Shatila 2022a).

Policy Recommendations

- Enhanced Support for Renewable Energy Projects: Policies like feed-in tariffs, tax incentives and direct subsidies can inspire the development of renewable energy. Second, an improvement in the process of renewable energy project approvals could speed up implementation.
- Focus on Energy Storage and Grid Integration: Policies should promote the advance and application of energy storage systems to enhance reliability in using renewable sources. Enabling regulations to enable grid integration of renewables will contribute towards managing their unstable nature.
- Decentralized Renewable Energy Systems: The emergence of decentralized power systems, especially in the remote and rural areas has a lot to do with ensuring energy sovereignty is attained. Renewable energy policies that promote small-scale and decentralized renewables projects can contribute significantly to this.
- Educational and Workforce Development Programs: Educational programs and technical training in renewable energy would help build consultants from local people who can support the development of a workforce capable to sustain growth of this emerging sector.

In summary, promoting renewable energy deployment in the Middle East involves a blend of short-term initiatives and long-range strategies, active private participation through PPPs means technology adoption specific policy adjustment. Addressing these areas will help the Middle East move towards a sustainable and renewable energy future by leaps.

4.5. Integration of energy transition with broader sustainable development goals

The Middle East energy transition is strongly linked with the United Nations' Sustainable Development Goals (SDGs), especially in ensuring climate change mitigation and providing sustainable electricity options. With the region having been adversely affected by climate change, its power systems are under great pressure to address economic expansion, energy safety and social needs. Therefore, the shift to renewables directly helps realize such goals as affordable and clean energy climate action as well responsible consumption and production. These initiatives are aimed at climate mitigation and also ensuring the resilience of energy systems to increase future climatic events such as droughts and flood (Jinsun et al. 2023).

The transition to renewable energy is likely to spark massive economic expansion in the Middle East. This shift is essential for the diversification of economies, reduced reliance on oil markets and creating new centers industrial growth. In this respect, the

construction and operations of large renewable energy projects such as solar farms or wind power generate employment in both stages. In addition, investments in renewable energy will attract both local and foreign investors thus strengthening the economy of any country (Carter 2021).

Embracing renewable energy technologies ensures earth-friendly benefits. It decreases dependence on fossil fuels, resulting in the reduction of greenhouse gas emissions and better air quality. In addition to this, renewable energy sources such as solar PV and wind turbines do not utilize much water during the operations thus making them more stable with drier climates predicted due to climate change in that region. This feature is even more important against the background of water scarcity issues that are typical for Middle Eastern countries (Jinsun et al. 2023).

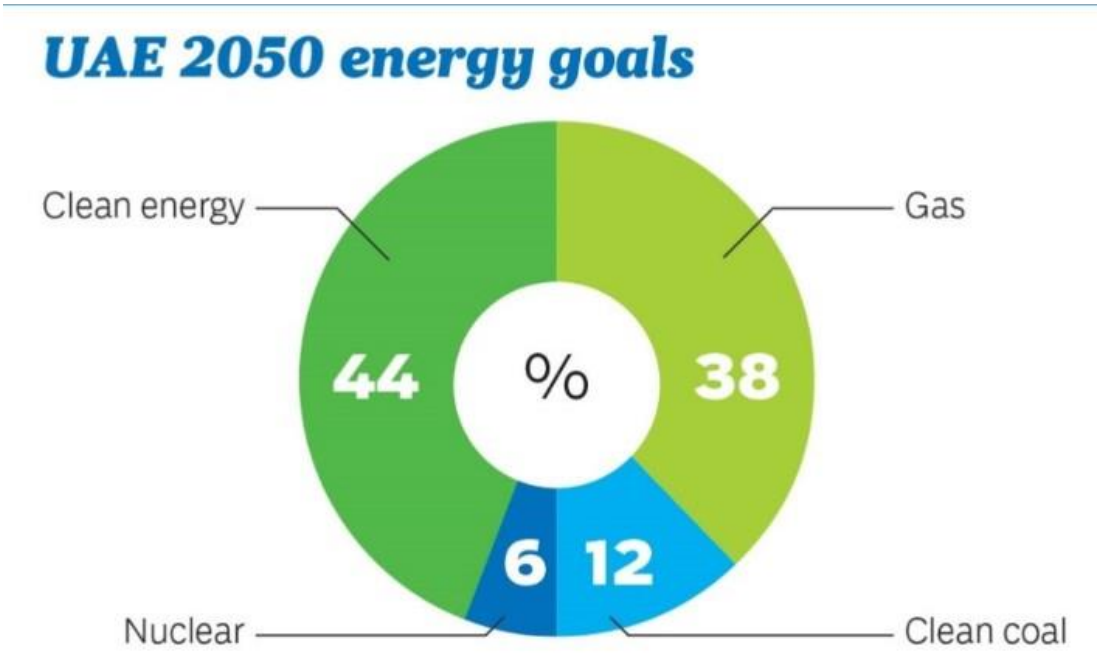
The social aspects of energy transition are also profound. Renewable energy initiatives can provide communities that are remote and underserved with a sustainable source of power, thus improving the quality of life in such regions. Besides, the shift aligns with the wider aims of addressing inequalities and fostering sustainable communities that work towards social wellbeing.

Finally, energy transition with broader sustainable development goals in the Middle East is a complicated phenomenon. It does promote the region’s economic growth and environmental sustainability and contributes to considerable social issues. These objectives can be attained only through the collective action of all governments, businesses and communities by continuous financing nd innovation on alternative energy technologies.

5 Chapter: Case Studies

Case study 1: UAE's transition towards renewable energy

The United Arab Emirates (UAE) has led the way in changing to clean energy in the Middle East. It shows how countries that use a lot of fossil fuels can spread out their types of power sources. This study looks at what the UAE is doing and how well it's going in moving to use energy from things like wind or sun.



UAE Energy Goals in 2050 (UAE Embassy in the United States)

Background and Rationale

Usually, the UAE's money matters have greatly relied on oil. But, knowing that fossil fuel resources are limited and there's a need for long-lasting growth, the UAE has started to change its mix of energy. This change goes well with the nation's larger plan to spread out its economy and promise on dealing with changes in weather patterns (Alnaqbi & Alami, 2023).

Strategic Initiatives and Goals

The way the UAE deals with green energy is driven by key plans and big aims. The plan for energy in the UAE by 2050 wants to build more clean electricity so it makes up half of all power we use. This plan stresses the need to balance money needs with

those of our environment. It sets goals to lower harmful gas releases and raise the use of clean power methods (Salimi et al., 2022).

Solar Energy Investments

One big aim of the UAE's move toward clean energy has focused a lot on using sun power because there is so much sunlight in this country. The Solar Park in Dubai, named after Mohammed bin Rashid Al Maktoum, is a clear example. When it's done, we think this place will be the biggest sun energy park in one spot on earth. Our plan is for it to ready and able with a power of 5 thousand million watts by year 2030. This work shows that the UAE is very serious about being at the top when it comes to using solar power (Alnaqbi & Alami, 2023).

Wind and Other Renewable Sources

Along with the sun's power, UAE is looking into wind and other types of energy that can be renewed. For example, the Masdar plan in Abu Dhabi is a leading effort to create lasting and changing energy answers. This means putting money into wind farms and studying ways to make energy from things that can be used over again, which makes the UAE a place known for coming up with new ideas in clean power.

International Collaboration and Investment

The UAE has strongly looked for teamwork with other countries to strengthen its clean energy area. Working together with big energy companies around the world, putting money into alternate energy projects outside their own country, and holding important meetings like the World Future Energy Summit have made UAE a main part of worldwide talks about renewable power. This work together projects have made it easier to move technology and expert knowledge, very important for the UAE's growth in clean energy (Sgouridis et al., 2016).

Policy Frameworks and Government Support

The UAE's move towards clean energy has been successful in part because of helpful rules and structures set by the government. These involve rewards for projects that use wind or sun power, changes in rules to inspire private money into green energy and plans like the Green Economy push. These rules aim to make a helpful place for developing usable energy from natural resources (Global Power Agency, 2023).

Economic Implications

Switching to clean power sources like the sun or wind is supposed to have big money effects on the UAE. This move also has the potential to make new businesses and job chances, while reducing our need for oil. The growth of clean energy can help make the economy more varied, bring in money from other countries and improve new ideas (Yergin, 2020).

Social and Environmental Benefits

The steps the UAE is taking towards renewable energy also come with big benefits for society and nature. By using fewer fossil fuels, these efforts help to decrease the amount of carbon we put out and fight against changes in our weather patterns. They also make the air better and people healthier, plus they help in keeping our cities safe for a long time (Amran et al., 2020).

Challenges and Future Outlook

Even though the UAE has made a lot of progress, it still faces problems in changing its energy use. This means putting useful ways of making energy into the current power system and overseeing how renewable energy can stop working for short periods. But the UAE keeps putting money into energy saving methods and making their power network better to deal with these problems. Looking in the future, UAE's promise to clean energy and development that lasts sets it as a top force in worldwide switch (Darwish et al., 2018).

Final, United Arab Emirates' move to green power is an important part of its bigger plan for not putting all their eggs in one basket on money matters and caring about nature. By smart plans, working with other countries and helpful rules, the UAE has moved forward a lot in growing its clean energy business. The path our country took gives us useful understanding of how nations can change from using fossil fuels a lot to a better mix that's steadier and different in energy sources.

Case study 2: Saudi Arabia's Vision 2030 and its impact on the energy sector

The plan called Vision 2030 was made in Saudi Arabia in 2016. It aims to change the country's money and social systems by lessening its need for oil, growing other parts of business, like health care and school learning, improving public areas such as hospitals or roads. This big plan has deep effects on the country's energy part, centering on change, upgrading and long-lasting growth.

Background and Rationale

Saudi Arabia, which sells the most oil in the world, has a very close link between its big supplies of oil and how much money it makes. But, as the world turns to clean energy and oil prices keep changing a lot, this country knows it must change its economy in big way. Vision 2030 marks a key turn towards a stronger and lasting business plan, with more variety (Amran et al., 2020).

Vision 2030 and the Energy Field

A main part of Vision 2030 is changing the energy area in Saudi Arabia. This means not just adding different kinds of energy, but also making oil production better and using less in our own country so we can sell more to others. The idea sees the growth of power from things like sun and wind to cut back use on old fuels for making electricity (Yergin, 2020).

Renewable Energy Initiatives

Saudi Arabia has big goals for clean energy as part of their plan by 2030. The goal for our nation is to create 9.5 billion watts of green energy by the year 2023 and half all its power from these clean sources by 2030. Making things like the Sakaka sun power plant and Dumat Al Jandal wind field are moves towards getting these aims. This work not only helps lower harmful gases in the air but also starts up new types of jobs and businesses.

Modernization of the Oil Sector

Saudi Arabia is making its energy sources more varied and improving the way it uses oil to be better at not wasting anything and lasting longer. This means using better tools to get and deal with oil, while also choosing ways that make the least damage to nature. The government-run oil company, Saudi Aramco, has been leading these moves by putting money into systems that catch and store carbon. They are also looking for better ways to use fossil fuels that cause less harm (Amran et al., 2020).

Economic Implications

The effect of Vision 2030 on the energy part has a big money-related meaning. Saudi Arabia wants to make their economy less tied to oil money. By doing this, they hope that changes in world oil price will have a smaller effect on them and the country's

income can come from more than just one place. The growth of clean energy businesses is also thought to bring in new money-making chances, get foreign people investing here, and make jobs. All this can help our economy grow stronger by making it more different (Griffiths, 2017).

Social and Environmental Considerations

The move to clean energy and the update of the oil industry are good for people and our world. Using less of things made from old plants and animals matches the world's work to fight changes in weather, while creating jobs for people and bettering society through new types of energy can be gained. Also, better oil industry work and care for nature can be good for people's health and our surroundings (El-Katiri & Husain, 2014)

Challenges and Strategic Approaches

Carrying out the energy goals of Vision 2030 is not free from difficulties. The change needs a lot of money put in, changes to rules and the building of new systems. Also, moving the work people from mainly using oil for money to a more mixed one needs big learning and training steps. Smart plans, like working together with the government and businesses, global teamwork and law-based rewards are important to beat these hard problems (Sgouridis et al., 2016).

The part of new ideas and tools

Change and new ways of doing things are very important in the energy part of Saudi Arabia that is moving forward using technology. The country is putting its money into studying and growing clean energy methods, smart electrical grid ideas, and ways to use power better. The emphasis on new ideas is very important for Saudi Arabia to reach its energy aims by 2030 and make itself a top name in the world's switch over to cleaner power sources (World Group of Green Energy, next year report).

Global and Regional Implications

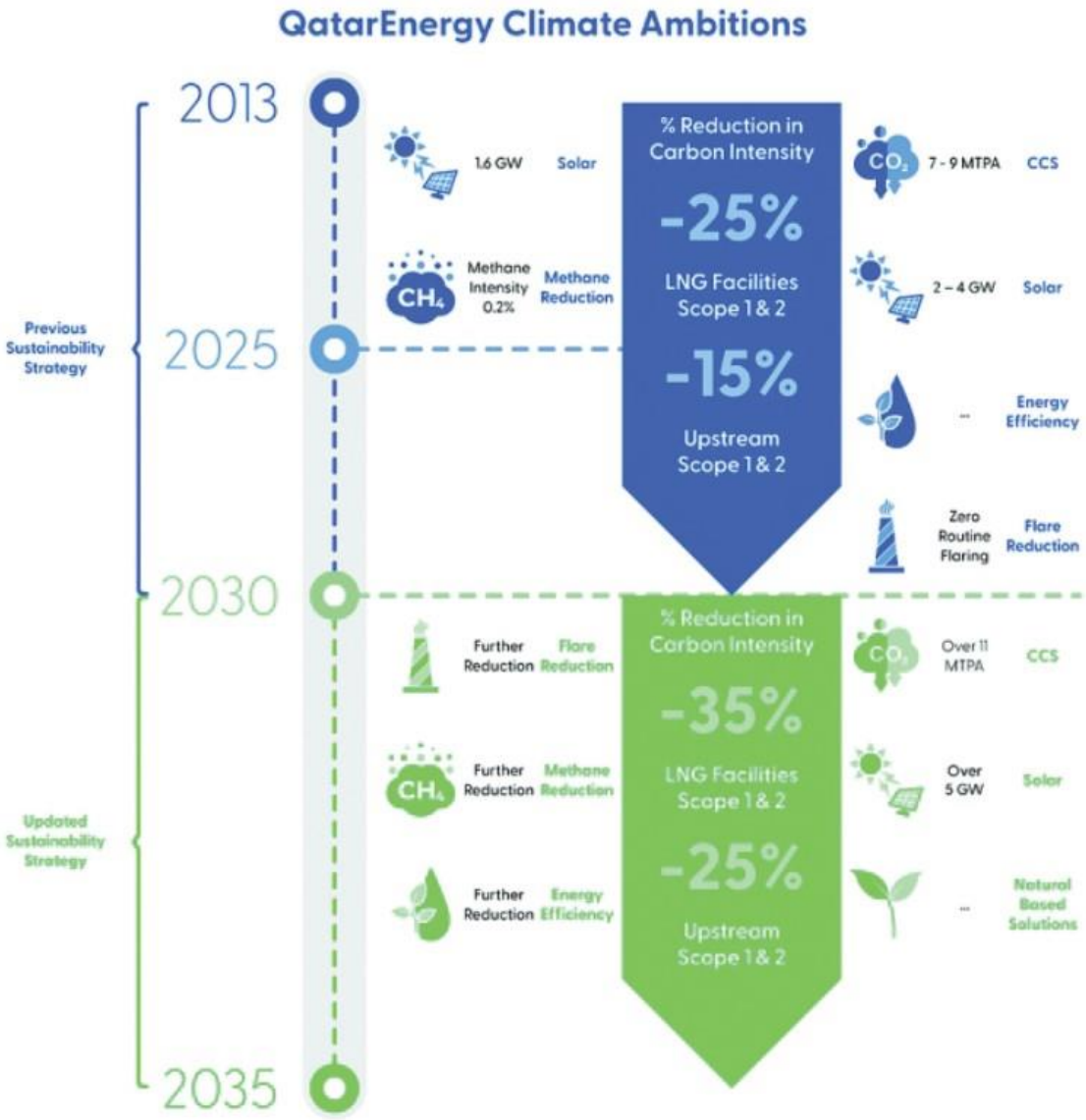
Changes in Saudi Arabia's energy business as part of Vision 2030 will have impacts outside the country. Being a top oil maker, the country's move to clean energy is showing that the worldwide shift in power sources can work. It also can change the rules and ways about energy in a bigger area like Middle East (Yergin, 2020).

Final, the plan of Saudi Arabia's Vision 2030 is a brave and smart start to change its energy part. It focuses on making things different, new ways of doing stuffs better and

long-lasting growth that protects our world. Even though there are problems, if Vision 2030's energy targets work well it could really change the country by making its economy stable, keeping nature healthy and helping people move forward in society. This is a very important time in the history of Saudi Arabia. It shows how they are changing from an economy that only depends on oil to one with more types of income and not easily broken (Amran et al., 2020).

Case study 3: Qatar's initiatives in sustainable energy

Qatar, known for its big supplies of natural gas and oil, has been slowly moving to use clean power. This follows Qatar's wider goals in the economy and nature protection too. This study looks at what Qatar is doing for sustainable energy, and how it helps their overall growth plan.



Qatar energy transition plan (Qatar Tribune)

Background and Rationale

Since Qatar is one of the main producers of natural gas, its economy depends a lot on money from hydrocarbons. But, because of big world worries about the environment and moving toward more green energy, Qatar understands it needs to mix up where it gets its power from. This change is all about making the country use less carbon so it can keep money going for a long time (Darwish et al., 2018).

National Goals 2030 and Sustainable Energy Plans

Qatar's big plan for 2030 helps make its country use energy that won't run out. This idea wants to change Qatar into a modern community that can reach long-lasting growth by 2030. An important part of this plan is to make the types of energy we use different. We want to focus on creating new ways like solar power because there's lots and lots sun in our country (International Energy Agency, 2023).

Solar Energy Initiatives

Qatar is putting a lot of money into solar power as part of its plan for green energy. The Al Kharsaah Solar Plant, one of the biggest in its area, is a well-known example. When this project is done, it will greatly help Qatar's use of renewable energy. This will make them not need to depend so much on gas for making electricity. These actions match Qatar's promise in the Paris Agreement on climate change. They are working to lower emissions of greenhouse gases (Yergin, 2020).

Energy Efficiency and Conservation

Qatar, along with their renewable energy projects, also really focuses on saving and using energy wisely. This means improving facilities, using energy-saving technology in homes and businesses. It also includes encouraging people to save energy at home or work. These actions not only use less energy, but they also help protect the environment and save money (Sgouridis et al., 2016).

Studying and Creating Sustainable Energy Resources

Qatar is putting money into research to make its clean energy better. Places like Qatar Environment and Energy Research Institute (QEERI) are leading the way in this work. They do research on solar power, saving water, and ways to be good for the environment. Qatar wants to encourage creativity, so they can create their own ways and learn new skills in green energy (El-Katiri & Husain, 2014).

Economic Diversification and Sustainable Development

Qatar is working hard to get more from different parts of the economy and this effort ties in closely with its goal for sustainable energy. Qatar wants to create a stronger and varied economy by relying less on money from oil and gas. The renewable energy field is likely to make new jobs and businesses, get investments for growth. This will help the economy be more stable (Griffiths, 2017).

Hosting Major International Events

Qatar is also showing its dedication to using clean energy and being good for the environment by getting ready for big worldwide events like the FIFA World Cup in 2022. The country is building stadiums and other structures in a way that helps the environment. They are using clean energy sources, like sun or wind power, along with green technologies to do this work properly. These programs show how committed Qatar is to being green worldwide (Amran et al., 2020).

Challenges and Strategic Approaches

Even though it's doing well, Qatar still has problems to fully reach its goals for eco-friendly energy. This includes blending renewable energy into the current power network and dealing with solar power's up-and-down nature. Big plans, like teaming up with private businesses and working together across countries or offering bonuses for investment in renewable energy are needed to face these problems (Darwish et al., 2018).

Global and Regional Implications

Qatar's actions on green energy can affect areas beyond its own. As a big part of the world's energy business, Qatar moving to use more clean power nicely shows other nations in its area that it can be done. This shows it's possible to move from using fossil fuels, like countries with big oil and gas reserves can do. (International Energy Agency, 2023).

Outlook

In the future, Qatar's promise to use energy that hurts Earth less will be important in its money and nature plans. Keeping money in renewable energy, doing more research, and working together internationally will be important to meet its goals for

lasting sustainability. The good results of these plans will help Qatar's goal to have a strong, green, and flexible economy (Yergin, 2020).

Final, Qatar's plan for eco-friendly energy includes big money spent on solar power and saving energy. They also focus a lot on new ideas that fit with what they want to do financially and protect their environment better. Qatar is using its National Vision 2030 to change how it gets energy, lessen harm on the environment and make sure money stays strong for a long time. Despite problems, Qatar's focus on green energy is a good move for a brighter and wealthier future.

Chapter 6: Conclusion

The change in the Middle East to reliable and clean energy, looked at through different parts of this thesis, is a big move away from oil and gas. These are usually the main power sources there. This conclusion shows important points from these chapters and gives ideas about the future of energy change in Middle East. We must think about world-wide needs along with local things that are special there too.

6.1 Challenges and Opportunities of the energy transition on Middle East

The majority of MENA countries rely heavily on state-provided affordable basic services. It is important to note, however, that the multilayer policy considerations necessary to ensure that a country's policy promoting energy transition promotes justice and equity for all its citizens and residents should not be compromised. Consequently, in order to achieve environmental, socioeconomic, and sustainable justice, governments in the Middle East must balance the existing economic systems with the demands of their energy transition.

The energy transition can only be facilitated by governments placing people at the center, both as responsible "consumers" of energy (i.e., energy consumers, including residential consumers) who begin producing electricity for their own use after the introduction of small-scale production technologies powered by renewable energy sources and as active stakeholders in developing and overseeing visions and strategies.

A supportive legislative environment and financial incentives are also necessary. This is particularly difficult in the MENA area since, due to varying degrees of civic space constraints, citizens are frequently excluded from decision-making processes.

In connection with this, the area has a history of oligarchic regimes, in which the powerful central states offer jobs, services, and other material advantages in exchange for restricted political and civil rights participation.

Furthermore, a key concern in making sure the energy transition is equitable worldwide is who will pay for it. It takes significant expenditures in infrastructure, technologies, and human resources to convert energy systems from fossil fuels to renewable energy. Trillions of dollars are predicted to be required globally. Local funding sources, such as state budgets, private sector investments, and individual contributions, can support climate mitigation and adaptation; but, industrialized nations that have made the largest contributions to global warming should also support climate response in developing nations.

Such foreign finance should be a great opportunity and also a great challenge to the Middle East countries. This is because, although being among the areas most impacted by climate change, the Middle East has not historically contributed as much to this issue as industrialized nations have. However, of the estimated USD 570 billion needed for the region's countries to satisfy their pledges (also known as "nationally determined contributions") under UN climate accords, the region has only received 11% during the last ten years, with only 4% coming from UNFCCC climate funding. (NRGI 2023)

The energy transition also opens up new economic opportunities for the Middle East. By diversifying their energy mix, countries in the region can reduce their dependence on oil exports, mitigating the impact of volatile oil prices. Moreover, the burgeoning renewable energy sector presents opportunities for job creation and the development of a skilled workforce in areas such as engineering, manufacturing, and technology

6.2 Future prospects and potential challenges

Impact of Fluctuating Oil Prices on Regional Economies: Middle Eastern countries, mainly driven by oil money, have seen big changes in their economy. This is because of the changing prices for global oil. These economies depend on oil. Because of this, they can be affected by international markets' ups and downs which lead to times when the economy is doing well or not so good (Amran et al., 2020; Yergin, 2020).

Diversification of Economies and Energy Transition: To deal with changes and understanding that fossil fuels can run out, Middle Eastern countries are working hard to make their economies more varied. This means putting money into things like sun, wind and waterpower. It also helps their economy to change while moving towards using all sources of energy in a good way (Sgouridis et al., 2016; Alnaqbi & Alami, 2023).

Opportunities for Renewable Energy Investments: The area's lots of solar and wind power resources give big chances for putting money into clean energy projects. These investments are very important for lessening our dependence on fuels that come from rocks. They also help the economy by making jobs and growing businesses (Darwish et al., 2018; Salimi et al., 2022).

Social Implications of the Energy Transition: The move to use clean energy will have big effects on society, like making new jobs and the need for people to learn different skills. This change gives a chance for society to grow, with more jobs and learning new skills in growing industries (Griffiths, 2017).

Carbon Emissions and Climate Change Concerns: Counting some of the biggest carbon emissions per person worldwide, it's very important for Middle East to change its energy use. This will help fight climate change too. These countries can cut down their carbon footprint a lot by moving to renewable energy. This will help with global environmental balance too (International Energy Agency, 2023).

Understanding the Future of Energy Change in Middle East Countries

Moving forward, the change in energy use in the Middle East is set to remake both local and worldwide patterns of power. The move towards alternative energy, pushed by money and nature needs, is probably going to speed up in the next few years.

Continued Investment in Renewable Energy: The growth in putting money into renewable energy, especially solar and wind sources is expected to keep going. This will be helped by better technology, lower costs of clean energy tools and working together with people from different countries (Sgouridis et al., 2016).

Economic Diversification and Stability: As economies in the Middle East shift away from oil, they should see steady and long-lasting growth. This spread out, along with the growth of renewable energy fields can lessen sudden money problems linked to changes in oil prices. (Alnaqbi & Alami, 2023)

Enhanced Regional Cooperation: A change in energy use may encourage more teamwork within the Middle East. Working together on renewable energy projects, doing research with others and making rules can make the use of clean power move faster in this area. (Darwish et al., 2018)

Global Leadership in Renewable Energy: The Middle East could become a big player in renewable energy, most importantly for solar power. The area's promise to use energy in a way that won't harm the environment can be used as an example for other places that depend on oil to change towards using renewable types of power (Amran et al., 2020).

Challenges and Strategic Approaches: Even though there are good things happening, problems still exist. This includes making sure new kinds of energy fit in with old systems and that everyone is managed properly when they switch to different types like sun or wind power jobs change for them too. Fixing these problems will need good plans, working together with other countries and continued new ideas (International Energy Agency, 2023).

To sum up, the change in energy use in the Middle East is a difficult journey but it's very important. It will help them grow their economy better ways, protect our environment, and make society move forward more smoothly. The area's special place

in world energy matters makes it a major part of the worldwide move to use clean power. As the Middle East moves through this change, its way and success will give important lessons for how energy works all around the world. The path forward is full of difficulties, but the possible gains for area and globe are large and long-lasting.

References

- Abadli, R., & Kooli, C. (2022, April). Sustainable Energy Policies in Qatar: On the Green Path. In Sustainable Energy-Water-Environment Nexus in Deserts: Proceeding of the First International Conference on Sustainable Energy-Water-Environment Nexus in Desert Climates (pp. 765-771). Cham: Springer International Publishing.
- Alnaqbi, S. A., & Alami, A. H. (2023). Sustainability and Renewable Energy in the UAE: A Case Study of Sharjah. Energies, 16(20), 7034.
- Amran, Y. A., Amran, Y. M., Alyousef, R., & Alabduljabbar, H. (2020). Renewable and sustainable energy production in Saudi Arabia according to Saudi Vision 2030; Current status and future prospects. Journal of Cleaner Production, 247, 119602.
- Darwish, S., Abdo, H., & AlShuwaiee, W. M. (2018). Opportunities, challenges and risks of transition into renewable energy: the case of the Arab Gulf Cooperation Council. International Energy Journal, 18(4).
- Dechamps, P. (2023). The IEA World Energy Outlook 2022–a brief analysis and implications. European Energy & Climate Journal, 11(3), 100-103.
- El-Katiri, L., & Husain, M. (2014). Prospects for Renewable Energy in GCC States–Opportunities and the Need for Reform.
- Griffiths, S. (2017). A review and assessment of energy policy in the Middle East and North Africa region. Energy Policy, 102, 249-269.
- Hafner, M., Tagliapietra, S., & De Strasser, L. (2018). Energy in Africa: Challenges and opportunities (p. 112). Springer nature.
- International Energy Agency. (2023). World Energy Outlook 2023. IEA. Retrieved from https://www.iea.org/reports/world-energy-outlook-2023.
- O'Sullivan, M., Overland, I., & Sandalow, D. (2017). The geopolitics of renewable energy.
- Salimi, M., Hosseinpour, M., & N. Borhani, T. (2022). Analysis of solar energy development strategies for a successful energy transition in the UAE. Processes, 10(7), 1338.
- Sgouridis, S., Abdullah, A., Griffiths, S., Saygin, D., Wagner, N., Gielen, D., ... & McQueen, D. (2016). RE-mapping the UAE's energy transition: An economy-wide assessment of renewable energy options and their policy implications. Renewable and Sustainable Energy Reviews, 55, 1166-1180.
- Temizel, C., Irani, M., Canbaz, C. H., Palabiyik, Y., Moreno, R., Balikcioglu, A., ... & Alkouh, A. (2018, December). Technical and economical aspects of use of solar energy in oil & gas industry in the Middle East. In SPE International Heavy Oil Conference and Exhibition (p. D022S028R001). SPE.
- Yergin, D. (2020). The new map: Energy, climate, and the clash of nations. Penguin Uk.
- Paravantis, J. and Kontoulis, N. 2020. Energy Security and Renewable Energy: A Geopolitical Perspective. In: Renewable Energy - Resources, Challenges and Applications. IntechOpen. doi: 10.5772/intechopen.91848.

❖ Alnaqbi, S.A. and Alami, A.H. 2023. Sustainability and Renewable Energy in the UAE: A Case Study of Sharjah. Energies 16(20), p. 7034. doi: 10.3390/en16207034.
❖ Al-Sarihi, A. 2023. The GCC and the road to net zero. Available at: https://www.mei.edu/publications/gcc-and-road-net-zero.
❖ AstraZeneca. 2022. AstraZeneca R&D: Turning science into medicine. Available at: https://www.astrazeneca.com/content/dam/az/r-and-d/pdf/turning-science-into-medicine.pdf.
❖ Banja M., Jégard M., Monforti-Ferrario F., Dallemand J.-F., Taylor N., Motola V. and Sikkema R. 2017. Renewables in the EU: the support framework towards a single energy market. Available at: https://e3p.jrc.ec.europa.eu/sites/default/files/documents/publications/kjna29100enn.pdf.
❖ Carter, D. 2021. Creating a sustainable future for energy and industry in the Middle East. Available at: https://www.woodplc.com/insights/articles/creating-a-sustainable-future-for-energy-and-industry-in-the-middle-east.
❖ Clynch Harry. 2023. Regulations on Middle East renewable energy industry starting to take shape. Available at: https://www.al-monitor.com/pro/trend-reports/regulations-middle-east-renewable-energy-industry-starting-take-shape?token=eyJlbWFpbCI6ImNoYXJyaXNlY29ub21pY3NAZ21haWwuY29tIiwibmlkIjoiNTcxNjAifQ%3D%3D&utm_medium=email&utm_campaign=Ungrouped%20transactional%20email&utm_content=Ungrouped%20transactional%20email+ID_d7816d41-b9fc-11ee-9db1-0cf6c4e781ac&utm_source=campmgr&utm_term=Access%20Article.
❖ Cms.law. 2019. RENEWABLE ENERGY LAW AND REGULATION IN THE UAE. Available at: https://cms.law/en/int/expert-guides/cms-expert-guide-to-renewable-energy/united-arab-emirates.
❖ Dourian, K. 2023. Solar and Wind Energy Driving the Middle East's Energy Transition. Available at: https://agsiw.org/solar-and-wind-energy-driving-the-middle-easts-energy-transition/.
❖ FitchRatings.com. 2023. Middle Eastern Countries Continue to Target Higher Renewable Energy Capacity. Available at: https://www.fitchratings.com/research/infrastructure-project-finance/middle-eastern-countries-continue-to-target-higher-renewable-energy-capacity-11-05-2023.
❖ Jaiswal, K.K. et al. 2022. Renewable and sustainable clean energy development and impact on social, economic, and environmental health. Energy Nexus 7, p. 100118. doi: 10.1016/j.nexus.2022.100118.
❖ Jamil, M., Ahmad, F. and Jeon, Y.J. 2016. Renewable energy technologies adopted by the UAE: Prospects and challenges – A comprehensive overview. Renewable and Sustainable Energy Reviews 55, pp. 1181–1194. doi: 10.1016/j.rser.2015.05.087.
❖ Jinsun, L., Nadim, A. and Chiara, D. 2023. Climate resilience is key to energy transitions in the Middle East and North Africa. Available at: https://www.iea.org/commentaries/climate-resilience-is-key-to-energy-transitions-in-the-middle-east-and-north-africa.

❖ Kiyasseh, L. 2022. Strong momentum in Saudi Arabia's drive toward renewables and infrastructure. Available at: https://www.mei.edu/publications/strong-momentum-saudi-arabias-drive-toward-renewables-and-infrastructure.
❖ Nicholson, M. 2023. Top Five Renewable Energy Projects Making a Global Impact. Available at: https://www.nesfircroft.com/resources/blog/top-five-renewable-energy-projects-making-a-global-impact/.
❖ Obeid, J. 2021. Failure to Power: The Need for Decentralized Renewable Energy Models. Available at: https://www.csis.org/analysis/failure-power-need-decentralized-renewable-energy-models.
❖ Obeid, J. and Shatila, S. 2022a. Pairing renewables with energy storage could help MENA states to realize their green goals. Available at: https://www.mei.edu/publications/pairing-renewables-energy-storage-could-help-mena-states-realize-their-green-goals.
❖ Obeid, J. and Shatila, S. 2022b. Pairing renewables with energy storage could help MENA states to realize their green goals. Available at: https://www.mei.edu/publications/pairing-renewables-energy-storage-could-help-mena-states-realize-their-green-goals.
❖ Planetarysecurityinitiative.org. 2023. How Renewables are Shaping the India-China Relationship. Available at: https://www.planetarysecurityinitiative.org/sites/default/files/2023-03/PB_How_renewables_are_shaping_the_India-China_relationship_2eproef.pdf.
❖ Seznec, J.-F. and Mosis, S. 2021. The Energy Transition in the Arab Gulf: From Vision to Reality.
❖ Sim, L.-C. 2022. Renewable power policies in the Arab Gulf states. Available at: https://www.mei.edu/publications/renewable-power-policies-arab-gulf-states.
❖ World Investment Report 2023. 2023. Chapter IV: INVESTING IN SUSTAINABLE ENERGY FOR ALL. Available at: https://unctad.org/system/files/official-document/wir2023_ch04_en.pdf.
❖ Young, K.E. 2021. The Middle East and the Global Energy Transition. Available at: https://www.mei.edu/publications/middle-east-and-global-energy-transition.