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Title Page: Comparative Analysis Between Saudi Arabia and Norway in Moving Beyond Fossil Fuels Towards a Sustainable Economy: A Special Emphasis on the Renewable Energy Sector

Abstract

Saudi Arabia is the largest economy in the Middle East and the 18th largest in the world. The country has the world's second-largest proven petroleum reserves and is the largest exporter of petroleum. In 2016, Saudi Arabia had the third highest estimated value of natural resources at \$34.4 trillion (US). However, because of the 2014 oil crash, climate change, and the development of renewable energy technology, the government has decided to transition from its complete reliance on oil revenues and to start investing heavily in other non-oil sectors, such as the renewable energy sector. The Saudi government plans to generate 30% of its electricity from renewable energy sources and to establish a sustainable competitive market system. The country has planned to make this enormous shift with the help of the McKinsey Global Institute and the plan titled “Saudi Arabia Beyond Oil: The Investment and Productivity Transformation,” which is also known as “the vision of 2030.”

Saudi Arabia and Norway are similar countries as they are both oil producers. Norway is a leading country in terms of creating a sustainable economy that generates electricity mostly from renewable energy, while Saudi Arabia has recently decided to shift away from fossil fuels and to focus on non-oil sectors, such as the renewable energy sector. Thus, this thesis will provide a comparative study between Saudi Arabia and Norway. This analysis will benefit Saudi Arabia with the Norwegian success in shifting from its reliance on fossil fuels to other non-oil sectors, mainly the renewable energy sector. The thesis will address the challenges that Saudi Arabia may encounter in achieving its goals related to the 2030 vision of shifting toward a sustainable economy and will offer some recommendations to facilitate achieving these goals

Acknowledgment

I would like to thank my wife, my parents, my sisters and my friends for the support they gave me during writing my dissertation. They were the main source of strength and motivation that lead me to overcome challenges along the way.

A special thanks to the SJD committee members, Professor Darren Rosenblum, Professor Nicholas Robinson and Professor Victor Tafur for attending the dissertation defense and give me their valuable comments.

Finally, I would like to express my sincere appreciation to Ms. Deborah Zipf to all of her effort in helping International students. She helped me in countless times and made me feel welcomed.

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Chapter 1 Introduction

Saudi Arabia has the largest economy in the Middle East, and it relies on fossil fuels for its GDP.¹ More specifically, fossil fuels constitute 50% of its GDP and 70% of its export earnings.² The country has the second-largest petroleum reserves, with 17% of all global reserves,³ and the fifth-largest proven natural gas reserves.⁴ Saudi Arabia remains the largest petroleum exporter in the world.⁵ Overall, high oil prices have shaped its economy and positively impacted its citizens.⁶ For instance, household income in Saudi Arabia increased by 75% when oil prices doubled between 2003 and 2011.⁷ Using its oil revenue, Saudi Arabia has increased the welfare of its citizens, such as by providing them with free health care and education, without taxing them for new services.⁸ Evidently, Saudi Arabia has historically benefited from its natural resources and used its wealth to create a high standard of living.

However, the oil crash in 2014 caused most oil-producing countries to suffer. This crash harshly affected Saudi Arabia,⁹ and it continues to drain the government's budget.¹⁰ The country faced a deficit of \$118 billion in 2016, which equaled 16% of GDP.¹¹ Financial issues may force policy makers to decrease welfare in the future, such as by raising taxes for citizens. In fact, a

¹ Look at the IMF report at: <https://www.imf.org/external/np/pp/eng/2016/042916.pdf>

² Look at the U.S Energy Information Database at: <https://www.eia.gov/international/overview/world?view=production>

³ Look at OPEC report at: https://www.opec.org/opec_web/en/about_us/169.htm

⁴ Look at the World Factbook in the CIA official site at: <https://www.cia.gov/library/publications/the-world-factbook/rankorder/2253rank.html>

⁵ Look at the U.S Energy Information Database at: <https://www.eia.gov/international/overview/world?view=production>

⁶ Bina Hussein, ENERGY: Driving Force Behind Increasing Female Participation in the Gulf?, Atlantic Council 6-9 (2018).

⁷ Id.

⁸ Id.

⁹ Look at OPEC report at: https://www.opec.org/opec_web/en/about_us/169.htm

¹⁰ Hany Abdel-Latif, Rehab Osman and Heba Ahmed, Asymmetric Impacts of Oil Price Shocks on Government Expenditures: Evidence from Saudi Arabia, 6 Cogent Economics & Finance 1-22 (2018).

¹¹ Id.

new oil crash would affect almost all domestic sectors in Saudi Arabia, including health and education.¹² Hence, in the case of an oil crash, the government would be responsible for helping poor citizens with the consequences of the unmanaged deficit, which would create further financial challenges.

The International Monetary Fund (IMF) stated that the financial reserves of Gulf region countries will only be able to fill their budget deficits for the next 15 years.¹³ The IMF observed that the decreasing demand for fossil fuels has contributed to this problem. Many countries are now prioritizing gas extraction, which is less disruptive to the environment, over fossil fuels.¹⁴ In addition, worldwide interest in renewable energy as a future alternative energy is increasing.¹⁵ Therefore, oil-producing countries reliant on fossil fuels as the main source of their GDP will face crises in the future if they do not diversify their economies. In particular, the Saudi economy must overcome two main issues: climate change and renewable energy development.

Climate change is serious, and different countries have already started to witness its power. It ultimately affects species distribution; increases the intensity of pests and diseases; and alters patterns of precipitation, floods, droughts, water temperature, stream flows, and water quality. Humans have long known about the direct link between their health and the climate. For instance, internal organ health depends, to some extent, on the weather, as human thermoregulation is linked directly to the circulatory system.¹⁶ This means that any temperature

¹² Id.

¹³ See the IMF report: The Future of Oil and Fiscal Sustainability in the GCC Region (2020) available at: <https://www.imf.org/en/Publications/Departmental-Papers-Policy-Papers/Issues/2020/01/31/The-Future-of-Oil-and-Fiscal-Sustainability-in-the-GCC-Region-48934>

¹⁴ Id.

¹⁵ Look at the official site of the Saudi Electricity & Cogeneration Regulatory Authority: The Development of National Renewable Energy Policy for Saudi Arabia. available at: <https://www.ecra.gov.sa/en-us/Events/Pages/8thEvent.aspx?Eventid=20>

¹⁶ Andreas Matzarakis & Bas Amelung, *Physiological Equivalent Temperature as Indicator for Impacts of Climate Change on Thermal Comfort of Humans*, Seasonal Forecasts. 30 *Climatic Change and Human Health*, 161-172 (2008).

increase will directly affect human bodies. For example, hookworm disease affects approximately 500 million people in tropical and subtropical regions, and it relies on hookworm larvae, the life cycle of which is related directly to temperature and soil moisture.¹⁷ It is clear that humanity is facing the complicated and pressing threat of climate change, and to support its citizens, Saudi Arabia must respond accordingly.

Renewable energy was introduced as a clean alternative for fossil fuel sources that can power modern civilizations while not harming the environment, and it has become more competitive than ever before because of technological developments. The price of solar energy has decreased by about 85% since 2009, making it a promising energy source that is expected to become even more competitive in the future.¹⁸ The cost of photovoltaics (PV) per watt decreased from \$100 in 2000 to only \$5 in 2020.¹⁹ Following technological developments, many countries have started to include renewable energy in their electricity grids. In fact, Norway produces 98% of its electricity from renewable energy sources, mainly hydropower.²⁰ Given that the Saudi economy depends on fossil fuels, the development of the renewable energy sector threatens its stability.

As a result of these challenges to the Saudi economy, the government decided to diversify its income sources. With the help of the McKinsey Global Institute, Saudi Arabia published “Saudi Arabia Beyond Oil: The Investment and Productivity Transformation” (Vision

¹⁷ William W. Kellogg & Robert Schware, *Society, Science, and Climate Change*, 60 Foreign Aff. 1076 (1982).

¹⁸ Sofia O'Connor, James McElfish & Lovinia Reynolds, *Corporate Renewable Energy Goals: What Does 100% Renewable Really Mean*, 49 *Envtl. L. Rep. News & Analysis* 10648 (2019).

¹⁹ *Id.*

²⁰ Look at the article written in the official Norwegian government's site: Renewable energy production in Norway (2016): available at: <https://www.regjeringen.no/en/topics/energy/renewable-energy/renewable-energy-production-in-norway/id2343462/>

2030).²¹ Vision 2030 outlines significant changes to the Saudi economy, aiming to increase its non-oil revenue from 10% to 70% of the total government revenue by 2030.²² Vision 2030 also aims to deploy 58.7 GW of renewable energy to reduce the proportion of oil used for electricity generation.²³ Thus, Saudi Arabia intends to generate 30% of the kingdom's total generation capacity from renewable energy.²⁴ Moreover, Saudi Arabia also wants to provide a competitive market system that will allow the private sector to play a main role in its GDP. Nevertheless, the constitution of Saudi Arabia makes the government responsible for the welfare of its citizens.²⁵ The constitution confirms that the government must actively regulate the market in a way that benefits society as a whole.²⁶ Hence, Saudi Arabia must also respect its constitution and protect its citizens as it develops its economy.

Norway is a perfect example of a country that is both an oil producer and a global leader in renewable energy. Hydropower plants account for over 98% of electricity production in mainland Norway. Furthermore, Norway's \$1 trillion oil fund, the world's largest sovereign wealth fund, aims to plunge billions of dollars into wind and solar power projects.²⁷ Unlike most oil-producing countries, Norway has not relied on its oil resources after their discovery. Instead, the government recognized the danger of its overreliance on oil, and it thus aimed to invest its oil

²¹ Look at the full report of McKinsey Global Institute (Hereinafter: the Saudi 2030 vision): SAUDI ARABIA BEYOND OIL: THE INVESTMENT AND PRODUCTIVITY TRANSFORMATION. available at: https://www.mckinsey.com/~media/McKinsey/Featured%20Insights/Employment%20and%20Growth/Moving%20Saudi%20Arabias%20economy%20beyond%20oil/MGI%20Saudi%20Arabia_Full%20report_December%202015.pdf

²² Id.

²³ Look at the ministry of investment report regarding the application of the 2030 vision regarding the renewable energy sector Hereinafter: (Hereinafter: the Saudi's Renewable energy plan 2030). available at: <https://investsaudi.sa/media/1375/renewable-energy-17th-feb.pdf>

²⁴ Id.

²⁵ See the constitution translated in the Saudi Embassy website: available at: <https://www.saudiembassy.net/basic-law-governance>.

²⁶ Id.

²⁷ The official Norwegian government's site: Renewable energy production in Norway (2016), *supra*.

and gas revenues instead of spending them.²⁸ Norway created the Government Pension Fund Global (GPFGL) to take advantage of its oil revenues without affecting the general income flow to the government.²⁹ Norway began depositing 90% of its total oil revenue into the fund to invest it in other sectors, which diversified its economy.³⁰ Wisely, Norway recognized that because oil is not sustainable, an economic reliance on it would become problematic when the demand for it decreased.

Saudi Arabia faces three main challenges in shifting from an economy that relies on fossil fuels to one that focuses on non-oil sectors, including the renewable energy sector. First, the Saudi economy still depends on the public sector. This has resulted in the absence of a regulatory framework that can provide a competitive market system for the private sector. In other words, because the government largely relies on oil, it has not regulated the private sector or created a competitive market system. Second, oil prices continue to decline. This is supported by the decreased global demand for oil and increased renewable energy development, which has made renewables more competitive. Third, Saudi administrative laws remain complex and bureaucratic. Hence, the private sector is disinterested in investing in the country.

This thesis provides three recommendations for how Saudi Arabia can effectively develop its non-oil sectors, mainly the renewable energy sector, and apply economic insights from Norway. First, Saudi Arabia must provide a competitive environment for the private sector to invest in the country. For this purpose, the country can adapt the successful Norwegian economic model. It outlines that the state must be involved in the economy due to the

²⁸ The Government Pension Fund Act: available at: <https://lovdata.no/dokument/NL/lov/2005-12-21-123?q=lov+om+statens+pensjonsfond>.

²⁹ Anita M. Halvorssen & Cody D. Eldredge, Investing in Sustainability: Ethics Guidelines and the Norwegian Sovereign Wealth Fund, 42 DENV. J. INT'L L. & POL'Y 389 (2014).

³⁰ Heather Hachigian, Ambiguity, discretion and ethics in Norway's sovereign wealth fund, 17 Business and Politics 603–631 (2015).

constitutional responsibility of the government to provide welfare to its citizens. Hence, the model does not accept neo-liberal economic theory, which argues that the welfare of society will be achieved by the market, not the state. Second, Saudi Arabia must enact comprehensive renewable energy laws. While the absence of renewable energy laws and the use of governmental projects might increase the use of clean energy in the short term, these measures cannot develop the sector in the long term. Instead, the government must provide a legal environment to help the private sector invest in the renewable energy sector. Third, Saudi Arabia should exploit its new gas discoveries to finance its non-oil sectors. Although the low oil price can still help the government finance Vision 2030 and its own spending, these new discoveries should be wisely invested in Vision 2030 and developing the renewable energy sector.

A comparative study between Saudi Arabia and Norway is useful, as the countries are similar in terms of their oil abundance and tendency to shift toward renewable energy. Thus, this novel thesis compares the goals of Vision 2030 with the Norwegian economic approach. It advances the literature by providing policy recommendations for Saudi Arabia to achieve its desired goal of focusing more on its non-oil sectors, including the renewable energy sector. In this sense, Norway's success in diversifying its economy should inspire Saudi Arabia. Significantly, this thesis investigates countries that are leading in renewable energy laws and practices. Moreover, it may assist Saudi Arabia in shaping its policies and plans to successfully generate clean energy from renewable resources. Furthermore, it outlines how Saudi courts should clarify and apply laws that affect the economy and renewable energy development.

The remainder of the thesis will proceed as follows. The first chapter will focus on climate change and discuss the extent to which the climate affects human health and the ecosystem as a whole. Further, this chapter will also analyze the long-term impact of climate

change on the political stability of countries around the world. In addition, the chapter will emphasize that some economies have already suffered from extreme temperatures, posing serious problems for developing countries.

The second chapter will cover the creation and development of renewable energy as well as the necessity of shifting from fossil fuels to renewable energy. It will focus mostly on solar energy, given that Saudi Arabia receives a lot of solar radiation, making it the most attractive source of potential renewable energy. Plus, this chapter will discuss the unique challenges that the renewable energy sector faces and promising projects that have been undertaken to address these challenges.

The third chapter will focus on Saudi Arabia's unique relationship with the environment. The chapter will shed light on environmental norms under Islam, since many laws in Saudi Arabia are inspired by Islamic rules. In addition, it will explain the four main Sunni schools of jurisprudence and their debate over the ownership of energy, which has influenced Saudi Arabia. Then, the chapter will focus on the Saudi constitution and the extent to which it forces the government to be responsible for the welfare of its citizens and the environment. The chapter will also discuss the Organization of the Petroleum Exporting Countries (OPEC) statute and its roles for different oil-producing countries. Finally, the chapter will examine Vision 2030 and the country's goals for renewable energy generation.

On the other hand, the fourth chapter will target Norway. First, it will explain the Norwegian economic model and the role of the state in its economic system, which differs from that of other European countries. It will also analyze the Norwegian sovereign fund, which invests oil revenues instead of using them to fund government spending. The chapter will

conclude by examining the effectiveness of renewable energy laws in Norway in the development of this sector.

The fifth chapter will outline the economic challenges that Saudi Arabia faces in pursuing its energy goals. More specifically, the chapter will explore the limited role of the private sector and the lack of a regulatory framework in Saudi Arabia. Additionally, it will determine the impact of low oil prices and the extent to which these prices can hinder Saudi Arabia from shifting toward a sustainable economy. The chapter will also concentrate on the complex administrative laws that can prevent the private sector from investing in the country and thus affect emerging sectors.

After comparing Norway and Saudi Arabia's energy and commercial laws, the final chapter will provide solutions to Saudi Arabia's main economic issues. The chapter will explain how Saudi Arabia can provide a competitive market system while also maintaining an active public sector that regulates the market, thus providing welfare to citizens. The chapter will also discuss why the government should enact comprehensive renewable energy laws to develop the renewable energy sector. Finally, it will outline how the government can deal with decreasing oil prices while also financing non-oil sectors.

Chapter 2 Climate Change Crisis

Introduction

Climate change definitely exists and affects almost all aspects of life, and humans' consumption of energy remains just as ubiquitous, comprising an integral, uninterrupted aspect of modern living, without which society cannot function properly. Unfortunately, over 80% of the world's energy comes from non-renewable sources, which are distributed unevenly and depleting quickly.³¹ Civilization has been relying on fossil fuels as its main source of energy – a cheap, effective source that can satisfy consumers' needs. Although fossil fuels can deliver energy, they disrupt the whole planet. The issue of climate change affects many nations politically and economically, including their ability to survive under extreme climate conditions.

Many treaties and laws began to recognize the importance of protecting the environment. This recognition can be seen in many treaties, such as the International Convention for the Preservation of Pollution of the Sea by Oil, the United Nations Convention on the Law of the Sea, the Convention on the High Seas, the Stockholm Action Program, the Stockholm Declaration, the United Nations Conference on Environment and Development (UNCED), and the European Convention on Human Rights (ECHR). In fact, the ECHR went even further in linking a healthful environment to existing human rights, such as the right to privacy. Nevertheless, courts do not seem to view environmental damage as a violation of human rights unless the damage is severe. Therefore, it could be argued that environmental protection must be a separate human right that stands on its own without the need to link it with other rights.

³¹ Glen Wright, *The International Renewable Energy Agency: A Global Voice for the Renewable Energy Era*, 2 *Renewable Energy L. & Pol'y Rev.* 251 (2011).

It could be argued that climate change threatens our existence on this planet, in addition to its political and economic impact. In terms of climate change's threat to human existence, it has been noted that extreme weather can affect food production, plants, and animals, which humans rely on for their existence. Climate change also has been shown to increase the spread of diseases, making many individuals more vulnerable to these diseases. Politically, climate change seems to be a principal source of many revolutions in many regions and nations, such as Afghanistan. In certain regions, climate change will increase droughts, resulting in demands that the government satisfy people's needs. Economically, trillions of dollars are lost annually to extreme weather that hits many sectors, such as agriculture. Increased temperatures also decrease workers' productivity, many studies have found. Most importantly, I argue that neoliberal economic theory is one of the principal problems with climate change research, as it focuses only on making money as a goal, rather than viewing money as a measuring instrument, without valuing the planet's natural resources. This theory tends to ignore the externalities of trade in markets – an issue that will be discussed below.

The rest of this chapter will proceed as follows: First, climate change's serious impact on our existence as humans on earth will be examined. Second, the paper will shed light on climate change's significant political impact on many nations, as their governments struggle to satisfy their peoples' demands. Third, the work will place some emphasis on how economies have worsened from extreme temperatures, posing serious problems for developing countries. This chapter also will discuss how neoliberal theory has not helped improve environmental quality due to its mechanisms and assumptions, which will be discussed below. Finally, the chapter will discuss human rights in the context of environmental quality, arguing that environmental rights must stand on their own without being linked to other human rights.

1. Impact of climate change on ecosystem

After the discovery of fire, human welfare started to improve due to humans' ability to harness energy,³² which once came from their own muscle, fueled by plant and animal food.³³ The beneficial effects from the efficiency gained by exploiting the earth's storehouses of energy have been dramatic. The use of energy from fire and the presence of some greenhouse gases in the atmosphere are acceptable and necessary.³⁴ However, the Industrial Revolution changed the global climate, damaging the world's ecosystems through overuse of fossil fuels.³⁵ The issue has become a matter of survival, not merely a problem that affects humans' welfare.

It is well known that climate always is changing, which leads many individuals to argue that human beings are not the principal cause of climate change.³⁶ In the past 650,000 years, the planet has experienced more than six cycles of glacial advance and retreat.³⁷ One of these cycles ended 11,700 years ago, when the last ice age ended, which led to the beginning of the modern climate era that enabled human civilization.³⁸ The earth also has experienced its hottest temperatures in its earliest days from collisions with other rocky debris in the solar system.³⁹ Such collisions kept temperatures high enough to keep the planet in a molten state.⁴⁰ During these times, the average temperature was upward of 3,600° F.⁴¹ During these time periods, the

³² David R. Hodas, *Ecosystem Subsidies of Fossil Fuels*, 22 J. Land Use & Envtl. L. 599 (2007).

³³ Id.

³⁴ Id.

³⁵ Id.

³⁶ NASA, Climate Change: How Do We Know?, available at: <https://climate.nasa.gov/evidence/> (accessed April 25, 2020)

³⁷ Id.

³⁸ Id.

³⁹ NOAA, What's the hottest Earth's ever been? (2014) available at: <https://www.climate.gov/news-features/climate-ga/whats-hottest-earths-ever-been> (accessed April 25, 2020).

⁴⁰ Id.

⁴¹ Id.

planet was much warmer than it is now.⁴² This shows that significant temperature increases are normal and can be caused by many factors besides human intervention. The earth was very warm not only in the beginning, but also during other periods. For instance, Paleoclimatologists have long suspected that the middle Holocene period, roughly 5,000 to 7,000 years ago, was warmer than the present day.⁴³ They argue that changes in the Earth's orbit caused such temperature rises.⁴⁴ These changes occurred slowly over thousands – even millions – of years, altering the amount of solar radiation reaching each latitudinal band of Earth during each month.⁴⁵ Paleoclimatologists argue that these orbital changes can be measured, allowing for predictions that the Northern Hemisphere was warmer during the mid-Holocene period than it is today during the summer and colder during the winter.⁴⁶ Moreover, geologists say that between 600 and 800 million years ago, during the Neoproterozoic Era, the earth was so cold that ice sheets not only capped polar latitudes, but also may have extended all the way to sea level near the equator.⁴⁷ Thus, many argue that huge temperature changes usually happen due to external factors.

1.1. Role of human in worsening climate change

However, these arguments have been proven to be inaccurate, as human intervention has been found to be the main cause of current climate change.⁴⁸ The science has been developed to prove it. Earth-orbiting satellites and other technological advances clearly have demonstrated a

⁴² Id.

⁴³ NOAA, Mid-Holocene Warm Period – About 6,000 Years Ago, available at: <https://www.ncdc.noaa.gov/global-warming/mid-holocene-warm-period> (accessed April 25, 2020).

⁴⁴ Id.

⁴⁵ Id.

⁴⁶ Id.

⁴⁷ NOAA, What's the hottest Earth's ever been?, *supra*.

⁴⁸ NASA, Climate Change: How Do We Know?, *supra*.

rapid increase in climate change compared with other periods.⁴⁹ It has been demonstrated that over-production of carbon dioxide (CO₂) and other gases, which began with the birth of the Industrial Revolution in the mid-19th century, is the main cause of climate change, as the heat from the sun cannot leave the atmosphere due to these gases being trapped in the atmosphere.⁵⁰ NASA definitively has said that increased levels of greenhouse gases must have caused the earth to warm in response.⁵¹ They note that the ice cores in Greenland and Antarctica clearly indicate how the earth continually has been responding to changes in greenhouse gas levels.⁵² Much ancient evidence found in ocean sediments and tree rings also demonstrates that current climate change is occurring 10 times faster than the average rate of ice-age-recovery warming.⁵³

Thus, it has been found that fossil-fuel emissions released to generate energy have caused global climate change, posing a threat to all species on the planet. A large amount of CO₂ and other gases and chemicals are released into the atmosphere when carbon sources, such as petroleum, are burned at fossil fuel plants, remaining in the atmosphere for thousands of years.⁵⁴ Their danger lies in the fact that many of these chemicals can trap heat in the lower atmosphere through the greenhouse effect. Research has estimated that without these greenhouse gases, the average temperature of Earth's surface would be close to -18° Celsius (0° Fahrenheit), as opposed to the present average of 15° C (59° F).⁵⁵

⁴⁹ Id.

⁵⁰ Id.

⁵¹ Id.

⁵² Id.

⁵³ Id.

⁵⁴ U.S. EPA, *Overview of Greenhouse Gases*, (2019), available at:

<https://www.epa.gov/ghgemissions/overview-greenhouse-gases> (accessed Oct. 16, 2019).

⁵⁵ Qiancheng Ma, *Greenhouse Gases: Refining the Role of Carbon Dioxide* (1998), available at

https://www.giss.nasa.gov/research/briefs/ma_01/ (accessed Oct. 16, 2019).

Modern living has pressured the planet to release energy more than ever before – energy generated by burning fossil fuels, leading to releases of greenhouse gases into the atmosphere and worsening climate change.⁵⁶ When oil and other fossil fuels are burned, carbon combines with oxygen in the air to make CO₂, which is released in enormous amounts into the atmosphere.⁵⁷ Generally, the sun’s heat enters the planet’s atmosphere, then escapes into space, but these gases trap heat in the biosphere, resulting in global warming.⁵⁸ Furthermore, these gases, generated mainly by human activities, remain in the atmosphere semi-permanently, do not respond physically or chemically to temperature changes, and are described as “forcing” climate change.⁵⁹ Furthermore, excess nitrogen in the atmosphere, in the form of nitrogen oxides, eventually returns to the land and interacts with bodies of water.⁶⁰ This causes pollution, leading to harmful algal blooms and creating oxygen-deprived aquatic zones.⁶¹ In turn, the lowered pH levels in the water and excess ammonia are viewed as toxic to aquatic organisms, jeopardizing their survival.⁶² Thus, organisms exposed to these phenomena either must adapt or face extinction.⁶³

Burning fossil fuels releases a significant amount of greenhouse gases. It is estimated that 3.4 billion tons of oil, 4.5 billion tons of coal and natural gas in an amount equivalent to 2.02 billion tons of oil – along with wood and other forms of traditional biomass at a rate equivalent

⁵⁶ Khan Academy, *Human impact on ecosystems review*, available at <https://www.khanacademy.org/science/high-school-biology/hs-ecology/hs-human-impact-on-ecosystems/a/hs-human-impact-on-ecosystems-review> (accessed Nov. 15, 2019).

⁵⁷ NASA. *The Causes of Climate Change*, available at <https://climate.nasa.gov/causes/> (Accessed Nov. 15, 2019).

⁵⁸ Khan Academy, *Human impact on ecosystems review*, *supra*.

⁵⁹ NASA. *The Causes of Climate Change*, *supra*.

⁶⁰ EPA. *The Sources and Solutions: Fossil Fuels*, available at <https://www.epa.gov/nutrientpollution/sources-and-solutions-fossil-fuels> (accessed Nov. 15, 2019).

⁶¹ *Id.*

⁶² *Id.*

⁶³ Khan Academy, *Human impact on ecosystems review*, *supra*.

to 0.9 billion tons of oil – are created.⁶⁴ As a result, greenhouse gases in the atmosphere have increased by 60% in the past 150 years.⁶⁵ Going further back, compared with 1750, greenhouse gases have increased by 310%.⁶⁶ It is estimated that energy demands will increase from 12.5 to 25 gigatons of oil equivalent by the year 2035.⁶⁷ Such demand would cause a corresponding rise in greenhouse gases, threatening the environment globally.⁶⁸ This threat is illustrated by predicted temperature increases ranging from 1 to 30° C worldwide.⁶⁹ In the United States, the average temperature is estimated to rise 3° C, which would result in more heat waves and an increased risk of prolonged droughts.⁷⁰

Many climate-change skeptics have argued that climate change is uncertain, as is the extent to which it would affect society.⁷¹ After the fall of the Soviet Union roughly 30 years ago, more and more global advocates have issued warnings – at the 1992 Rio Earth Summit and elsewhere – leading many skeptics to say that the “green threat” has replaced the “red threat.”⁷² It has been argued that because climate change’s potential damage is uncertain, it is unwise to make any cost-benefit analyses. For instance, the three integrated assessment models that the U.S. government uses have provided different estimates of these effects during the Obama

⁶⁴ Hodas, supra, at 607

⁶⁵ Id.

⁶⁶ James Jeffers, *Climate Change and the Law: Reducing Ireland's Greenhouse Gas Emissions*, 3 Galway Student L. Rev. 51 (2007).

⁶⁷ N. Abas, A. Kalair, & N. Khan, *Review of fossil fuels and future energy technologies*, 69 Futures 31-49 (2015).

⁶⁸ Hodas, supra.

⁶⁹ Susan Charles, *Climate Change: Impacts on Food Safety*, 26 Nat. Resources & Env't 44 (2011).

⁷⁰ Id.

⁷¹ John Dryzek, Richard Norgaard, & David Schlosberg, *The Oxford Handbook of Climate Change and Society*, Oxford University Press 145-146 (2011).

⁷² Id.

administration.⁷³ This has led many experts to argue that making projections in the light of such uncertainty is essentially worthless.⁷⁴

However, the unknown results from climate change do not mean that it will not be catastrophic, i.e., climate change should be seen as a crisis, and the uncertainty simply reflects the extent to which climate change is harmful. Thus, climate change always is harmful, even if the harm has not been identified. Many climate-change skeptics often refer to uncertainty to forestall mitigative action.⁷⁵ For political or ideological reasons, the uncertainty arguments often are exaggerated to justify inaction.⁷⁶ Many psychological factors can explain climate-change skeptics' tendency to focus on climate change's uncertainty, even if it always is harmful.⁷⁷ Among them is the fact that conflicts between scientists generate more doubts in participants' minds than agreed-upon, but imprecise, estimates, thereby weakening individuals' trust in the experts.⁷⁸

1.2. Impact of climate change on human well-being

Climate change affects not only human health, but also all aspects of life. For example, individuals have different vulnerabilities to change and susceptibility to diseases.⁷⁹ Thus, hygiene practices that involve clothing and medical traditions and affect human health definitely will suffer.⁸⁰ Moreover, land use plays a role in the distribution of disease carriers, and climate

⁷³ Cass R. Sunstein, Sebastian Bobadilla-Suarez, Stephanie C. Lazzaro, & Tali Sharot, *How People Update Beliefs about Climate Change: Good News and Bad News*, 102 *Cornell L. Rev.* 1431 (2017).

⁷⁴ *Id.*

⁷⁵ Stephan Lewandowsky, Naomi Oreskes, James Risbey, & Michael Smithson, *Seepage: Climate change denial and its effect on the scientific community*, 33 *Global Environmental Change* 1-13 (2015).

⁷⁶ *Id.*

⁷⁷ *Id.*

⁷⁸ *Id.*

⁷⁹ Martin Beniston, *Climate change and its impacts: Growing stress factors for human societies*, 92 *Int'l Rev. Red Cross* 557 (2010).

⁸⁰ *Id.*

influences their range and affects disease outbreaks' timing and intensity.⁸¹ Humans long have known of the direct link between health and climate. For example, fevers vary seasonally based on weather.⁸² Internal organs' health also depends to some extent on weather, as human thermoregulation is linked directly to the circulatory system.⁸³ Furthermore, when the temperature rises, parasites that affect humans are more abundant, resulting in threats to human health.⁸⁴ This issue is more serious for poor countries that tend to lie in the tropics or subtropics.⁸⁵ For instance, hookworm disease affects approximately 500 million people in tropical and subtropical regions through hookworm larvae, the life cycle of which is related directly to temperature and soil moisture.⁸⁶

1.3. Impact of climate change on biodiversity

Climate change also has been affecting biodiversity and entire ecosystems adversely as well.⁸⁷ It ultimately affects species distribution; increases the intensity of pests and diseases; alters precipitation, flood, drought, water temperature, stream-flow, and water-quality patterns; and alters the weather over and temperature of sensitive coastal and marine ecosystems, such as coral reefs.⁸⁸ For example, Africa – which contains mostly forests, trees, and shrubs – is a continent in which climate change threatens biodiversity.⁸⁹ Specifically, reduced rainfall and increasing fires will stem from climate change in the semi-arid and sub-humid woodlands and

⁸¹ Id.

⁸² Andreas Matzarakis & Bas Amelung, *Physiological Equivalent Temperature as Indicator for Impacts of Climate Change on Thermal Comfort of Humans*, Seasonal Forecasts. 30 Climatic Change and Human Health, 161-172 (2008).

⁸³ Id.

⁸⁴ William W. Kellogg & Robert Schware, *Society, Science, and Climate Change*, 60 Foreign Aff. 1076 (1982).

⁸⁵ Id.

⁸⁶ Id.

⁸⁷ David R. Hodas, *Ecosystem Subsidies of Fossil Fuels*, 22 J. Land Use & Envtl. L. 599 (2007).

⁸⁸ Id.

⁸⁹ Id.

savannas.⁹⁰ Climate change also will affect ecosystems' habitat formation, soil fertility, and carbon sequestration. Carbon sequestration is the process of trapping and storing atmospheric carbon dioxide in the earth's soil. Carbon sequestration is used to reduce the overall amount of atmospheric carbon dioxide, thereby reducing the effects from global climate change. In short, climate change adversely harms every type of ecosystem and every species on this planet.

Many industrial practices have caused significant damage by contributing to climate change, one of which is deforestation.⁹¹ Forests are carbon sinks in their natural states, as they store more carbon than they release.⁹² In fact, forests use carbon in a beneficial way that serves the ecosystem.⁹³ For instance, trees convert carbon into stems and roots, while releasing oxygen.⁹⁴ In fact, more than a quarter of the earth's land area is forest, giving it the potential to store 40% of soil carbon and about three quarters of the carbon in terrestrial plants.⁹⁵ Thus, deforestation can lead to significant carbon releases into the atmosphere. It is estimated that about 5.9 GtCO₂ (gigatons of carbon dioxide) will be released annually as a result of deforestation, comprising 17% of all annual anthropogenic GHG emissions.⁹⁶ Thus, saving forests plays an important role in climate change mitigation. Forest fires are another issue that forests faces, as they can kill some or all trees in a forest.⁹⁷ The nature of fire is related to the evolutionary development of fire regimes that lead to climatic conditions such as drought.⁹⁸

Forest fires' danger comes from the fact that burning forests release CO₂ in large amounts over

⁹⁰ Id.

⁹¹ Congressional Research Service, Deforestation, and Climate Change. (24 March, 2010)

⁹² Id.

⁹³ Id.

⁹⁴ Id.

⁹⁵ Id.

⁹⁶ Id.

⁹⁷ Id.

⁹⁸ Id.

short periods, leading to increases in temperatures and more forest fires.⁹⁹ Fires not only release CO₂ into the atmosphere, but also produce large quantities of fine particulates and aerosols, which affect human health.¹⁰⁰

1.4. Impact of climate change on sea levels:

Moreover, rising sea levels are another major effect from climate change that affects the entire ecosystem.¹⁰¹ This happens as a result of thermal expansion of water and the additional influx of freshwater into oceans, as well as outflows of freshwater from ice sheets into oceans.¹⁰² It is estimated that the global sea level will rise by 50-100 cm by the end of the century.¹⁰³ This threatens many ecosystems and cities' existence, e.g., through flooding. A large volume of the world's population lives on or near a seashore within the critical meter above sea level, such as the Maldives, Bangladesh, and Indonesia.¹⁰⁴ Their existence will be threatened by climate change and the rising sea level; thus, they might relocate to other parts of the world, which can cause other serious issues that will be discussed below. This issue is not confined to developing countries, but also to developed countries, such as the U.S., where rising sea levels threaten many regions. For instance, Isle de Jean Charles, home to the Biloxi-Chitimacha-Choctaw tribe of Native Americans, lost 98 percent of its land to rising sea levels since 1955, and its residents have been dubbed "America's first climate refugees."¹⁰⁵ This clearly shows that sea level rise is a crisis that affects not only human welfare, but also people's very existence.

⁹⁹ Id.

¹⁰⁰ Id.

¹⁰¹ Martin Beniston, *Climate change and its impacts: Growing stress factors for human societies*, 92 Int'l Rev. Red Cross 557 (2010).

¹⁰² Id.

¹⁰³ Id.

¹⁰⁴ Id.

¹⁰⁵ MICHAEL ISAAC STEIN, How to Save a Town From Rising Waters, available at: <https://www.citylab.com/environment/2018/01/how-to-save-a-town-from-rising-waters/547646/> (April 25, 2020).

Moreover, climate change also has affected oceans significantly, which can threaten humans directly.¹⁰⁶ Oceans cover 72% of the Earth's surface and a diverse global marine ecosystem.¹⁰⁷ This marine diversity also has been linked to human survival, providing a key source of food through fisheries and aquaculture.¹⁰⁸ It also can provide humans with financial benefits due to the commerce that marine life generates. Marine life's importance is maximized in countries that historically rely heavily on the sea to provide food, such as Japan. It is estimated that about 33,629 species live in Japanese waters.¹⁰⁹ Other reports have put that number above 155,542, as these species have been identified, but undescribed.¹¹⁰ Thus, many countries like Japan rely heavily on water and their habitats. This reliance is reflected in these countries' consumption of seafood, e.g., Japan's average per capita consumption of seafood is 66.9kg per year, four times the world's average.¹¹¹ Another example that illustrates healthy coastal and ocean resources' importance can be found in the U.S. economy. According to the National Oceanic and Atmospheric Administration, under the U.S. Department of Commerce, 14% of U.S. counties are adjacent to coastlines and produce 45 percent of their GDP from ocean or Great Lakes resources.¹¹² It then could be argued that ocean resources are vitally important to many countries that are adjacent to coasts, and that climate change threatens their survival and well-being.

1.5. Impact of climate change on animals' extension

¹⁰⁶ Robin Warner, *Oceans in Transition: Incorporating Climate-Change Impacts into Environmental Impact Assessment for Marine Areas beyond National Jurisdiction*, 45 Ecology L.Q. 31 (2018).

¹⁰⁷ Id.

¹⁰⁸ Id.

¹⁰⁹ Katsunori Fujikura et al. *Marine Biodiversity in Japanese Waters*, 5 PLOS (2010).

¹¹⁰ Id.

¹¹¹ Id.

¹¹² National Oceanic and Atmospheric Administration U.S. Department of Commerce, How important is the ocean to our economy? (2016) available at: <https://oceanservice.noaa.gov/facts/oceaneconomy.html> (March 15, 2020).

It has been argued that some animals can adapt to climate change. When spring arrives earlier, insects emerge earlier, leading to many birds laying their eggs to match insect availability so that their young will have food.¹¹³ It has been noted that Australian female butterflies' annual spring emergence from their cocoons has shifted 1.6 days earlier per decade, corresponding to temperatures rising 0.14° C per decade.¹¹⁴ Thus, many animals have altered their behavior to adapt to climate change. Many other examples could be cited to illustrate animals' behavioral changes and abilities to adapt to the new climate. For instance, coral reefs, comprising colonies of individual animals called polyps, have witnessed extensive bleaching when the ocean becomes warm.¹¹⁵ When bleaching occurs, the corals expel colorful symbiotic algae that live within them.¹¹⁶ Scientists noticed that corals around American Samoa were not bleaching, even when the water was warm.¹¹⁷ They exposed the corals to higher temperatures in their labs and found that their heat tolerance had improved by 32.5%, i.e., they had become more adaptable to ocean conditions.¹¹⁸ It then could be argued that species, by their nature, can adapt to climate change, which is why many species have survived as earth went through many significant climate changes throughout its lifetime.

Thus, climate change is not confined to land-based ecosystems and affects marine ecosystems as well. Climate change in marine ecosystems includes increasing water temperatures, storm severity, and overall ranges in weather events. Marine climate change also increases thermal and other stresses on species.¹¹⁹ As a result of increasing temperatures, many

¹¹³ Renee Cho, What Helps Animals Adapt (or Not) to Climate Change?, Columbia University (2018).

¹¹⁴ Id.

¹¹⁵ Id.

¹¹⁶ Id.

¹¹⁷ Id.

¹¹⁸ Id.

¹¹⁹ Robin Warner, *Oceans in Transition: Incorporating Climate-Change Impacts into Environmental Impact Assessment for Marine Areas beyond National Jurisdiction*, 45 Ecology L.Q. 31 (2018).

marine species have relocated, which likely will lead to their extinction.¹²⁰ The distribution of marine species is the result of their thermal tolerance, so if the temperature increases, these species must relocate or face extinction. Thus, these species would face extinction whether they remain in their original habitat or move to another one. Scholars predict a 50% reduction in the overall number of fish species by 2055, which would lead to adverse conditions in countries whose cultures depend on fish for food, such as Asian countries.¹²¹

Amphibians are experiencing a significant decline in terms of population rates.¹²² The International Union for Conservation of Nature (IUCN) says that almost one-third of the world's amphibian species are threatened with extinction.¹²³ Thus, roughly 2,000 species would comprise a mass extinction event on par with those from the past detected in the geological record.¹²⁴ The Global Amphibian Assessment (GAA) says that much of this decline in amphibians is attributable to anthropogenic causes, such as habitat loss and overexploitation.¹²⁵ It has been argued that the *Batrachochytrium dendrobatidis* fungus, also referred to as "Bd," or chytrid fungus, is the main reason for these enigmatic amphibian declines.¹²⁶ It is known that Bd has caused the extinctions of about 200 frog species found in undisturbed areas.¹²⁷ Bd is a pathogenic fungus that causes chytridiomycosis, a skin infection that thickens superficial skin layers, compromising a frog's osmotic regulation, leading to death by cardiac arrest.¹²⁸ What makes Bd so destructive to frogs is the fact that amphibians rely heavily on their skin, through

¹²⁰ Id.

¹²¹ Warner, *supra*.

¹²² Ana L. Porzecanski & Adriana Bravo, *Applying critical thinking to the amphibian decline problem*, 8 American Museum of Natural History 44-53 (2018).

¹²³ Id.

¹²⁴ Id.

¹²⁵ Id.

¹²⁶ Id.

¹²⁷ Id.

¹²⁸ Id.

which they conduct most of their gas exchange with the environment.¹²⁹ Essentially, amphibians' skin is their primary physiological interface with the environment, thereby requiring them to live in moist, humid, or aquatic environments.¹³⁰ Thus, without climate change, which makes regions warmer, Bd would not be as effective, as it thrives in higher temperatures.¹³¹ Moreover, this means that even though Bd is causing diseases in amphibians, its efficacy requires temperature increases that climate change facilitates.¹³² The optimal temperature range for Bd is 17–25 °C, and the optimum temperature is 23 °C. Thus, if the temperature lies below or above this range, the fungus dies.¹³³

Climate change also has affected wild animals and has threatened many species with extinction. It has been proven through the fossil record that five extinctions, comprising 50% of all the planet's animals, have occurred in the previous 540 million years.¹³⁴ Scientists argue that four of these mass extinctions corresponded with global temperature peaks.¹³⁵ Current climate change threatens all living species even more than the extinctions faced millions of years ago.¹³⁶ This threat comes from the fact that the planet's temperature is increasing more than before, and that since the 1970s, the earth's temperature has increased, on average, by 0.6° C.¹³⁷ The Intergovernmental Panel on Climate Change says that the temperature would rise by up to 6° C this coming century.¹³⁸ This clearly shows that climate change affects not only human beings, but also animals, which humans rely on for their food and welfare.

¹²⁹ Id.

¹³⁰ Id.

¹³¹ Id.

¹³² Id.

¹³³ Id.

¹³⁴ Andrew Knight, *The Global Guide to Animal Protection*, University of Illinois Press 254-256 (1st ed., 2013).

¹³⁵ Id.

¹³⁶ Id.

¹³⁷ Id.

¹³⁸ Id.

Many examples can be provided to explain climate change's threat to animals. For instance, polar bears depend on Arctic sea ice for their survival.¹³⁹ Due to increasing temperatures, these bears must move north to survive and find stable platforms.¹⁴⁰ This would make these bears' ability to hunt more difficult, as they cannot hunt on open water.¹⁴¹ This issue can be more serious for pregnant female bears, which are forced to leave the ice to find their preferred terrestrial den areas, which are far away from the ice, as the ice continually drifts farther from land.¹⁴² Thus, these bears would face food shortages, thereby threatening their survival. Another example of animals that face the threat of extinction from climate change is the British ring ouzel, whose numbers have decreased by 58% just from 1998 through 1999.¹⁴³ This decline is a consequence of climate change, as these animals could not continue to live in this warm environment.¹⁴⁴ More specifically, the food shortages caused by extreme rainfall led to a decrease in food availability, thereby threatening their survival.¹⁴⁵ Almost all animal species have faced declines in their existence due to climate change, making the issue more serious than if this extinction threatened only certain species. One dramatic study points out that up to 37% of all species could face extinction by 2050 due to climate change.¹⁴⁶

Animal extinctions directly affect not only human health, but also the economy. It is estimated that \$360 billion will be lost annually due to the extinction of many species as a result of climate change.¹⁴⁷ These losses were projected without taking into account the value of some

¹³⁹ Wayne Hsiung & Cass R. Sunstein, *Climate Change and Animals*, 155 U. Pa. L. Rev. 1695 (2007).

¹⁴⁰ *Id.*

¹⁴¹ *Id.*

¹⁴² *Id.*

¹⁴³ *Id.*

¹⁴⁴ *Id.*

¹⁴⁵ Colin M. Beale et al., *Climate Change May Account for the Decline in British Ring Ouzels *Turdus Torquatus**, 75 J. ANIMAL ECOLOGY 826, 827-28 (2006).

¹⁴⁶ Chris D. Thomas et al., *Extinction Risk from Climate Change*, 427 NATURE 145, 145 (2004).

¹⁴⁷ Robert Costanza et al., *The Value of the World's Ecosystem Services and Natural Capital*, 387 NATURE 253, 259 (1997).

habitats because it arguably entails non-use of the habitats, not their value.¹⁴⁸ This study seems to be optimistic, as it breaks down the value of all ecosystem habitats and treats losses individually. Another study, published in 1997, avoids the problem of breaking down the value of all habitats in the ecosystem, instead reporting that U.S. biodiversity is valued at \$389 billion in 2005 dollars, compared with \$3.5 trillion for the world's biodiversity.¹⁴⁹ This study seems to link climate change's impact to the ecosystem as a whole and the extent to which it would affect countries financially. It has been estimated that the loss of some habitats due to climate change would comprise up to \$144 billion in U.S. GDP and up to \$1322 billion for the world.¹⁵⁰ These predicted financial losses were attributed to the loss of some habitats due to climate change, not climate change's total impact on other sectors, such as the agriculture or transportation sector, as losses will increase.

1.6. Argument of climate change skeptics'

One might argue that CO₂ increases have made the earth greener, which eventually will lead to cooler temperatures.¹⁵¹ It also has been noted that over the past 35 years, a significant greening has occurred globally, causing CO₂ increases in the atmosphere, as plants are the principal consumers of CO₂.¹⁵² An international team of 32 authors from 24 institutions in eight countries conducted studies using satellite data from NASA's moderate resolution imaging spectrometer to examine the planet's vegetative regions.¹⁵³ An increase in leaves on plants and

¹⁴⁸ Id.

¹⁴⁹ Id.

¹⁵⁰ Daniel Pimentel et al., *Economic and Environmental Benefits of Biodiversity*, 47 *BIOSCIENCE* 747, 748 tbl.2 (1997).

¹⁵¹ Samson Reiny, CO₂ is making Earth greener—for now, Available at: <https://climate.nasa.gov/news/2436/CO2-is-making-earth-greener-for-now/> (Accessed April 12, 2020).

¹⁵² Id.

¹⁵³ Id.

trees equivalent in area to two times the continental U.S. was found.¹⁵⁴ More specifically, the green leaves rely on sunlight to produce sugars, which are the plants' principal food source.¹⁵⁵ This happens through photosynthesis, in which CO₂ is drawn in from the air with water and nutrients tapped from the ground. Thus, the increase in CO₂ increases photosynthesis, spurring plant growth.¹⁵⁶

This argument seems to ignore many elements that lead to greening the planet other than CO₂. Carbon dioxide fertilization is not the only reason for an increase in plant life on earth; many other elements also are important, such as nitrogen and land-cover changes.¹⁵⁷ Moreover, climate change by way of global temperature, precipitation, and sunlight changes all contribute to the greening effect.¹⁵⁸ Many studies have been conducted to determine whether CO₂ is the main reason why plants grow.¹⁵⁹ They isolated CO₂ and all other variables using several computer models that mimic plant growth observed in satellite data.¹⁶⁰ It was found that CO₂ is responsible for 70 percent of the greening effect, i.e., CO₂ is not the only reason behind plant growth, as other variables play an important role in increasing plant growth, such as nitrogen, which comprises 9% of the process of growing plants.¹⁶¹ This clearly shows that although CO₂ is the most important element in growing plants, this compound by itself, without other variables, is not enough to explain the increased greening noticed on earth.

Moreover, CO₂ increases affect many aspects of the ecosystem that humans rely on, such as soil. The Natural Resources Conservation Service defines *soil* as “a living and life-giving

¹⁵⁴ *Id.*

¹⁵⁵ *Id.*

¹⁵⁶ *Id.*

¹⁵⁷ *Id.*

¹⁵⁸ *Id.*

¹⁵⁹ *Id.*

¹⁶⁰ *Id.*

¹⁶¹ *Id.*

natural resource.”¹⁶² Soil plays an important role in conservation of the world’s ecosystem. Healthy soil, combined with proper technique, can increase overall farm productivity and, overall, positively affects surrounding ecosystems. Awareness of these issues is of the utmost importance when considering the world’s ever-growing population. Restricted access to fertile soil also may affect adversely the global fight to reduce, and eventually reverse, climate change. Climate change has caused, and continues to cause, serious damage to soil health, which depends on certain climate conditions, and when these conditions change, soil health may change negatively.¹⁶³ For instance, when the climate becomes warmer, soil loses excess carbon, which may result in poor soil structure and stability, reduced topsoil-water-holding capacity, limited nutrient availability, and increased erosion.¹⁶⁴

1.7. Impact of climate change on soil health

Soil health simply refers to soil’s capacity to function as a vital living system, maintaining water and air quality and promoting plant and animal health.¹⁶⁵ Thus, reduced soil health most certainly would threaten ecosystems and, most importantly, their organisms, including plants, animals, and humans. For soil to be viewed as “healthy,” it must be stable, water must be infiltrated, and the microbial life within it must be diverse.¹⁶⁶ Soil health is extremely important, as plants rely on soil, and it is known that plants capture energy from the

¹⁶² “Soil Health.” Natural Resources Conservation Services. Available at: <https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/soils/health/> (Accessed March 2, 2020).

¹⁶³ Rajib Karmakar, Indranil Das, Debashis Dutta, & Amitava Rakshit, *Potential Effects of Climate Change on Soil Properties: A Review*, 4 Science International, 51-73 (2016).

¹⁶⁴ Id.

¹⁶⁵ John W. Doran & Michael R. Zeiss, *Soil health and sustainability: Managing the biotic component of soil quality*, 15 Applied Soil Ecology 3-11 (2000).

¹⁶⁶ Diane Allen, Bhupinder Singh, & Ram Dalal, *Soil Health Indicators Under Climate Change: A Review of Current Knowledge*, 29 Soil Health and Climate Change, 25-45 (2011).

sun for photosynthesis, which benefits the entire ecosystem. Thus, if soil is not healthy, plant growth will shrink, providing less total energy for the ecosystem's organisms.

Climate change also alters soil characteristics – such as its water volume, temperature, and organic matter content – in many different ways.¹⁶⁷ Beginning with soil water, climate change can affect soil water, as increasing temperatures lead to evapotranspiration loss of water from the soil. According to the Intergovernmental Panel on Climate Change (IPCC), global temperatures are expected to rise 1.1 to 6.4 ° C during the 21st century, which may lead to significantly different rainfall patterns.¹⁶⁸ In some regions, rain totals will decrease, which immediately can lead to water shortages and a lack of water infiltration into the soil. Moreover, filtration losses and groundwater recharge are other consequences from reduced rain.¹⁶⁹ This could be a serious issue, especially for Western states, because geographically Western states rely heavily on groundwater. Large cities such as San Antonio rely almost entirely on groundwater for their survival.¹⁷⁰ Soil water relies on the climate system through carbon, nitrogen, and hydrogen cycles.¹⁷¹ For these reasons, it can be perceived that any change in climate most likely would affect the soil's water negatively, and more broadly, the soil's overall health.

Moreover, soil temperature is an important feature of soil health, which climate change affects significantly.¹⁷² Unfortunately, soil temperature historically has been reported rarely, although it is a very important measure in evaluating soil health.¹⁷³ It has been reported that any

¹⁶⁷ Karmakar, Das, Dutta, & Rakshit, supra

¹⁶⁸ Eric C. Brevik, *Climate Change, Soils, and Human Health*, 15 EGU General Assembly Conference Abstracts (2013).

¹⁶⁹ Karmakar, Das, Dutta, & Rakshit, supra

¹⁷⁰ Amy Hardberger, *World's Worst Game of Telephone: Attempting to Understand the Conversation between Texas' Legislature and Courts on Groundwater*, 43 Tex. Envtl. L.J. 257, 304 (2013)

¹⁷¹ Karmakar, Das, Dutta, & Rakshit, supra

¹⁷² *Id.*

¹⁷³ *Id.*

change, or general increase, in air temperature inevitably will lead to an increase in soil temperature.¹⁷⁴ Soil temperature arguably can be viewed as the most important aspect of all soil processes.¹⁷⁵ Under warmer soil temperatures, the soil process accelerates, i.e., organic matter decomposes, microbiological activity increases, and nutrients are released more quickly than they normally should be, increasing the nitrification rate.¹⁷⁶ Qian et al. have supported these findings in Canada, where they found a relationship between soil temperature and air temperature that affects snow cover depth in some regions.¹⁷⁷

Third, the soil's organic matter level, without a doubt, is the most important component of soil health.¹⁷⁸ An increase in organic matter can improve soil quality by holding oxygen and other storage nutrients.¹⁷⁹ Organic matter also is important to microflora, which play a critical role in soil health and productivity.¹⁸⁰ Some experts have reported that organic matter in the soil has decreased due to climate change, and that this reduction has led to soil erosion.¹⁸¹ The importance of organic matter in soil also can be viewed in the context of its ability to act as both a carbon source and a sink in the biosphere during climate change.¹⁸² Climate change has affected all these organic-matter benefits significantly, causing soil carbon to decrease overall, with a loss of 4 Pg global grasslands in only 50 years.¹⁸³ Moreover, soil's chemical process has

¹⁷⁴ Id.

¹⁷⁵ Id.

¹⁷⁶ Id.

¹⁷⁷ Budong Qian, Edward G. Gregorich, Sam Gameda, David W. Hopkins, & Xiaolan L. Wang, *Observed soil temperature trends associated with climate change in Canada*, 116 *Journal of Geophysical Research: Atmospheres* 1-16 (2011).

¹⁷⁸ Karmakar, Das, Dutta, & Rakshit, supra

¹⁷⁹ Id.

¹⁸⁰ Id.

¹⁸¹ Id.

¹⁸² Id.

¹⁸³ Id.

increased rapidly due to external climate change, which has led to many consequences, such as loss of salts and other nutrients.¹⁸⁴

1.8. Impact of climate change on food production

As a result of climate change's effects on the ecosystem and soil health, food production also has been affected significantly. The IPCC finds that climate change will affect important crops – such as rice and wheat, which are grown in tropical and temperate areas, respectively – negatively, with local temperature increases of 2° C or more.¹⁸⁵ In fact, the impact already has occurred, fueling some arguments that decreasing the temperature by 1.5° C would be insufficient to stop agricultural productivity loss.¹⁸⁶ It has been argued that even if countries exercised extremely aggressive mitigation efforts, the temperature still would increase by at least 2° C above pre-industrial levels during the 21st century.¹⁸⁷ A study indicates that by 2080, agricultural output would decline by 24% in Latin America, 28% in Africa, and 19% in Asia.¹⁸⁸

In some regions, the percentage of losses will be attributed more to location. For instance, India's agricultural output would decrease by 38%, and some African countries would witness a 50% decrease.¹⁸⁹ Thus, climate change's impact on food production is a crisis that must be addressed due to steady population growth. It is estimated that the world's population will grow from 7 billion today to 9 billion by 2050.¹⁹⁰ Thus, the food industry must increase output by 40%

¹⁸⁴ Id.

¹⁸⁵ Jonathan Verschuuren, *The Paris Agreement on Climate Change: Agriculture and Food Security*, 7 Eur. J. Risk Reg. 54 (2016).

¹⁸⁶ Id.

¹⁸⁷ Id.

¹⁸⁸ WILLIAM R. CLINE, *GLOBAL WARMING AND AGRICULTURE: ESTIMATES BY COUNTRY* 79 (2007).

¹⁸⁹ Anthony Nyong, *Climate Change Impacts in the Developing World: Implications for Sustainable Development*, in *CLIMATE CHANGE AND GLOBAL POVERTY: A BILLION LIVES IN THE BALANCE?* 47-51 (Lael Brainard et al., eds., 2009).

¹⁹⁰ Verschuuren, *supra* at 55.

to satisfy the demand from this population growth.¹⁹¹ This goal is difficult to achieve due to climate change, and more than 50% of some regions, such as Sub-Saharan Africa, will be affected negatively.¹⁹² In fact, an increase in food production would lead to more pollution, thereby exacerbating climate change.¹⁹³

Not only is food production a victim of climate change, but food access is also a serious issue that affects many people.¹⁹⁴ Food access simply refers to the amount of food that individuals need to meet their nutritional needs.¹⁹⁵ It also refers to the extent to which food that can meet individuals' nutritional needs is affordable.¹⁹⁶ This issue is critical because most individuals are not producing their own food, but rather buying it.¹⁹⁷ Thus, food prices would determine whether people can receive enough food to satisfy their needs. This also means that if demand increases, the price would increase as well; thus, many poor people might not be able to afford food that they once were able to acquire. Climate change would harm the agriculture industry, as explained above, while the population continues to grow, i.e., households would face a crisis in terms of food access, and their vulnerability to food insecurity would increase.¹⁹⁸

The issue of food production also affects labor in many counties, especially among those that rely heavily on agriculture in their GDP. For instance, India's agricultural sector is its economy's Achilles heel.¹⁹⁹ Agriculture's contribution to the economy is 17-18 percent of GDP, but 60 percent of labor.²⁰⁰ Thus, if climate change affects the agriculture industry, most of the

¹⁹¹ Id.

¹⁹² Id.

¹⁹³ Id.

¹⁹⁴ Susan Charles, *Climate Change: Impacts on Food Safety*, 26 Nat. Resources & Env't 44 (2011).

¹⁹⁵ Id.

¹⁹⁶ Id.

¹⁹⁷ Id.

¹⁹⁸ Id.

¹⁹⁹ Hans V. Basil, *Impact of Climate Change on Indian Agriculture* (May 12, 2014).

²⁰⁰ Id.

labor force would be harmed, which would affect the whole economy, as well as the country's stability.²⁰¹ It is estimated that by 2100, up to 40% of the nation's crop production would be lost.²⁰² Thus, most of the labor will pose more difficulties for Indians.²⁰³ This issue would lead to climate change inflation; thus, laborers would not be able to satisfy their basic needs, turning them into climate refugees.²⁰⁴

1.9. Impact of climate change on water quality

Climate change has affected many other essential resources, such as water. Throughout history, water has been the main source of human survival, satisfying drinking needs, as well as agricultural needs. Thus, it is no surprise that most civilizations that have endured were located near water sources, such as the Roman Empire. Thus, water is not only a valuable resource, but also a sacred resource that humans rely on for survival. To understand how climate change affects freshwater, which is suitable for drinking, an understanding of global water distribution is required. On this planet, approximately 98% of the water is saltwater, while the remaining 2% is freshwater.²⁰⁵ Of this freshwater, approximately 70% comes from snow, while the remaining 30% is groundwater, with only 0.5% surface-based, cradled in lakes and rivers.²⁰⁶ This shows that only a small portion of water is surface-based, which many low-income populations rely on for drinking water; thus, any negative effects on this source could endanger large populations.²⁰⁷

²⁰¹ Id.

²⁰² Id.

²⁰³ Id.

²⁰⁴ Id.

²⁰⁵ Hany Besada, Fatima Denton, & Benjamin O'Bright, *Development in Africa: Refocusing the lens after the Millennium Development Goals*, Bristol University Press 315-344 (1ed, 2015).

²⁰⁶ Id.

²⁰⁷ Id.

To describe the issue of climate change's impact on water quality, it is important to understand how CO₂ has been integrated with water during the Industrial Revolution.²⁰⁸ It is estimated that one-third of the CO₂ released from fossil fuels dissolves in oceans, which are viewed as the largest "carbon sinks."²⁰⁹ When CO₂ dissolves in the ocean, it reacts with seawater to form carbonic acid.²¹⁰ Oceans naturally have a pH of 8.16, and since the Industrial Revolution began, the pH has decreased by 0.1.²¹¹ This number appears small because the pH scale is logarithmic, but this means that oceans have become 30% acidic in the past 250 years.²¹² It is expected that the ocean's pH would drop another 0.3 to 0.4 units by the end of the century.²¹³ This would mean that by the year 2100, the logarithmic value of the ocean would be 120% compared with the present day, which would seriously affect not only ocean species, but also humans' health and their main drinking-water source.

Water quality is tied not only to increased CO₂ levels, but also to increases in global temperature. Water-temperature increases change water's chemical reactivity.²¹⁴ This can cause water-quality standards in water bodies to suffer.²¹⁵ Moreover, when water becomes warmer, it is less able to carry oxygen, thereby affecting all animal life.²¹⁶ Researchers at the University of Copenhagen in Denmark said the oceans will continue to lose the capacity to hold oxygen, leading to more frequent "dead zones" (hypoxic zones), which support little to no life.²¹⁷ It is projected that high water temperatures could cause many forms of water pollution, such as lost

²⁰⁸ Robin Kundis Craig, *The Clean Water Act on the Cutting Edge: Climate Change and Water-Quality Regulation*, 24 *Nat. Resources & Env't* 14 (2009).

²⁰⁹ *Id.*

²¹⁰ *Id.*

²¹¹ *Id.*

²¹² *Id.*

²¹³ *Id.*

²¹⁴ *Id.*

²¹⁵ *Id.*

²¹⁶ *Id.*

²¹⁷ *Id.*

nutrients, dissolved organic carbon, pathogens, pesticides, and salts.²¹⁸ It also has been projected that high temperatures would increase bacterial growth in global water resources, thereby affecting human health.²¹⁹

Increased rainfall from climate change also can affect water quality. For instance, in Northeast regions, increases in heavy-precipitation events would lead to water infrastructure problems because increasing water volumes would overwhelm water treatment plants and sewer systems.²²⁰ Heavy downpours also would lead to increased amounts of runoff into rivers, dumping sediment, pollutants, and other materials into water supplies and making them unsafe for human consumption, thereby requiring water treatment.²²¹ In fact, increased rainfall also would lead to increases in levels of these pollutants in water supplies and boost erosion, leading to deteriorating water quality.²²² Moreover, escalated occurrences of lower river flows arguably would decrease contaminant-dilution capacity, which would lead to higher pollutant concentrations, especially in areas that struggle with climate-change-induced runoff reductions.²²³

Water quality is not the only climate-change issue, as water shortages also present a problem that must be addressed, especially with the planet's steady population growth. It is known that climate change already has altered water resources' quantity and quality.²²⁴ This includes changes in precipitation patterns, warmer temperatures, increased flooding in some

²¹⁸ Besada, Denton, & O'Bright, *supra*.

²¹⁹ *Id.*

²²⁰ EPA, Climate Impacts on Water Resources, available at: <https://19january2017snapshot.epa.gov/climate-impacts/climate-impacts-water-resources.html#main-content> (accessed March 20, 2020).

²²¹ *Id.*

²²² Besada, Denton, & O'Bright, *supra*.

²²³ *Id.*

²²⁴ Tuula Honkonen, *Water Security and Climate Change: The Need for Adaptive Governance*, 20 Potchefstroom Elec. L.J. 1 (2017).

areas, and droughts in others.²²⁵ This issue is problematic, especially for poor people, as such a shortage would lead to increased water prices, thereby forcing them to spend more of their incomes on this necessity.²²⁶ Such spending eventually could worsen poor people's economic predicament even more.²²⁷ A study indicates that the world needs to increase 30% of its water resources to satisfy future demand in response to population growth.²²⁸ In fact, the present demand for water still is viewed as a global challenge, as a large number of people live in watersheds that are exposed to water scarcity.²²⁹ It is estimated that 2.4 billion (39%) of people living in watersheds are exposed to water scarcity.²³⁰ This number will increase to 4.3 billion (53%) people.²³¹ Such a lack of water among more than half the population would threaten not only the economy, but also the ability to survive. Consequently, many civilizations would be endangered from a lack of water caused mainly by climate change.

Many countries decided to satisfy their water demands by using groundwater. It is known that groundwater is the main container for freshwater. A statistic shows that roughly 90% of U.S. freshwater comes from groundwater.²³² Moreover, more than half the U.S. population drinks water from groundwater.²³³ In rural areas, more than 90% of citizens consume their freshwater from groundwater.²³⁴ In fact, large cities rely entirely on groundwater for survival, including San

²²⁵ GAO-14-23 1 (2013-11-14). Climate Change: Federal Efforts Under Way To Assess Water Infrastructure Vulnerabilities And Address Adaptation Challenges.

²²⁶ Helen Kang, *Recognizing the Link among Climate Change, Food, and Poverty*, 46 Clearinghouse Rev. 289 (2012).

²²⁷ Id.

²²⁸ Rhett B. Larson, *Water Security*, 112 Nw. U. L. Rev. 139 (2017).

²²⁹ Simon Gosling & Nigel Arnell, *A global assessment of the impact of climate change on water scarcity*, 134 Climatic Change 371-385 (2016).

²³⁰ Id.

²³¹ Id.

²³² Ben Mandler, *Groundwater use in the United States* (2017), *American Geoscience Institute*, <https://www.americangeosciences.org/critical-issues/factsheet/groundwater-use-united-states>

²³³ "WHAT IS GROUNDWATER?", *The Groundwater Foundation*, <https://www.groundwater.org/get-informed/basics/groundwater.html>

²³⁴ Id.

Antonio.²³⁵ Groundwater also plays an important role in growing food, as almost 65% of groundwater is used for irrigation to grow crops.²³⁶ This clearly shows that groundwater plays a significant role in providing drinking water for society more than surface water, as most of the population consumes their freshwater from it.

1.10. Impact of climate change on agrobiodiversity

A lack of water globally would lead to many other issues, such as an agrobiodiversity crisis.²³⁷ This issue also threatens the world's food supply. Agrobiodiversity entails multiple biological resources, comprising the core of food production.²³⁸ This includes diverse varieties of animals, plants, and microorganisms that sustain agroecosystems' functioning.²³⁹ In the 21st century, the U.N. speculates that the world would lose 75% of its food-crop diversity due to the fact that farmers would want to use genetically uniform crops instead of local crops.²⁴⁰ This has led to the current situation, in which only 12 crops supply 80% of the world's plant-based dietary energy, with thousands of crops in existence, but not used.²⁴¹ One of the main reasons is financial, as these 12 crops reap more profit and are genetically uniform. In fact, out of the 12 crops used most often, only four supply approximately 60% of plant-derived calories and protein worldwide.²⁴² This could be a crisis not only for people's health, but also for food security.

²³⁵ Amy Hardberger, *World's Worst Game of Telephone: Attempting to Understand the Conversation between Texas' Legislature and Courts on Groundwater*, 43 Tex. Env'tl. L.J. 257, 304 (2013).

²³⁶ WHAT IS GROUNDWATER?", *supra*.

²³⁷ Carmen G. Gonzalez, *Climate Change, Food Security, and Agrobiodiversity: Toward a Just, Resilient, and Sustainable Food System*, 22 Fordham Env'tl. L. Rev. 493 (2011).

²³⁸ *Id.*

²³⁹ *Id.*

²⁴⁰ U.N. FOOD & AGRIC. ORG., First Fruits of Plant Gene Pact, (June 21, 2009), <http://www.fao.org/news/story/0/item/20162/icode/en/>.

²⁴¹ *Id.*

²⁴² *Id.*

An example that illustrates the perils of depending on only one or a few crops is the Irish Potato Famine of the 1840s.²⁴³ This crop was introduced to Spain, England, and Ireland in 1590.²⁴⁴ For two centuries, these three nations were the sources for all potatoes in Europe.²⁴⁵ As a result of the Irish crop's genetic uniformity, only a single infestation caused massive devastation.²⁴⁶ This famine led to the deaths of more than 2 million people and lasted five years.²⁴⁷ This demonstrates the importance of agrobiodiversity to ensure a healthy, secure food supply. The U.N.'s Food and Agriculture Organization said in 2009 that one-sixth of the world's population is malnourished chronically worldwide. It could be argued that among other reasons, a lack of agrobiodiversity is one reason, as it affects food security.²⁴⁸

As a result of the lack of food production, many countries tend to use pesticides heavily to protect a variety of crops. Pesticides play a major role in satisfying this increased need for food production. In addition, population growth is not the only reason for demand, as the same people spend more money on food, and they consume in a way never seen before in history. According to the Consumer Expenditure Survey (CE), in the Bureau of Labor Statistics, U.S. consumers spent \$6,129 on average in 2010 on food.²⁴⁹ Thus, almost 15% of the average household's annual expenditures went toward food.²⁵⁰ This number is increasing every year, and this significantly larger amount of food consumed has led to many environmental issues due to externalities from industrial farms, as well as health issues such as obesity.²⁵¹ It has been argued

²⁴³ Gonzalez, *supra* 497.

²⁴⁴ *Id.*

²⁴⁵ *Id.*

²⁴⁶ *Id.*

²⁴⁷ *Id.*

²⁴⁸ *Id.*

²⁴⁹ Jonathan C. Weinhagen, *Price Transmission Effects through Three Stages of Food Production*, 135 MONTHLY LAB. REV. 19, 27 (2012).

²⁵⁰ *Id.*

²⁵¹ *Id.*

widely that outbreaks of foodborne illnesses have risen dramatically due to the increasing amount of "food miles" traveled by the products that make up our daily meals, as well as this food's growing size and complexity.²⁵²

Although pesticides positively affect crop protection against insects and other pests, they also have been shown to be harmful and even toxic to humans, animals, and the environment.²⁵³ Essentially, pesticides are designed to kill regardless of whether it is a pest or a human.²⁵⁴ These pesticides are formulated to attack and destroy organisms, which are living entities.²⁵⁵ It is estimated that over a billion pounds of chemical pesticides are spread in farms, schools, parks, and many other places nationwide.²⁵⁶ It also has been estimated that more than half of Americans' food contains chemical residues.²⁵⁷ In short, because humans occupy part of nature, poisoning pests eventually can backfire, leading to poisoned people.

Many experts have argued that hydroponic and aquaponic methods of growing food in perpetually flowing water, in which nutrients are dissolved, can be viewed as organic, which can play an important role in satisfying increasing food demand.²⁵⁸ It also means that these crops are not grown in soil, but rather on roofs, yet still are viewed as organic, healthy food. In the U.S. and EU, organic certification is granted to crops that meet certain requirements, even if they were not grown in soil.²⁵⁹ Proponents of hydroponic organic certification argue that they can reduce the amount of water and energy use compared with soil-based farms, as soil requires a

²⁵² Emily Broad Leib, *The Forgotten Half of Food System Reform: Using Food and Agricultural Law to Foster Healthy Food Production*, 9 J. FOOD L. & POL'Y 17, 60 (2013).

²⁵³ John Carlucci, *Reforming the Law on Pesticides*, 14 VA. ENVTL. L.J. 189, 224 (1994).

²⁵⁴ *Id.*

²⁵⁵ *Id.*

²⁵⁶ *Id.*

²⁵⁷ *Id.*

²⁵⁸ Dan Nosowitz, *Can Hydroponic Farming Be Organic? The Battle Over The Future Of Organic Is Getting Heated*. *Modern Farmer* 1-15 (2017).

²⁵⁹ *Id.*

large amount of water, while the other farms do not rely on soil.²⁶⁰ They also say that their farms can reduce transportation costs, as their crops can be grown anywhere, including indoors and smack dab in the middle of cities.²⁶¹ They also argue that even when crops are not grown in soil, they can be just as sustainable and eco-friendly as any traditional crop.²⁶²

However, this tendency toward relying on unnatural methods to minimize climate change's damage to food production has faced much criticism.²⁶³ It has been argued that the main aim of providing certification for non-soil crops is reaping profits for large corporations, as the organic label is worth about \$40 billion a year.²⁶⁴ Moreover, throughout history, humans have relied on soil to grow their food, and it has been proven that these crops satisfy humans' vitamin and mineral needs. Thus, there is no doubt that healthy soil is beneficial for food production. On the other hand, non-soil crops still need time to prove their efficacy over time, and extant research is insufficient to claim that non-soil crops are just as beneficial as soil crops. Another major criticism is related to the fact that non-soil crops detach themselves from the ecosystem.²⁶⁵ In other words, soil is not only important for food production, but also plays a role in the ecosystem as a whole, which allows for thriving communities of beneficial insects and, in turn, an entire ecosystem around them.²⁶⁶

1.11. Impact of climate change on the energy sector:

²⁶⁰ Id.

²⁶¹ Id.

²⁶² Id.

²⁶³ Id.

²⁶⁴ Id.

²⁶⁵ Id.

²⁶⁶ Id.

Finally, climate change heavily impacts the energy sector. When the temperature rises, energy demands increase for cooling purposes.²⁶⁷ Thus, people will use air conditioning, which means that more energy will be used to satisfy this need. In the U.S, if the temperature heats up by 1.8° F, energy demand increases by approximately 20%.²⁶⁸ Net expenditures on annual heating would increase by 10%, which will cost \$26 billion by the end of the century.²⁶⁹ This percentage will increase during warm weather, as cooling demand would increase by 22%, which will cost \$57 billion.²⁷⁰ To meet peak demand, investment in energy generation and distribution infrastructure will be needed to manage system reliability and peak demand.²⁷¹ For instance, based on a 6.3 to 9° F temperature increase, the need for electric generating capacity will increase 10-20% by 2050.²⁷² Thus, hundreds of billions of dollars are required in additional investment.²⁷³

The issue of the energy sector is not only about generating electricity for cooling and heating, but also about energy for basic needs such as water.²⁷⁴ The energy sector is connected with water systems, as energy is used to pump, transport, and treat drinking water and wastewater.²⁷⁵ The need for cooling water is important to operate many of today's power plants, such as hydroelectricity plants.²⁷⁶ Hydroelectricity is a major source of power in parts of the U.S.; thus, any issues in the water-cooling process might affect this energy source.²⁷⁷ In other

²⁶⁷ EPA, Climate Impacts on Energy, available at: <https://19january2017snapshot.epa.gov/climate-impacts/climate-impacts-energy.html> (accessed March 21, 2020).

²⁶⁸ CCSP, Effects of Climate Change on Energy Production and Use in the United States (2008).

²⁶⁹ USGCRP. Dell, J et al., Energy Supply and Use. Climate Change Impacts in the United States: The Third National Climate Assessment. Global Change Research Program, Ch. 4 113-129 (2014).

²⁷⁰ Id.

²⁷¹ Id.

²⁷² EPA, Climate Impacts on Energy, *supra*.

²⁷³ Id.

²⁷⁴ Id.

²⁷⁵ Id.

²⁷⁶ Id.

²⁷⁷ Id.

words, changes in precipitation, increased risk of drought, and any change in snowmelt timing in the spring will influence patterns used for energy and water use.²⁷⁸ For instance, power plants used for cooling purposes require large amounts of water. A kilowatt-hour of electricity needs 25 gallons of water, which will be drawn from rivers or lakes.²⁷⁹ This might affect the use of water as a resource, as much water will be withdrawn to generate energy as demand increases.²⁸⁰ Thus, many governments are conflicted over whether to stop or slow plans for new power plants due to water withdrawal issues.²⁸¹ This issue could be problematic for hot regions, such as the Southwest.²⁸² These regions likely will reduce water supplies due to increased temperatures and evaporation, as well as possible decreased rainfall.²⁸³ The stress on water will occur due to the fact that water is necessary for electricity production.²⁸⁴ It then could be argued that the climate change crisis affects almost all aspects of life and the entire ecosystem as a whole.

2. Political Impact of climate change

It has been noted that climate change significantly impacts nations politically, and in some cases, it might threaten these countries' existence. Thus, one must not think that climate change is only an economic and environmental matter, but also can play a vital role in the political realm. Climate change has been a major reason for political instability in many countries, although it is not the only reason. Temperature increases have caused many droughts, which have affected people's lives, leading to revolutions or mass migrations. Many countries

²⁷⁸ Id.

²⁷⁹ Id.

²⁸⁰ Id.

²⁸¹ USGCRP. Global Climate Change Impacts in the United States. "Climate Change Impacts by Sectors: Energy Supply and Use." United States Global Change Research Program. Cambridge University Press (2009).

²⁸² EPA, Climate Impacts on Energy, supra.

²⁸³ Id.

²⁸⁴ Id.

seem to underestimate the importance of natural resources, while avoiding climate change issues and focusing only on short-term gains, such as oil revenues. This will lead to serious issues in the future, as people, since ancient times, could not survive and build civilizations unless they lived near water and natural resources that could aid their survival.

2.1. Role of climate change in the Indo-Pakistani conflict

Many developing countries seem to be affected by climate change more than other nations, leading to many political consequences. The conflict between India and Pakistan is an example of the extent to which climate change can elicit long conflicts between countries – and sometimes even wars.²⁸⁵ The root of the conflicts started when Britain decided to draw an international boundary between India and Pakistan at the time of the subcontinent's partition.²⁸⁶ India suddenly became an upper riparian state, while Pakistan became a lower riparian region.²⁸⁷ Thus, the water from six major rivers flowed from India to Pakistan.²⁸⁸ Due to India's increasing water needs, the nation began to suspend water flows to Pakistan to satisfy its water demands.²⁸⁹ These demands have increased mainly because of climate change through rising temperatures.²⁹⁰ Suspending river water flows to Pakistan affected Pakistan's agricultural and agrarian infrastructure, as it was heavily reliant on river water for irrigation.²⁹¹ Thus, many people in Pakistan became more vulnerable due to a lack of water, which put pressure on the government to find solutions. After a decade of strained relations between India and Pakistan, both nations signed the Indus Waters Treaty, which ended the conflict for a while, but the issue has heated up

²⁸⁵ Waseem Ahmad Qureshi, *Water as a Human Right: A Case Study of the Pakistan-India Water Conflict*, 5 Penn State Journal of Law & International Affairs 375 (2017).

²⁸⁶ Id.

²⁸⁷ Id.

²⁸⁸ Id.

²⁸⁹ Id.

²⁹⁰ Id.

²⁹¹ Id.

recently.²⁹² This shows that humans rely heavily on natural resources and cannot survive without them, regardless of their development, as India and Pakistan are countries with strong military capacity, yet were affected significantly by water shortages from climate change.

2.2. Role of climate change in the political instability in Sudan and Ethiopia

Drought not only creates conflicts between countries, but also can spark food riots among individuals within a country. This issue could be seen in Ethiopia and Sudan, as both experienced severe droughts during the 1980s.²⁹³ The issue began in the 1950s, when climate change's effects began to appear, and decreasing rainfall in the region became noticeable.²⁹⁴ It is estimated that more than half the highland soils showed significant signs of accelerated erosion, i.e., millions of hectares of cultivated land became useless.²⁹⁵ Moreover, livestock mortality increased by 90%, boosting meat prices more than 25% compared with pre-drought prices.²⁹⁶ Furthermore, grain prices increased to 2.5 times their pre-drought levels.²⁹⁷ Thus, the most basic human needs became difficult to obtain. This led to the Ethiopian highlands becoming unable to support its population due to climate change.²⁹⁸ Thus, many suggestions have been offered concerning where to resettle the massive population.²⁹⁹ Consequently, food riots began and escalated to the point that the Nimeiri regime was overthrown in April 1985.³⁰⁰ It should be noted that the riots that led to political instability mainly were the result of climate change and

²⁹² Id.

²⁹³ Peter Cutler, *The Political Economy of Famine in Ethiopia and Sudan*, 20 *Environmental Security* 176-178 (1991).

²⁹⁴ Id.

²⁹⁵ Id.

²⁹⁶ Id.

²⁹⁷ Id.

²⁹⁸ Id.

²⁹⁹ Id.

³⁰⁰ Id.

temperature increases. Thus, without the consequences from climate change, these countries would not have faced this crisis, which led to a political disaster.

2.3. Role of climate change in the ending of the monarchy in Afghanistan

Similarly, Afghanistan also has suffered from drought, leading to a political crisis that lasted for many decades. In fact, Afghanistan's instability continues to the present day, and one of the main reasons for this chaos is drought from climate change.³⁰¹ It must be noted that Afghanistan is not viewed as a drought-prone country.³⁰² However, due to climate change, droughts hit the entire nation, causing much damage.³⁰³ The most relevant drought was recorded in 1970, which resulted in displaced populations, loss of animals, and severe food shortages. It has been estimated that these droughts have affected almost half the population.³⁰⁴ Altogether, 4 million residents were affected severely, and approximately 12 million still face the threat of famine.³⁰⁵ More than a million citizens have relocated due to a lack of water and food from climate change.³⁰⁶ This has led to the nation's mortality rising by two people per 10,000 population.³⁰⁷ It must be noted that before climate change, a king ruled Afghanistan, and political life was stable. However, due to the massive droughts, Mohammad Daoud came to power on July 17, 1973, dethroning the king in a coup partly sponsored by Parcham.³⁰⁸ This, again, shows that the issue of climate change can play a central role in political life.

³⁰¹ See the report of the WHO design engineer (Abdul khabir) and the WFO water expert (Sharif): available at: http://www.nourin.tsukuba.ac.jp/~tasae/2002/Alim_2002.pdf

³⁰² Id.

³⁰³ Id.

³⁰⁴ Id.

³⁰⁵ Id.

³⁰⁶ Id.

³⁰⁷ Id.

³⁰⁸ Thomas M. Cynkin, *Aftermath of the Saur Coup: Insurgency and Counterinsurgency in Afghanistan*, 6 Fletcher F. 269 (1982).

One might argue that climate change caused many issues to these countries as a result of their reluctance to protect the environment, either through policies or non-disruptive practices. Thus, these countries failed, in their quest for economic growth, to protect their environments as they focused only on short-term benefits and ignored their policies' disruptive results. This suggests that many climate change consequences are the result of policies and practices that these countries adopted in their regions. For instance, in the Nile Delta, the Egyptian government tended to use drainage water for irrigation.³⁰⁹ These practices can bring significant benefits to areas that are short on water, but also can lead to the accumulation of salts and toxins in soils, thereby harming agricultural production.³¹⁰ Thus, the government tends to accept long-term disruptive consequences for short-term benefits.³¹¹ This seems to support the argument that many climate change consequences are a result of countries' policies and practices.

2.4. Impact of China's drought on Egypt's political stability

It seems that this argument ignores the fact that climate change does not recognize borders between countries, as once temperatures increase, all countries will bear the consequences. Many examples could be given that demonstrate how consequences from climate change in one country can cause chaos in others. For instance, one of the major reasons why a revolution erupted in Egypt, which resulted in the ouster of President Mubarak in 2011, was a drought in China. A drought in eastern China's wheat-growing region led to the nation doubling the global price of wheat.³¹² This seriously impacted Egypt economically, as it is the largest wheat importer, leading to bread prices tripling.³¹³ This issue with soaring food prices, among

³⁰⁹ Report OD/133 March 1996, Soil Salinity Processes Under Drainwater Reuse in the Nile Delta, Egypt, available at: <https://assets.publishing.service.gov.uk/media/57a08dbfed915d622c001b5f/R5835-od133.pdf>

³¹⁰ Id.

³¹¹ Id.

³¹² Troy Sternberg, *Chinese drought, bread, and the Arab Spring*, 34 Applied Geography 519-524 (2012).

³¹³ Id.

others, was a contributory factor to civil unrest.³¹⁴ It has been noted that public anger peaked when the price of bread tripled, proving that climate change consequences could threaten political stability.³¹⁵ This example also shows that even if climate change is not present in a particular region, countries in this region can bear the consequences of climate change elsewhere, as nations worldwide rely on each other for trade and other needs. Thus, a large crisis in one region could harm all countries and might lead to serious consequences, as in the Egypt example, in which soaring wheat prices helped lead to political upheaval.

2.5. Climate change refugees

Another major issue caused by climate change is immigration. There are many reasons that lead to people fleeing their lands as a result of climate change, such as flooding and sea level rise. Many studies have demonstrated that floods will occur more often, which threatens many coastal communities that rely on the sea for their survival.³¹⁶ A study identified vulnerable U.S. communities and how sea level rise would affect them. It has been estimated that 668 communities, respectively, would face effective flood inundation by 2100.³¹⁷ The issue could be more problematic in regions with high population density, such as South Asia.³¹⁸ The Ganges-Brahmaputra-Meghna river delta – which stretches from India and Bangladesh to Nepal, China, and Bhutan – is home to approximately 129 million people.³¹⁹ Bangladesh is the most vulnerable country among these nations, as vast rice fields and agricultural land that the people rely on have

³¹⁴ Id.

³¹⁵ Id.

³¹⁶ Kristina Dahl, Erika Siegfried, Astrid Caldas, & Shana Udvardy, *Effective inundation of continental United States communities with 21st century sea level rise*, 5 *Elementa Science of the Anthropocene* 1-37 (2017).

³¹⁷ Id.

³¹⁸ Angela Williams, *Turning the Tide: Recognizing Climate Change Refugees in International Law*, 30 *Law & Pol'y* 502 (2008).

³¹⁹ Id.

been replaced by export-based shrimp farms due to salt contamination and rising sea levels.³²⁰ The IPCC says that if the sea level increases 45 centimeters, 5.5 million people will be displaced, and over 10 percent of Bangladesh will be submerged.³²¹ They also say that increased migration levels are unavoidable.³²² Another disaster that occurs more often due to climate change also plays a major role in large immigrations: hurricanes. For instance, Hurricane Mitch killed as many as 20,000 people and displaced 2 million others within a week in Florida 1998.³²³ This should force many countries that are not extremely vulnerable to climate change to face and prepare for the possibility of needing to relocate large numbers of immigrants inside their borders.

2.6. Impact of climate change refugees on BREXIT

The issue of immigration must not be underestimated, as it can cause internal pressures within host countries where immigrants aim to settle, including societal divides, such as in the U.K. It is well known that the U.K. left the EU because of many issues after the June 2016 referendum. Aggregate- and individual-level data from the British Election Study (BES) were collected in a survey conducted to examine how immigration shaped public support for Brexit.³²⁴ It has been found that immigration was a key predictor of how people voted for Brexit, even after accounting for factors stressed by established theories on Eurosceptic voting.³²⁵ Individuals who voted to leave the EU voiced concerns about losing English culture and identity when

³²⁰ Id.

³²¹ Id.

³²² Id.

³²³ Robert McLeman & Lori Hunter, Migration in the context of vulnerability and adaptation to climate change: Insights from analogues, 1 U.S. National Library of Medicine, 450-461 (2010).

³²⁴ Matthew Goodwin and Caitlin Milazzo, *Taking back control? Investigating the role of immigration in the 2016 vote for Brexit*, 19 British Journal of Politics and International Relations 450-464 (2017).

³²⁵ Id.

immigrants decided to migrate to the U.K.³²⁶ Blocking immigrants from entering the country violates EU rules, so this issue played a central role in the nation voting to leave the EU as a whole. British voters became increasingly concerned about the economic and cultural effects from immigration after the join of Central and Eastern European states in the EU in 2004.³²⁷ Since then, the immigration issue has been ranked by British people as the most important issue in the country.³²⁸

Leaving the EU has not been the only issue that the U.K. has faced due to the immigration issue. It also has considered breaking up into three countries: England; Scotland; and Ireland. The referendum on Scottish independence was held in 2014, with 55% voting to remain in the U.K. for many reasons – including membership in the EU. It should be noted that Scotland wants to remain in the EU, as most Scottish people voted to remain in the EU two years later in the Brexit referendum. Thus, the Scottish population might vote against remaining in the U.K., which later left the EU regardless of what Scotland wanted. This might elicit calls for another referendum on Scottish independence to remain in the EU. Scotland’s economy definitely will be affected after the U.K. leaves the EU because there were no tariffs within the EU borders. This can damage many industries, such as oil, as the trade borders will not be as open as they used to be, causing many losses. Similarly, Northern Ireland has been part of the U.K. after a long war with the Republic of Ireland. After the war, Ireland was divided into two regions, with an agreement that the borders would be open between the north and south. This accord, called the “Good Friday” Agreement, ended the war. Now, the U.K. has left the EU,

³²⁶ Id.

³²⁷ Id.

³²⁸ Id.

which means it must put a boarding with EU countries, including Northern Ireland. This might cause another fight, and this issue might even spark another war, or at least a serious conflict.

All these issues have been the result of immigration caused mainly by climate change. In fact, it has been predicted that the immigration issue will increase due to climate change, creating 1 billion environmental migrants by 2050.³²⁹ This might lead to right-wing parties winning control and creating worldwide disasters. The rise of such factions came from the anger that people have against immigrants, whom these factions claim steal their jobs. It has been argued that if the issue that caused immigration had been solved in the first place, the aforementioned upheavals would not have occurred. When countries ignore the perils of focusing only on the economy at the expense of environmental concerns, they face disruptions that can be costly economically. The issue of money and the question of its importance compared with the environment will be discussed below.

3. Economic impact of climate change

There is no doubt that climate change could harm all countries economically. Even if countries manage to adapt to the new situation of increasing temperatures, the cost will be higher, thereby challenging countries that might not be able to afford this new cost. For instance, wildfires in Northern California led to power company PG&E Corp. reporting a steep second-quarter loss in 2019 as the utility contended with costs associated with many issues, such as lawsuits and efforts to repair and improve its electrical grid.³³⁰ The company posted a loss of

³²⁹ United Nations University, Climate Migrants Might Reach One Billion by 2050 (2017) available at: <https://unu.edu/media-relations/media-coverage/climate-migrants-might-reach-one-billion-by-2050.html> (accessed April 25, 2020).

³³⁰ Katherine Blunt and Kimberly Chin, PG&E Losses Widen as Fire Costs Rise, The Wall Street Journal (2019).

\$2.55 billion, compared with a loss \$984 million in the year-earlier quarter.³³¹ Thus, its loss more than doubled, and the main reason for the loss was climate change. These incidents will occur more often as temperatures continue to increase at the same rate. This also will lead to increased insurance costs due to increased risk, and likely higher power bills for consumers.

3.1. Impact of climate change on productivity

The issue of climate change is not confined to losing money from disasters, but also can cost jobs and productivity. Increased temperatures from climate change could make the “heat stress” phenomenon more common.³³² “Heat stress” simply means received heat in excess of that which the body can tolerate.³³³ This excess can lead to heatstroke and even death if the person was vulnerable.³³⁴ This issue will become more prominent as a result of the growing global population, thereby causing more “heat stress.”³³⁵ To explain the issue, each person has a physical capacity and productivity. Productivity will decrease due to external elemental changes, such as temperature. It has been reported that labor productivity will decrease when the temperature rises above 24–26° C.³³⁶ At 33–34° C, productivity will fall 50%, i.e., the needs of the growing population might not be delivered efficiently.³³⁷ Many studies have predicted that at the end of the 21st century, the world would lose 2.2 percent of total working hours worldwide, equivalent to 80 million full-time jobs, from a 1.5° C rise in global temperature.³³⁸ This estimate does not take into account the fact that the temperature might exceed 1.5° C, and the weather

³³¹ Id.

³³² International Labor Organization, Working on a warmer planet: The effect of heat stress on productivity and decent work, available at: https://www.ilo.org/global/publications/books/WCMS_711919/lang--en/index.htm (accessed April 25, 2020).

³³³ Id.

³³⁴ Id.

³³⁵ Id.

³³⁶ Id.

³³⁷ Id.

³³⁸ Id.

might not be cloudy by 40%.³³⁹ If these assumptions are inaccurate, the loss would rise to 3.8 percent – the equivalent of 136 million full-time jobs globally.³⁴⁰ The global economy will lose US\$2,400 billion in 2030, and this amount of money will be most pronounced in lower-middle- and low-income countries.³⁴¹

3.2. Contradiction between environmental protection and free market theory

Some countries might argue that climate change advocates are unfair – that developed countries have harmed the environment for more than a century to reach their advanced economic growth levels, with a developed infrastructure. However, these other countries did not industrialize and harm the environment the way developed countries did. Thus, they argue that developed countries do not have a solid argument to prevent them from launching their own “industrial revolution era,” even if it harms the environment. Regarding labor rights, developing countries argue that developed countries did not provide such rights to their workers until they built their economies. Thus, if developing countries gave their workers the same rights as developed countries during their development, they would not be able to develop, nor provide any labor rights at all, as they would need to close down their businesses. They argue that ignoring labor rights and the environment at the beginning of development is necessary for future growth, and that labor rights and the environment can be protected later.

These and similar arguments tend to focus on the value of money regardless of the environment, indicating a deep philosophy that economists have adopted. They tend to embrace vision of life and the importance of money to justify their argument.³⁴² They argue that time is money, which leads to wealth. Generating wealth is the purpose of people within a community

³³⁹ Id.

³⁴⁰ Id.

³⁴¹ Id.

³⁴² David C. Korten, *Change the Story, Change the Future: A Living Economy for a Living Earth* (1st ed, 2015).

because maximizing financial returns maximizes wealth and prosperity for all.³⁴³ Their vision of life also states that wealth is a reward for hard work and that poverty is a consequence of laziness.³⁴⁴ They continue saying that the earth belongs to humans and that being individualistically competitive leads to prosperity that a free market's invisible hand guides.³⁴⁵ This world view tends to view a community as simply an aggregation of individual members' private interests. This leads to a philosophy that focusing on maximizing personal individual interests benefits society the most. Many economists and nations cited this philosophy to argue for focusing only on making money and that damaging the environment is reasonable and wise.

On the other hand, another life philosophy can lead to opposing arguments regarding money and the environment. The other vision starts with the fact that time is not money, but rather life.³⁴⁶ Real community wealth is living well.³⁴⁷ This vision views money as only a number that is useful as a medium of exchange in a well-regulated market.³⁴⁸ Those with this world view think that earth is unique and, thus, must be saved, and that human beings are part of nature, not apart from nature. Thus, it would be insane to harm the environment for personal financial gain, which is identified as merely an instrument of measure.³⁴⁹ Moreover, they argue that humans belong to the earth, not the opposite.³⁵⁰ This leads automatically to believing that people's health and well-being depend on the planet's health and well-being. They view the community as an essential entity through which people can prosper.³⁵¹ Thus, sharing and caring

³⁴³ Id.

³⁴⁴ Id.

³⁴⁵ Id.

³⁴⁶ Id.

³⁴⁷ Id.

³⁴⁸ Id.

³⁴⁹ Id.

³⁵⁰ Id.

³⁵¹ Id.

within the same community are essential for overall prosperity. It could be said that this philosophy would not support anything that might harm the environment to gain money, based on the aforementioned beliefs.

The neoliberal economy seems to value certain things more than essential resources, such as water and air.³⁵² The fact that the future value of stock is more valuable than water and air defies both common sense and reality. In such an economy, it is more beneficial to drive a car than to walk, although the latter is healthier. Driving a car is viewed as beneficial by feeding oil demand, thereby increasing its price and benefitting the economy. According to neoliberal theory, this economy does not seem to treat the health of humans and the environment as scarce, but rather as commodities that can be evaluated in a cost-benefit analysis.³⁵³ The fact is that treating money as an economy's main goal would lead to a catastrophic scam.³⁵⁴ Money is supposed to be only a measurement of goods and services. Unfortunately, making money became the main goal, which leads to identifying "wealth in a society" as creating money and using it to make money from nothing.³⁵⁵ This does not benefit society, as money can be made without any real production or flourish added to society as a whole.

Some scientists have suggested using "Emergy synthesis" as a method to evaluate natural resources, rather than using the "consumer preference" that neoliberal theory has adopted.³⁵⁶ Emergy synthesis provides a methodology to value resources or services based on their "intrinsic" value, rather than consumer preference.³⁵⁷ They compare this approach to the

³⁵² Id.

³⁵³ Id.

³⁵⁴ Id.

³⁵⁵ Id.

³⁵⁶ Mary Jane Angelo, *Harnessing the Power of Science in Environmental Law: Why We Should, Why We Don't, and How We Can*, 86 Tex. L. Rev. 1527 (2008).

³⁵⁷ Id.

neoclassic economic approach and see advantages from energy synthesis vs. consumer preference. Among the most promising uses of energy synthesis are as a way to inform decision making on the severity of environmental impacts on an ecosystem, and as a way to choose which is the most environmentally efficient of two or more proposed options for development or restoration.³⁵⁸

Regardless of the vision of money and life, the issue of climate change has forced the world to recognize the importance of shifting to renewable energy.³⁵⁹ The world's challenge would be to avoid environmental degradation and at the same time foster economic development.³⁶⁰ This issue is not only for developing countries – where the need for economic growth is urgent, as they must feed, clothe, provide health care, educate, house, and find jobs for exploding populations – but also for developed countries, as they would suffer environmental degradation, debt forfeitures, and soaring fuel prices.³⁶¹ Although this step could be fatal for many countries, it is, nevertheless, important to ensure “human survival” on this earth, as harming the environment can provide short-term benefits, but a crisis in the future. If countries maintain their CO₂ production, then more economic losses would occur through disasters. For instance, The U.S. has sustained 265 weather and climate disasters since 1980, with their costs exceeding \$1.775 trillion.³⁶² The 1980–2019 annual average is 6.6 events (CPI-adjusted), while the annual average for the most recent five years (2015–2019) is 13.8 events (CPI-adjusted).³⁶³

³⁵⁸ Id.

³⁵⁹ Richard Ottinger, *Energy and Environmental Challenges for Developed and Developing Countries: Keynote Address Presented at the United Nations Meeting on Energy and Environment in the Development Process*, 9 *Pace Environmental Law Review*, 55-105 (1991).

³⁶⁰ Id.

³⁶¹ Id.

³⁶² NOAA, *Billion-Dollar Weather and Climate Disasters: Overview (2020)* available at: <https://www.ncdc.noaa.gov/billions/> (accessed April 26, 2020).

³⁶³ Id.

4. Law and climate change

Historically, no correlation has existed between human rights and environmental quality. This is evident in agreements and treaties that focus on human rights without mentioning environmental rights.³⁶⁴ For instance, the Universal Declaration on Human Rights 1948 (UDHR) contains no explicit right to environmental quality.³⁶⁵ Many other agreements had this same tendency not to focus on environmental quality as part of human rights, such as the International Covenant on Civil and Political Rights (ICCPR).³⁶⁶ Moreover, in the United Nations Convention on the Rights of the Child (UNCROC), environmental quality was mentioned only in relation to hygiene and discusses disease and malnutrition prevention.³⁶⁷ It should be noted that these agreements did not emphasize environmental quality as part of human rights, but rather the emphasis was related to physical human rights, such as the right to life and private property.

4.1. Beginning of environmental treaties

The first agreement between nations that mentioned the environment's importance was forged in the 1950s.³⁶⁸ However, these agreements have focused only on the distribution and protection of certain environmental media, such as the International Convention for the Prevention of Pollution of the Sea by Oil from 1954 and the United Nations Convention on the Law of the Sea and the Convention on the High Seas from 1958.³⁶⁹ In the 1970s, a shift occurs toward more comprehensive environmental regulations due to nations' awareness of climate

³⁶⁴ Susan Glazebrook, *Human Rights and the Environment*, 40 *Victoria U. Wellington L. Rev.* 293 (2009).

³⁶⁵ *Id.*

³⁶⁶ *Id.*

³⁶⁷ *Id.*

³⁶⁸ Xiao Zhu, Shenghang Wang, & Eva-Maria Ehemann, *Development of Environmental Rights in China: Substantive Environmental Rights or Procedural Environmental Rights*, 12 *Frontiers L. China* 24 (2017).

³⁶⁹ Ulrich Beyerlin & Thilo Marauhn, *International Environmental Law*, Hart (Oxford, 2011).

change and the dangers of pollution.³⁷⁰ Many environmental catastrophes in the 1960s – such as the oil spills in the U.K. in 1967 and in Santa Barbara, California, in 1969 – forced the world to recognize the environment’s importance.³⁷¹ This led to global think tank Club of Rome’s release of a 1972 report, “The Limits to Growth,” which examined the importance of having a sustainable approach in growth, warning that if resource depletion continued unabated, the planet would reach its growth limits within the next 100 years.³⁷²

4.2. Stockholm Declaration

As a result of the increased recognition of the environment’s role in future growth, the U.N. gathered in Stockholm, Sweden, in 1972 to address environmental degradation and human rights.³⁷³ The nations aimed to find comprehensive international solutions to these environmental problems.³⁷⁴ During this meeting, the Stockholm Action Program (UNEP) and the Stockholm Declaration were established. Their main aim was to develop a holistic concept to protect the environment, while taking social and economic aspects into consideration.³⁷⁵ The Stockholm Declaration was the foundation for adapting environmental quality rights as part of human rights, as it stated in Article 1 that “Man has the fundamental right to freedom, equality, and adequate conditions of life, in an environment of a quality that permits a life of dignity and well-being.”³⁷⁶ This article emphasizes environmental quality and links it to human rights.

³⁷⁰ Zhu, Wang, & Ehemann, *supra*.

³⁷¹ *Id.*

³⁷² *Id.*

³⁷³ *Id.*

³⁷⁴ Icelandic Human Rights Center, HUMAN RIGHTS AND THE ENVIRONMENT, available at: <http://www.humanrights.is/en/human-rights-education-project/human-rights-concepts-ideas-and-fora/human-rights-in-relation-to-other-topics/human-rights-and-the-environment>. (accessed on March 28, 2020).

³⁷⁵ Zhu, Wang, & Ehemann, *supra*.

³⁷⁶ *Id.*

This increasing recognition of environmental quality as part of human rights came from a demand from experts and the public.³⁷⁷ As a result of this demand, politicians started to pay attention to the nexus of ecological and human rights in the 1980s.³⁷⁸ Besides these pressures to protect environmental quality, there were demands to establish procedural rights to protect the environment.³⁷⁹ This led to the creation of an anthropocentric approach to ecological positions.³⁸⁰ In many agreements, the word “greening” is mentioned often, such as in the ICCPR and ICESCR.³⁸¹ It could be argued that environmental quality is a prerequisite for all human rights, as these rights cannot be protected without having a decent environment, such as the right to adequate housing (Article 11 ICCPR), health (Article 12 ICCPR), and life (Article 6 ICESCR).³⁸²

4.3. United Nations Conference on Environment and Development

After the first global environmental conference, an important conference called the United Nations Conference on Environment and Development (UNCED) took place in Rio de Janeiro in 1992.³⁸³ This conference’s main goal was to encourage governments to adopt serious reforms that aim to halt the destruction of irreplaceable natural resources on this planet, as climate change had accelerated at an alarming rate.³⁸⁴ As a result of this conference, the Rio Declaration on Environment and Development was adopted which places a huge emphasis on human rights and environmental quality.³⁸⁵ This could be viewed in the agreement’s principles,

³⁷⁷ Id.

³⁷⁸ Id.

³⁷⁹ Id.

³⁸⁰ Id.

³⁸¹ E. F. Roberts, *The Right to a Decent Environmental: A Premature Construct*, 1 *Envtl. Pol’y & L.* 185 (1975).

³⁸² Id.

³⁸³ Icelandic Human Rights Center, *HUMAN RIGHTS AND THE ENVIRONMENT*, see 221.

³⁸⁴ Id.

³⁸⁵ Id.

the first of which illustrates that “human beings are at the center of concerns for sustainable development. They are entitled to a healthy and productive life in harmony with nature.”³⁸⁶ Principle 4 also clarifies environmental quality’s importance: “In order to achieve sustainable development, environmental protection shall constitute an integral part of the development process and cannot be considered in isolation from it.”³⁸⁷ This clearly indicates countries’ tendency toward protecting the environment, instead of only distributing natural resources.

4.4. World Summit on Sustainable Development

Countries focus more on protecting the environment, although not sufficiently; thus, the World Summit on Sustainable Development (WSSD) took place in Johannesburg in 2002.³⁸⁸ The summit’s implementation plan clearly shows the link between human rights and achieving sustainable development.³⁸⁹ It also illustrates national actions’ importance in achieving necessary sustainable development.³⁹⁰ The plan includes key components, such as the rule of law, gender equality, and a democratic society.³⁹¹ It also focused heavily on the need to promote public participation in environmental decision-making and how the public has the right to access information regarding legislation, policies, and programs.³⁹²

4.5. International Covenant on Economic, Social, and Cultural Rights

Many agreements address environmental quality issues, either directly or indirectly. For instance, The International Covenant on Economic, Social, and Cultural Rights includes the right

³⁸⁶ Id.

³⁸⁷ Id.

³⁸⁸ Id.

³⁸⁹ Id.

³⁹⁰ Id.

³⁹¹ Id.

³⁹² Id.

to safe and healthy working conditions (Article 7b).³⁹³ Moreover, in Article 10-3, the agreement also gives children the right to be free from work that's harmful to their health.³⁹⁴ Furthermore, Article 12 of the covenant gives a state the right to take steps to improve and protect the environment.³⁹⁵ This could be viewed as direct recognition of the idea of protecting the environment as a right, rather than linking environmental protection to other rights, such as the right to life. In other words, the right to protect the environment must be a standalone right, as it could be argued that this right is needed to apply all other rights. This idea seems to have been adopted under some agreements, such as the Convention on the Rights of the Child, as it refers to aspects of environmental protection with respect to a child's right to health.³⁹⁶ Article 24 illustrates that the state must take steps regarding environmental pollution to protect adequate nutritious foods and clean drinking water that children need to thrive and survive.³⁹⁷ In these agreements, it should be noted that environmental issues have been taken more seriously than past accords, i.e., the right to protect the environment, arguably, is a human right that stands on its own and is not linked to other rights, as explained above.

4.6. African Charter on Human and Peoples Rights

The African Charter on Human and Peoples Rights can be viewed as another example of directly addressing the right to protect the environment.³⁹⁸ Article 24 states: "Peoples shall have the right to a general satisfactory environment favorable to their development."³⁹⁹ Thus, countries must protect the environment to sustain development, as well as practice other human

³⁹³ Dinah Shelton, *Human Rights, Health & Environmental Protection: Linkages in Law & Practice*, 1 World Health Organization report, 3-23 (2002).

³⁹⁴ *Id.*

³⁹⁵ *Id.*

³⁹⁶ *Id.*

³⁹⁷ *Id.*

³⁹⁸ *Id.*

³⁹⁹ *Id.*

rights. Article 16 of the charter states that every individual has the right to enjoy the best attainable state of physical and mental health.⁴⁰⁰ This article explains that protecting the environment is prerequisite for all human rights to ensure “the best attainable state of physical and mental health,” and this cannot be achieved without a generally satisfactory environment. Other articles support this argument, such as Article 11, which states, “Everyone shall have the right to live in a healthful environment and to have access to basic public services.”⁴⁰¹ This again shows that the right to live in a healthful environment is an individual right, as well as a prerequisite for all other human rights.

4.7. Vienna Convention for the Protection of the Ozone Layer

Moreover, the Vienna Convention for the Protection of the Ozone Layer was established to address the problem of ozone layer depletion.⁴⁰² This convention was the product of many negotiations between the Toronto Group.⁴⁰³ Twenty-one delegations signed the convention in 1985 and agreed to create a working group to draft a protocol for the Vienna Convention.⁴⁰⁴ However, many reports have explained that this convention was vague and therefore ineffective in addressing the problem of ozone layer depletion.⁴⁰⁵ One possible explanation for the vagueness was the scientific uncertainty of the subject matter in the 80s.⁴⁰⁶ However, the goal of the Vienna Convention was not to provide solutions for the ozone layer depletion.⁴⁰⁷ Rather, the

⁴⁰⁰ *Id.*

⁴⁰¹ *Id.*

⁴⁰² Timothy C. Faries, *Clearing the Air: An Examination of International Law on the Protection of the Ozone Layer*, 28 ALTA. L. REV. 818 (1990).

⁴⁰³ *Id.*

⁴⁰⁴ *Id.*

⁴⁰⁵ *Id.*

⁴⁰⁶ *Id.*

⁴⁰⁷ *Id.*

convention aimed to force parties to address ozone layer depletion with the intent of developing subsequent protocols that may solve this problem.⁴⁰⁸

4.8. United Nations Framework Convention on Climate Change (UNFCCC)

Moreover, the UN adopted the United Nations Framework Convention on Climate Change (UNFCCC) in May of 1992⁴⁰⁹ in response to the overwhelming evidence of the danger of climate change on the planet.⁴¹⁰ Specifically, the UN recognized the danger of carbon dioxide, methane, CFCs, and nitrous oxides in the atmosphere.⁴¹¹ An increase in these emissions in the atmosphere causes an increase in natural disasters, such as flooding and hurricane and cyclone activity.⁴¹² This convention aimed to limit an increase to the average global temperature and to mitigate the consequences of climate change.⁴¹³

The UNFCCC went beyond the 1985 Vienna Convention to protect the climate by incorporating three key principles.⁴¹⁴ First, the convention targeted the stabilization of greenhouse gas concentrations in accordance with soft targets and timetables.⁴¹⁵ Second, the convention established a financial mechanism to ensure developed countries provided financial resources to help achieve the convention's goals.⁴¹⁶ Finally, the convention provided innovative implementation and settlement mechanisms for disputes.⁴¹⁷

4.9. Paris Agreement

⁴⁰⁸ Id.

⁴⁰⁹ Philippe Sands, *The United Nations Framework Convention on Climate Change*, 1 REV. EUR. COMP. & INT'L ENVTL. L. 270 (1992).

⁴¹⁰ Id.

⁴¹¹ Id.

⁴¹² Id.

⁴¹³ Norah bin Hamad, *Foundations for Sustainable Development: Harmonizing Islam, Nature and Law*, A dissertation published at Pace University 1-377 (2017).

⁴¹⁴ Sands, *supra*.

⁴¹⁵ Id.

⁴¹⁶ Id.

⁴¹⁷ Id.

The world went beyond the UNFCCC and signed the Paris Agreement on climate change in 2016. This agreement considered the common but distinct responsibilities of each country in addressing climate change.⁴¹⁸ Ultimately, 185 countries ratified the Paris Agreement.⁴¹⁹ The main goal of the Paris Agreement was to limit warming to below two degrees with efforts to limit it to 1.5 degrees.⁴²⁰ The agreement focused on both mitigation and adaptation to climate change.⁴²¹ Although the agreement seemed to focus on mitigation, this was considered the “soft belly” of the agreement because it completely relied on nationally determined contributions.⁴²² These contributions were established by the members of the agreement and were compiled in a flexible public register.⁴²³ All member states could choose their ambition level based on two requirements:⁴²⁴ (1) an update of their nationally determined contributions and (2) an obligation to progress in the level of ambition.⁴²⁵ The agreement emphasized adaptation to climate change with Article 7 requiring each member state to adopt an adaptation plan, record it in the public registry,⁴²⁶ and include it in the global stocktake contemplated in Article 14 of the Agreement.⁴²⁷

However, the Paris Agreement had many issues. It did not firmly impose any emission reduction obligations.⁴²⁸ It did not detail the financial responsibilities of developed countries to assist developing countries with achieving the agreement’s goals.⁴²⁹ Furthermore, the Paris

⁴¹⁸ Noura’s thesis.

⁴¹⁹ Paul B. Lewis & Giovanni Coinu, *Climate Change, the Paris Agreement, and Subsidiarity*, 52 UIC J. Marshall L. REV. 257 (2019).

⁴²⁰ Id.

⁴²¹ Jorge E. Vinuales, *The Paris Agreement on Climate Change*, 59 GERMAN Y.B. INT’L L. 11 (2016).

⁴²² Id.

⁴²³ Id.

⁴²⁴ Id.

⁴²⁵ Id.

⁴²⁶ Id.

⁴²⁷ Id.

⁴²⁸ Lewis and Coinu, *supra*.

⁴²⁹ Id.

Agreement did not establish binding reduction targets.⁴³⁰ The Climate Action Tracker states that no industrial country has met its obligation under the agreement.⁴³¹ This failure led to the Katowice Climate Package that was established after a meeting of the UNFCCC.⁴³² This package addressed the implementation of the Paris Agreement, which was the agreement's main criticism,⁴³³ and provided uniform standards to track the progress of member states under the agreement.⁴³⁴

Professor David Korten argues that most mainstream economists align with the neoliberal school of economic rationalism.⁴³⁵ Rationalism is “the doctrine that knowledge comes wholly from pure reason, without aid from senses.”⁴³⁶ Hence, this principle does not incorporate the real world. This commitment to rationalism has given economics its standing as the only truly objective, value-free social science and has often caused economics to defy both common sense and observable reality.⁴³⁷ Furthermore, economic risk assessments fail to account for unmeasured values, such as human health and the environment, and consequently, there will always be problems with these assessments.

In *Change the Story, Change the Future*, Korten argues that considering the environment as a commodity leads to catastrophic results because risk-benefit analyses cannot determine the true value of natural resources.⁴³⁸ A risk-benefit analysis may view natural resources, such as water or air, as less important than securities in some companies, including

⁴³⁰ Id.

⁴³¹ Id.

⁴³² Id.

⁴³³ Id.

⁴³⁴ Id.

⁴³⁵ David Korten, *Agenda for a New Economy: From Phantom Wealth to Real Wealth* (Second edition, 2010).

⁴³⁶ Id.

⁴³⁷ Id.

⁴³⁸ David Korten, *Change the Story, Change the Future: A Living Economy for a Living Earth* (1st ed, 2015).

those in the oil industry.⁴³⁹ According to Korten, relying on economic world treaties that consider the environment as a commodity will lead to a good economy but a disrupted earth.⁴⁴⁰ Furthermore, Korten argues that the earth is the only place where humans can exist. Therefore, because economic risk-benefit analyses fail to recognize the value of the planet and the protection of this sacred earth, environmental repairs are clearly not prioritized by trade organizations and agreements, such as the WTO and the General Agreement on Tariffs and Trade.⁴⁴¹

4.10. Other environmental law policies

However, most countries do not adapt the idea of protecting the environment into a standalone right, but rather that the environment should be protected indirectly. In the 1970s, a U.S. environmental movement tried to make federal courts address the extent to which the Constitution implicitly contained substantial environmental rights.⁴⁴² Its argument was based on penumbra theory, which states that some rights that are not guaranteed within the text of the Constitution can be derived from other explicitly protected constitutional rights.⁴⁴³ Thus, as explained, because human rights cannot be exercised without a healthful environment, the environment must be protected, as it is the first step needed to practice all human rights, and that without it, no rights can be exercised. Environmentalists hoped that federal courts would derive a fundamental right to a healthful environment from other constitutional provisions.⁴⁴⁴ Unfortunately, federal courts did not accept this argument and held that the Constitution does not

⁴³⁹ Id.

⁴⁴⁰ Id.

⁴⁴¹ Id.

⁴⁴² Xiao Zhu, Shenghang Wang & Eva-Maria Ehemann, *Development of Environmental Rights in China: Substantive Environmental Rights or Procedural Environmental Rights*, 12 *Frontiers L. China* 24 (2017).

⁴⁴³ Id.

⁴⁴⁴ Id.

protect environmental rights.⁴⁴⁵ For instance, in *Tanner v. Armco Steel Corp* (1972), the court held that the Ninth Amendment does not protect the right to a healthful environment.⁴⁴⁶ Another example can be found in *Environmental Defense Fund v. Hoerner Walford*, in which a federal court held that the Fifth and 14th Amendments do not protect the right to both personal and environmental health.⁴⁴⁷

In the EU, environmental protection was not a priority in its early days.⁴⁴⁸ However, this changed in the 1970s, and environmental law developed as the EU made the environment part of its policy portfolio.⁴⁴⁹ The first step was taken at a Paris summit meeting of the European Community's (EC) heads of state, in which an agreement was forged on how the EC should place more emphasis on the environment and also must create programs that aim to protect the environment.⁴⁵⁰ This elicited the creation of programs such as the First Action Program on the Environment in 1973, which covered the 1973-1976 period.⁴⁵¹ After the first program was established, five others were established that could be viewed as a significant improvement in addressing the issue of climate change and protecting environmental quality.⁴⁵² In 1987, the Single European Act (SEA) contained environmental provisions that gave the EC authority on environmental matters.⁴⁵³

However, the EU did not view a healthful environment as a standalone right, but rather as one connected with other protected human rights, such as the right to private and family life and

⁴⁴⁵ Id.

⁴⁴⁶ Id.

⁴⁴⁷ Id.

⁴⁴⁸ Ole W. Pedersen, *European Environmental Human Rights and Environmental Rights: A Long Time Coming*, 21 *Geo. Int'l Env'tl. L. Rev.* 73 (2008).

⁴⁴⁹ Id.

⁴⁵⁰ Id.

⁴⁵¹ Id.

⁴⁵² Id.

⁴⁵³ Id.

the right to life.⁴⁵⁴ Although environmental jurisprudence has developed rapidly, the European Convention on Human Rights (ECHR) repeatedly refused to add environmental quality protection as a separate right. Nevertheless, the court's decisions set out some general principles that aimed to protect the environment as part of protecting other rights, which eventually led to environmental protection. Thus, protecting the environment must be addressed only to protect other rights that the ECHR recognized, such as the right to private life and the right to life. These rights entitled the government to take serious steps to protect the environment as a means to protect human rights.

4.11. Environment quality and human rights

The ECHR clearly shows in its decisions that the right to protect the environment is linked to other human rights, starting with the *Lopez Ostra v. Spain*, which recognized the right to protect the environment as a means to protect the right to private and family life.⁴⁵⁵ In this case, the complainant argues that the state tolerated continuation of business activities that violated waste-management rules and hindered the private life of Gregoria Lopez Ostra and her family, who lived near a waste-treatment facility.⁴⁵⁶ The court ruled that any environmental pollution that resulted in preventing people from enjoying their homes in such a way as to affect their private and family life is forbidden and violates the European Convention on Human Rights.⁴⁵⁷ The Lopez Ostra case became a precedent that served as a basis for cases to follow.⁴⁵⁸ This precedent could be seen in many other cases, such as the *Guerra v. Italy*.⁴⁵⁹ In this case, the complainant argued that the state did not inform its citizens of its project's dangers to their

⁴⁵⁴ Id.

⁴⁵⁵ Hannes Veinla, *Precautionary Environmental Protection and Human Rights*, 12 *Juridica Int'l* 91 (2007).

⁴⁵⁶ Id.

⁴⁵⁷ Id.

⁴⁵⁸ Id.

⁴⁵⁹ Id.

private and family life.⁴⁶⁰ The court held that every person has a right to a certain private space and, thus, any violation of this space, including pollution, is a violation of human rights.⁴⁶¹ The court went further and stated that even airport noise violates the right of private life, which can be seen in *Arrondelle v. United Kingdom* and *Baggs v. United Kingdom*.⁴⁶² These show that ECHR courts were protecting the environment, albeit indirectly.

Another major article that the ECHR relies on to protect the environment is Article 6, which focuses on fair trials.⁴⁶³ Many cases demonstrate this type of protection, such as *Zander v. Sweden*.⁴⁶⁴ In this case, the court held that if a neighboring landowner suffers from water pollution from an adjacent waste treatment facility, this would violate Article 6.⁴⁶⁵ Another major case in which the court relied on Article 6 to protect the environment is *Zimmermann and Steiner v. Switzerland*. In this case, it was ruled that any damage caused by noise and air pollution from a nearby airport violates Article 6.⁴⁶⁶ Thus, domestic laws might not dismiss these claims, using the argument that non-pecuniary damage cannot be taken into account under existing laws.⁴⁶⁷ *Taşkin et al. v. Turkey* is another case in which the court recognized environmental rights as part of Article 6.⁴⁶⁸ In this case, local inhabitants near a gold mine suffered from cyanide pollution that the mine produced.⁴⁶⁹ The court held that people have the

⁴⁶⁰ Id.

⁴⁶¹ Id.

⁴⁶² Id.

⁴⁶³ Jonathan Verschuuren, *Contribution of the Case Law of the European Court of Human Rights to Sustainable Development in Europe*, Edward Elgar Publishers, 1-15 (2014).

⁴⁶⁴ Id.

⁴⁶⁵ Id.

⁴⁶⁶ Id.

⁴⁶⁷ Id.

⁴⁶⁸ Id.

⁴⁶⁹ Id.

right to bring a lawsuit for environmental damages and that dismissing their claims violates Article 6.⁴⁷⁰

The court even went further, allowing environmental NGOs to file lawsuits to protect their environmental interests.⁴⁷¹ This could be seen in a case on the construction of dams in Itoiz, Spain. Environmental NGOs argued that these dams threaten three nature reserves and several small villages.⁴⁷² The court explained that an environmental NGO can seek a claim and have the right to a fair trial under Article 6 as long as it represents its members' interests.⁴⁷³ The court explained the distinction between common-interest and general-interest litigation.⁴⁷⁴

It seems that the EU tried to include environmental protection in its laws. UNHRC Resolution 2005/60 (2005) recognized the importance of linking a decent environment with human rights.⁴⁷⁵ It encourages the implementation of the principles from the Rio Declaration on Environment and Development, which aim to ensure effective access to judicial and administrative proceedings, including redress and remedy.⁴⁷⁶ Article 10 of the Rio Declaration goes even further, acknowledging the importance of the public's role in the decision-making process regarding environmental issues.⁴⁷⁷ Including the right to a decent environment and human rights comes from the fact that the latter rights cannot be performed without a safe environment.⁴⁷⁸ It also comes from the fact that human beings would bear the consequences of living with a damaged environment; thus, they must be involved in the decision making.

⁴⁷⁰ Id.

⁴⁷¹ Id.

⁴⁷² Id.

⁴⁷³ Id.

⁴⁷⁴ Id.

⁴⁷⁵ Alan Boyle, *Human Rights and the Environment: Where Next?*, 23 *European Journal of International Law*, 613–642 (2012).

⁴⁷⁶ Id.

⁴⁷⁷ Id.

⁴⁷⁸ Id.

Nevertheless, courts have refused to accept the inclusion of environment rights as separate, standalone human rights.

One might argue that not linking environment rights with other human rights is not problematic. This argument comes from the contention that because the procedures that the ECHR adopted would protect the environment anyway, it is pointless to discuss whether environmental rights should exist in their own right. In other words, environmental rights seem to be prerequisite rights for other human rights, as they cannot be performed unless a healthful environment is present. This has been seen in many cases that the ECHR has adjudicated, such as *Zander v. Sweden*, *Zimmermann and Steiner v. Switzerland*, and *Taşkin et al. v. Turkey*, as the court held in all these cases that a healthful environment is important to perform other human rights. Thus, there would be no point to insisting on including the environment as a separate right, as it already is protected.

This argument seems to assume that any environmental damages automatically will violate some ECHR articles, which is inaccurate. In fact, the court must be convinced that a direct link exists between environmental damage and human rights that the convention protects. Thus, not all environmental damages are protected. This could be seen in many cases, such as *X and Y v. Federal Republic of Germany*.⁴⁷⁹ In this case, the applicant is an environmental organization that owned 2.5 acres of land for nature observation. It argues that the adjacent area was used for military purposes, which damaged this area's environment.⁴⁸⁰ The commission rejected this argument: "No right to nature preservation is as such included among the rights and freedoms guaranteed by the Convention and in particular by Arts. 2, 3, or 5 as invoked by the

⁴⁷⁹ Malgosia A. Fitzmaurice, *Human rights and the environment – right to a clean environment*, 293 Recueil des cours 305 (2001).

⁴⁸⁰ *Id.*

Applicant.”⁴⁸¹ This clearly shows that not all environmental damages are protected, thereby refuting the aforementioned argument that says environmental rights always are protected as long as they are linked to other human rights.

It has been shown that the ECHR does not adopt the idea of protecting the environment as a separate right. Therefore, environmental damages always have been tested against other rights that have been laid down in the convention.⁴⁸² This approach has been criticized, as it does not allow for maneuvering room in the courts.⁴⁸³ It also denies the importance of avoiding any action that can damage the environment.⁴⁸⁴ The ECHR fails to recognize the fact that the environment is the principal reason for humans’ existence, so it must be protected more than any other rights. For example, there would be no point in protecting the right to privacy in a disruptive environment with extreme air and water pollution. The ECHR could not restrict itself to protecting only rights in existence because at that time (1950s), the need for environmental protection was not yet apparent.⁴⁸⁵ However, this is not the case today, as climate change and protecting the environment have become major issues on which our existence relies. The Declaration of the United Nations Conference on the Human Environment stated, as its first principle: “Man has the fundamental right to freedom, equality, and adequate conditions of life, in an environment of quality that permits a life of dignity and well-being.”⁴⁸⁶

Many attempts have been taken to include environmental rights as part of human rights through additional protocols in the ECHR system.⁴⁸⁷ This began in 1973 when a German

⁴⁸¹ Id.

⁴⁸² Verschuuren, supra.

⁴⁸³ Id.

⁴⁸⁴ Id.

⁴⁸⁵ Id.

⁴⁸⁶ Id.

⁴⁸⁷ Id.

working group proposed adding a protocol to Article 1, establishing the right to a healthful environment.⁴⁸⁸ The Committee of Ministers rejected this proposal, arguing that no need exists to expand the ECHR with a right to a healthful environment.⁴⁸⁹ Many scholars demanded that environmental quality become a right in the ECHR.⁴⁹⁰ In 2009, the Parliamentary Assembly of the Council of Europe made some recommendations about including the environmental quality right as a human right through an additional ECHR protocol.⁴⁹¹ It argued for adding not only a healthy-environment right, but also stating explicitly that protecting the environment is society's duty as a whole.⁴⁹² However, all these recommendations remain unanswered by the Committee of Ministers.⁴⁹³

One of the possible reasons for ignoring environmental rights as human rights is the fact that the economic system does not include externalities in its risk-benefit analysis.⁴⁹⁴ Thus, corporations and governments assess their profits without considering any harm that their actions may cause.⁴⁹⁵ Thus, companies, according to neo-liberal economic theory, focus on their own interests without including externalities in their assessment.⁴⁹⁶ For instance, when a coal factory assesses its costs and benefits, it focuses on factory, salary, and loan costs, as well as factory profits, simultaneously. In this assessment, the factory does not assess potential harm to land, air, or water in communities near the factory, thereby increasing its profits. This fuels the argument

⁴⁸⁸ *Id.*

⁴⁸⁹ *Id.*

⁴⁹⁰ *Id.*

⁴⁹¹ *Id.*

⁴⁹² *Id.*

⁴⁹³ *Id.*

⁴⁹⁴ David Korten, *When Corporations Rule the World*, Second Edition, *supra*.

⁴⁹⁵ *Id.*

⁴⁹⁶ *Id.*

that trying to include environmental health as part of human rights would damage the business community, thereby creating resistance to such an idea.

I argue that linking environmental rights with other human rights will not be efficient in realizing the goal of protecting the environment because each court must be convinced that environmental damage harms human rights directly to grant ECHR protection. Thus, environmental damage cannot be viewed as a violation of human rights based on court discretion. For instance, in the *Kyrtatos v. Greece*, the court ruled that the destruction of a forest near the complainant's house affected the complainant's well-being, while simultaneously ruling that the destruction of other natural habitat types is not a ECHR violation.⁴⁹⁷ Thus, deciding what environmental dangers violate human rights will be decided based on judges' perspectives, e.g., whether he or she prefers forests over other types of nature.⁴⁹⁸ Thus, environmental damages will be decided subjectively.

Conclusion

Climate change is a serious threat to the existence of human beings. Crucially, it harms the Earth, which is arguably the only planet that humans can survive on, and impacts the necessities of human life, including food production, plants, and animals. Moreover, climate change can introduce serious short-term challenges to a country's political stability and economy. The consequences of climate change have led to revolutions in many countries that were otherwise politically stable, such as Afghanistan. Further, many studies have found that trillions of dollars are lost annually due to increased temperatures and decreased worker productivity. Notably, the

⁴⁹⁷ Verschuuren, supra.

⁴⁹⁸ *Id.*

foundational Stockholm Declaration outlined how environmental quality rights can be adopted as human rights. Following its logic, environmental quality is a prerequisite for all human rights, as rights such as the right to adequate housing (Article 11 ICCPR), health (Article 12 ICCPR), and life (Article 6 ICESCR) cannot be protected without a decent environment.

Chapter 3 Renewable Energy Sector

Introduction

Renewable energy has been introduced as a promising new clean energy that can replace fossil fuels in energy generation. Compared with fossil fuels, renewable energy has become more competitive than ever before because of technological developments. It is predicted that the use of renewable energy will increase, which can help in partly solving the problem of climate change. Moreover, even oil-producing countries such as Saudi Arabia have been encouraged to shift to shift to renewable energy as many countries have become less interested in generating energy from fossil fuels because of climate change. This would lead to a decrease in the demand for fossil fuels, thereby reducing their price. Furthermore, it is predicted that many countries would shift from fossil fuels even further owing to the ongoing advancement of renewable energy.

However, there are many issues associated with the use of renewable energy, making it less competitive than fossil fuels. The first issue is that this source of energy is intermittent, which means that electricity will only be generated when the sun is shining or the wind is blowing. This leads to the second issue, which is energy storage. The issue of intermittency can be solved by storing energy through batteries or by any other means when the sun is shining or the wind is blowing. However, batteries still face many issues, such as short lifetimes as well as their inability to store energy for a long time. Although there are many developments in battery technology, it is still seen as one of the most important issues in renewable energy. It also makes it less competitive than fossil fuels wherein energy is stored in a raw material that can be used whenever it is needed.

Nevertheless, ongoing developments are promising for advancing energy storage technologies, such as the current use of flow batteries instead of lithium-ion batteries for solving many issues, such as increasing lifetime and recycling. Many developments have occurred, such as the improvement of solar cells as well as battery technology for energy storage. These developments are rapid and promising; for instance, the price of solar energy has decreased by about 85% since 2009, which makes it a promising energy source that is expected to be more competitive in the future. The cost of photovoltaics (PV) per watt has decreased from US\$ 100 in 2000 to only US\$ 5 in 2020. Many current promising projects, such as the NASA and MIT projects on developing solar cells (PV), are predicted to increase the efficiency of renewable energy even further. The NASA project is expected to improve efficiencies from 30% to over 40%.

The rest of this chapter will proceed as follows: first, this chapter will focus on the existence and development of renewable energy. It will explain how the idea of shifting from fossil fuels to renewable energy came from and how necessary is this shift. This part will shed light on how humanity has shifted from an old source of energy to another more efficient one, such as the shift from wood to fossil fuels. The second part of this chapter will shed light on the importance of renewable energy. More specifically, it will address the reason for shifting from fossil fuels to renewable energy, even though the former is more efficient than the latter. The third part of this chapter will focus on solar energy as one of the most important types in relation to Saudi Arabia. The reason for restricting the scope of this chapter to solar energy is that Saudi Arabia receives a large amount of solar radiation, making it the most attractive source of renewable energy. Since this dissertation focuses on renewable energy in Saudi Arabia, it is important to address the types of renewable energy that are available in that country. The fourth

part of this chapter will emphasize on the main issues facing renewable energy, namely, intermittency and energy storage. It will also explain the developments that have occurred and the promising projects that have been undertaken to address these issues.

1. Existence and development of renewable energy

Throughout history, wood was the source of energy for all human beings, who used it for heating, cooking, and lighting.⁴⁹⁹ Plants obtain energy mainly from the sun and nutrients from the soil.⁵⁰⁰ The light from the sun strikes the leaves, and photosynthesis uses this light to combine carbon dioxide (Co2) and water to make glucose, which is stored in the wood itself.⁵⁰¹ From wood, humans could generate fire, which is arguably the first use of resources to generate energy.⁵⁰² The use of fire enabled human communities to flourish and allowed them to eat new types of food.⁵⁰³ Thus, fire became a major part of all human history.⁵⁰⁴

1.1. Discovery of fire

Moreover, the use of fire influenced human biology, because it enabled humans to obtain a high-quality diet that fueled the increase in brain size throughout the Pleistocene.⁵⁰⁵ Fire was the core of all developments as all modern technologies contain many forms of hidden fire, as in the internal combustion engine.⁵⁰⁶ It means that without the discovery of fire, the idea of the engine would not have been developed. Fire also made the most contribution in technologies,

⁴⁹⁹ EIA, Renewable energy explained (2019), available at: <https://www.eia.gov/energyexplained/renewable-sources/> (accessed June 10, 2020).

⁵⁰⁰ See Energy Education Activity Guide Student Book of the University of Wisconsin.

⁵⁰¹ Id.

⁵⁰² J. A. J. Gowlett, The discovery of fire by humans: a long and convoluted process, US National Library of Medicine 1696 (2016).

⁵⁰³ Id.

⁵⁰⁴ Id.

⁵⁰⁵ Id.

⁵⁰⁶ Id.

from ceramics to metal working to the nuclear industry.⁵⁰⁷ As a result of this huge impact of fire on human lives, it became socially embedded to the point that it became a part of many religious rituals.⁵⁰⁸ This made Darwin consider fire as humanity's greatest discovery, aside from language.⁵⁰⁹

1.2. Primitive uses of renewable energy

After the discovery of fire and pre-industrial prime movers and fuels, humans generated energy from many sources other than wood, such as water.⁵¹⁰ In his book "Energy and Civilization", Smil explained that humans were able to use many energy sources, such as wind and water, through impressive feats of engineering, although these resources did not change over millennia.⁵¹¹ Even before the existence of tools to convert water and wind power into energy, animate power supplied by people or animals was managed and led to impressive achievements, such as the erection of a 140-ton structure at the Inca city of Ollantaytambo in Peru and the construction of 85,000 km of hard top roads in ancient Rome.⁵¹² These old discoveries inspired the development of intricate water-raising and windmill machines and improved efficiency in charcoal and iron production, producing blast furnaces.⁵¹³

1.3. Fossil fuels era

After the use of wood and water as the main sources of energy, fossil fuels became the dominant resource for generating energy in the 16th and 17th centuries in England, owing to serious wood shortages.⁵¹⁴ According to Smil, generating energy from fossil fuels was the

⁵⁰⁷ Id.

⁵⁰⁸ Id.

⁵⁰⁹ Id.

⁵¹⁰ Vaclav Smil, *Energy and Civilization: A History*, The MIT Press (1st ed, 2017).

⁵¹¹ Id.

⁵¹² Id.

⁵¹³ Id.

⁵¹⁴ Id.

“greatest technical innovations of the modern era,” which increased iron production.⁵¹⁵ This has led to the establishment of the modern steel industry and provided the key metal for industrialization.⁵¹⁶ The use of fossil fuels played an important role in the establishment of the steam engine, which is an internal combustion engine, and the gas turbine.⁵¹⁷ Most importantly, fossil fuels enabled humans to generate electricity, which is arguably the most important benefit derived from fossil fuels. The use of electricity has led to light as a result of a combination of efforts between engineers and scientists, beginning with Luigi Galvani who demonstrated animal electricity serendipitously and Michael Faraday who discovered electromagnetic induction.⁵¹⁸ Then, Thomas Edison made a major contribution to the discovery of electricity as he did not only invent the first light bulb, but also built an electricity-generating plant and utility system.⁵¹⁹ Notice that all these discoveries were made after releasing energy from fossil fuels, which is still the dominant source of energy. This made enriched oil-producing countries by only relying on this resource.

1.4. Decline of fossil fuels

However, fossil fuel prices tend to oscillate owing to many reasons. The first reason is that many countries have become less interested in generating energy from fossil fuels owing to the climate change that they cause.⁵²⁰ The second reason why fossil fuels have become less important as the main source of energy is the development of renewable energy technologies. Renewable energy that is generated from natural resources has become reliable. This development led to a decrease in the demand for fossil fuels, which caused a decline in oil prices

⁵¹⁵ Id.

⁵¹⁶ Id.

⁵¹⁷ Id.

⁵¹⁸ Id.

⁵¹⁹ Id.

⁵²⁰ The issue of climate change has been explained in the first chapter

and much harm to oil-producing countries such as those in the Persian Gulf.⁵²¹ It has been reported that the financial reserves of the Gulf countries will be able to fill the budget deficit for 15 years, according to a study by the IMF.⁵²² The IMF stated that these reserves will disappear because of many reasons,⁵²³ among which is the decrease in the demand for fossil fuels owing to the abundance of extracted gas, which countries tend to use instead of fossil fuels as it is less disruptive to the environment. Consequently, many oil-producing countries such as Saudi Arabia have made plans to shift from fossil fuels to renewable energy as the main source of energy. The country planned to make this monumental shift with the help of McKinsey Global Institute; the plan was called “SAUDI ARABIA BEYOND OIL: THE INVESTMENT AND PRODUCTIVITY TRANSFORMATION” or “the vision of 2030” in short.⁵²⁴ The vision of Saudi Arabia will be discussed extensively in the next chapter.

The idea of shifting from fossil fuels to other resources to generate energy is not new; in fact, it started in the 1970s.⁵²⁵ In that period and owing to many political conflicts, OPEC countries decided to impose an embargo against many countries, which caused oil prices to increase significantly.⁵²⁶ Initially, many countries tried to replace oil with coal and gas, but nevertheless, oil retained its favored position.⁵²⁷ In fact, oil is still the dominant energy source of

⁵²¹ Kristian Coates Ulrichsen, ECONOMIC DIVERSIFICATION IN GULF COOPERATION COUNCIL (GCC) STATES, Rice University's Baker Institute for Public Policy (2017).

⁵²² See the IMF report: The Future of Oil and Fiscal Sustainability in the GCC Region (2020), available at: <https://www.imf.org/en/Publications/Departmental-Papers-Policy-Papers/Issues/2020/01/31/The-Future-of-Oil-and-Fiscal-Sustainability-in-the-GCC-Region-48934> (accessed June 10, 2020).

⁵²³ Id.

⁵²⁴ The vision is available at:

https://www.mckinsey.com/~media/McKinsey/Featured%20Insights/Employment%20and%20Growth/Moving%20Saudi%20Arabias%20economy%20beyond%20oil/MGI%20Saudi%20Arabia_Executive%20summary_December%202015.ashx

⁵²⁵ See the blog of the United Nations University, A brief history of the role of energy in the global economy, available at: <https://www.wider.unu.edu/publication/brief-history-role-energy-global-economy> (accessed June 10, 2020).

⁵²⁶ Id.

⁵²⁷ Id.

countries as shown by the strong growth of oil consumption in non-OECD countries, whereas in OECD countries, it peaked in 2004. The reason for the total reliance on fossil fuels as the main source of energy is the efficiency of fossil fuels in energy generation. However, renewable energy continually began to be more efficient in energy generation owing to technological developments, which made many countries consider this type of energy seriously.⁵²⁸ In fact, OPEC countries such as Saudi Arabia have a long-term vision of relying on clean energy instead of fossil fuels, even if not totally.⁵²⁹ In 2018, about 17% of the total U.S. electricity generation was from renewable energy sources.⁵³⁰

The shift towards renewable energy comes from the fact that the energy is produced from natural resources that are constantly replaced and never run out.⁵³¹ For instance, energy can be produced from sunlight, geothermal heat, wind, tides, and water in order to satisfy the increasing energy demand by populations.⁵³² Although humans used some of these natural resources to generate energy in the past, the new technological developments have made the process of generating energy from these resources more efficient, which can be relied on to satisfy the needs of modern societies.⁵³³ This development comes from the investments of many countries on research to improve the efficiency of the use of renewable energy.⁵³⁴ For instance, the U.S. Department of Energy (DOE) made a significant contribution to the improvement of solar technologies in terms of the performance and reliability of renewable energy systems.⁵³⁵ In other

⁵²⁸ EIA, Renewable energy explained (2019), available at: <https://www.eia.gov/energyexplained/renewable-sources/> (accessed June 10, 2020).

⁵²⁹ The Saudi vision, *supra*.

⁵³⁰ EIA, Renewable energy explained, *supra*.

⁵³¹ Australian Renewable Energy Agency, Renewable Energy (2020), available at: <https://arena.gov.au/what-is-renewable-energy/> (accessed June 10, 2020).

⁵³² Daniel Ciolkosz, What is Renewable Energy?, Penn State extension (2009).

⁵³³ Australian Renewable Energy Agency, Renewable Energy, *supra*.

⁵³⁴ Stanley Bull and Lynn Billman, RENEWABLE ENERGY: READY TO MEET ITS PROMISE?, National Renewable Energy Laboratory (1998).

⁵³⁵ *Id.*

words, renewable resources can be used to produce electricity for all economic sectors, fuel for transportation, and heat for buildings and industrial processes.⁵³⁶

Energy that comes from natural resources must not be seen as a tiny source of energy that can only satisfy the needs of small towns and cities. Rather, natural resources can satisfy the needs of all humans on Earth, but the main issue is that the energy that comes from natural resources is not utilized efficiently. In other words, the energy from natural resources could be utilized more efficiently if humans can develop advanced technological equipment. It is estimated that energy that comes from the sun has the capability to provide electricity for the entire world if 100% of this energy is exploited.⁵³⁷ Moreover, the solar insolation that falls daily on North African deserts is sufficiently intense to provide energy to the entire planet.⁵³⁸ Although it is not practical because human beings could not yet exploit 100% of the energy that comes from the sun, there is no reason to argue that a 100% exploitation is impossible. Fortunately, renewable energy is not restricted to solar energy but also other resources, such as energy from wind and water power, geothermal heat, and biomass, where technological developments can help in providing energy from these resources.⁵³⁹

Admittedly, scientific advancement is the main reason for developing renewable energy technologies that allow efficient energy generation at a low cost. Many fields of science were used the most to develop renewable energy technologies, which include mechanical and electrical engineering, materials science, physics, chemistry, and the biological sciences, and in

⁵³⁶ Id.

⁵³⁷ Federal Ministry for economic cooperation and development of Germany, Sustainable Energy for Development (2014), available at: https://www.bmz.de/en/publications/topics/energy/Materialie235_Information_Brochure_1_2014.pdf (accessed June 10, 2020).

⁵³⁸ Id.

⁵³⁹ Id.

many cases, a multidisciplinary team is required to tackle the multifaceted problems posed.⁵⁴⁰ Some fields of science such as physics were used more than others in certain technologies.⁵⁴¹ Physics plays a more notable role than other sciences in the development of photovoltaics.⁵⁴² Most of the fundamental research studies that are significant to the development of novel types of cell, which resulted in step changes in the cost of photovoltaic generation, came from physics.⁵⁴³ Physics can also contribute to the development of hydrogen storage, fuel cells, and grid integration.⁵⁴⁴ What made physics contribute more to the development of renewable technology is the fact that physicists have the capability to transfer some skills, such as simplification by approximation, systems analysis, and problem solving.⁵⁴⁵ These skills are useful for tackling engineering problems and can be helpful in statistical analysis.⁵⁴⁶

The development of renewable energy technology has made even oil-producing countries take serious steps towards renewable energy.⁵⁴⁷ In Texas, an oil-producing state, wind power generated 17% of the electricity in 2017.⁵⁴⁸ Similarly, Saudi Arabia is joining this transition, installing several of the world's largest solar projects.⁵⁴⁹ Among the reasons is the decrease in the demand for fossil fuels owing to the abundance of extracted gas, which countries tend to use instead of fossil fuels as it is less disruptive to the environment. The second reason is the development of renewable energy resources, which would lead to a decrease in the demand for

⁵⁴⁰ The Role of Physics in Renewable Energy RD&D, A report produced for the Institute of Physics by Future Energy Solutions (2005), available at: https://www.iop.org/publications/iop/archive/file_52050.pdf (accessed June 11, 2020).

⁵⁴¹ Id.

⁵⁴² Id.

⁵⁴³ Id.

⁵⁴⁴ Id.

⁵⁴⁵ Id.

⁵⁴⁶ Id.

⁵⁴⁷ BRUCE USHER, RENEWABLE ENERGY IN THE TWENTY-FIRST CENTURY (Columbia University Press, 2019).

⁵⁴⁸ Id.

⁵⁴⁹ Id.

fossil fuels to generate energy and thus decrease their price. This issue could also become increasingly serious because many countries have become more interested in clean energy and thus enacted laws that give incentives to the use of clean energy. This made Saudi Arabia decide to shift from relying on fossil fuels towards a diversification of income sources through its 2030 vision.

The idea of shifting to renewable energy is not a technical or political matter or an environmental concern.⁵⁵⁰ Rather, it is an ethical duty of the current generation to ensure a high quality of life for future generations.⁵⁵¹ The future survival of human beings will depend on finding clean energy sources that are sustainable and not harmful to the environment. The fate of humanity depends heavily on how quickly humans can provide a clean source of energy and then improve the legal framework for sustainable development.⁵⁵² The UN General Assembly has estimated that humans have only a decade or two before critical global ecosystems suffer significant irreversible consequences.⁵⁵³ Nevertheless, human beings still have the potential to find solutions to shift to clean energy if these solutions are adopted early. As a recognition of this issue by many countries, the United Nations Conference on Environment and Development adopted Agenda 21 as a blueprint for attaining sustainable development.⁵⁵⁴ The 27 principles of the Rio Declaration say that “States and people shall cooperate in good faith and in a spirit of partnership in the fulfilment of the principles embodied in this Declaration and in the further

⁵⁵⁰ Norah bin Hamad, *Foundations for Sustainable Development: Harmonizing Islam, Nature and Law*, A dissertation published at Pace University 1-377 (2017).

⁵⁵¹ Rajendra Ramlogan, *Sustainable development: Towards a judicial interpretation* (BRILL publication, 2010).

⁵⁵² Hamad, *supra*.

⁵⁵³ UN General Assembly Resolution available at <http://www.un.org/en/ga/70/resolutions.shtml>

⁵⁵⁴ Nicholas A. Robinson, “The Law of Sustainable Development,” 13 *Pace Env'tl. L. Rev.* 507 (1996). Available at: <http://digitalcommons.pace.edu/pelr/vol13/iss2/4>

development of international law in the field of sustainable development.”⁵⁵⁵ This cooperation between states and people is important since the human population is increasing, and it is predicted that by 2100, the global population will grow to approximately 11 billion.⁵⁵⁶

If human beings ignore the importance of shifting to clean energy and stick with fossil fuels to satisfy their energy needs, catastrophic consequences would occur. Relying on fossil fuels would result in more pollution, which would worsen the problem of climate change and thus threaten the very existence of human beings. In addition to the long-term crisis that fossil fuels would cause, this source seems to affect human health in the short term.⁵⁵⁷ Throughout the energy life cycle, starting from fuel collection to energy production to the disposal of waste products, humans could be negatively impacted as a result, especially poor societies.⁵⁵⁸ The Global Burden of Disease assessment (2010) calculated the health issues caused by solid fuel use for selected diseases with sufficient evidence.⁵⁵⁹ It has been shown that children under five years of age would suffer from pneumonia, chronic obstructive pulmonary disease (COPD), cardiovascular disease, cataracts, and lung cancer in adults.⁵⁶⁰ It has also been proven that children would suffer from cognitive dysfunction, low birth weight, and tuberculosis.⁵⁶¹ The study also estimated that 3.5 million deaths were caused in 2010 simply by using solid fuels for household cooking.⁵⁶² In terms of lost healthy life years, it has been estimated that the use of

⁵⁵⁵ Stockholm Declaration on the Human Environment, Principle 21, (1972) Available at: https://www.un.org/en/development/desa/population/migration/generalassembly/docs/globalcompact/A_CONF.151_26_Vol.I_Declaration.pdf

⁵⁵⁶ Hamad, *supra*.

⁵⁵⁷ Kirk Smith et al, Energy and Human Health, 34 National library of medicine 159–188 (2013).

⁵⁵⁸ *Id.*

⁵⁵⁹ *Id.*

⁵⁶⁰ *Id.*

⁵⁶¹ Dix-Cooper et al, Neurodevelopmental performance among school age children in rural Guatemala is associated with prenatal and postnatal exposure to carbon monoxide, a marker for exposure to woodsmoke, 33 *Neurotoxicology* 246-254 (2012).

⁵⁶² *Id.*

solid fuels was the most important risk factor after high blood pressure among women who were examined worldwide.⁵⁶³ For men, the use of solid fuels was the fourth important risk factor that causes the loss of healthy life years after smoking, high blood pressure, and alcohol.⁵⁶⁴

Montgomery said that pollution coming open-fire sources harms about 3 billion people, which means that people who spend more time near a stove would be more vulnerable than others who do not, as the particulate matter generated mostly by coal and diesel is easily inhaled and absorbed into the bloodstream.⁵⁶⁵

1.5. Impact of fossil fuels on human health

The direct negative impact of using fossil fuels on human health is even worse for many poor regions, such as South Asia and much of sub-Saharan Africa.⁵⁶⁶ It has been shown that solid fuel use was the first or second main cause of poor human health in these regions.⁵⁶⁷ In fact, the impact of fossil fuels is more dangerous than unsafe water in these societies.⁵⁶⁸ It is found that household cooking using solid fuels causes 16% of outdoor particle air pollution in the world.⁵⁶⁹ It has been proven that household solid fuels cause about 5% world's lost healthy life years and nearly 4 million premature deaths in 2010.⁵⁷⁰ This danger coming from the use of fossil fuels is a result of petroleum refining, which releases many chemicals that are mostly

⁵⁶³ Id.

⁵⁶⁴ Id.

⁵⁶⁵ See Kim Eckart's blog at University of Washington, UW Jackson School researcher: Alternative energy is key to long-term health (2018), available at: <https://www.washington.edu/news/2018/04/16/renewable-energy-is-key-to-long-term-health/> (accessed June 13, 2020).

⁵⁶⁶ Smith, *supra*.

⁵⁶⁷ Id.

⁵⁶⁸ Id.

⁵⁶⁹ Stephen Lim, A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990--2010: a systematic analysis for the Global Burden of Disease Study 2010, 380 *The Lancet* 2224-2260 (2012).

⁵⁷⁰ Id.

carcinogenic.⁵⁷¹ Many epidemiological studies have shown that petroleum industry workers are more vulnerable to cancer than other workers.⁵⁷² These negative effects would also harm communities located near refineries as they would be exposed to all these carcinogens.⁵⁷³

What makes fossil fuels even more dangerous is the fact that leaks and spills of these fuels can cause serious harm. There are many examples of spills that have occurred, such as the 2010 Deepwater Horizon spill, the 1989 Exxon Valdez spill that occurred during transport by pipeline or ship, and the 1998 pipeline leak and subsequent explosion in northern Nigeria.⁵⁷⁴ Ships that carry fossil fuels might sink in the sea and thus kill sea creatures.⁵⁷⁵ The spill of the Ixtoc I in Mexico might be the largest spill that ever occurred.⁵⁷⁶ This accident caused half a million tons of crude oil to be dumped into the Gulf of Mexico, which polluted 162 miles of U.S. beaches.⁵⁷⁷ In China, the Sinopec pipeline exploded in 2013, causing the deaths of 55 people.⁵⁷⁸ It could be seen that these spills and leaks cause serious harm to human health and considerable ecological damage.⁵⁷⁹ Human impacts would include fatalities, food contamination, and mental health disorders.⁵⁸⁰ This would also make refiners of fossil fuels targets of intentional attacks in any political conflict, which will lead to more damage.⁵⁸¹

1.6. Need to shift towards clean energy sources

⁵⁷¹ SP Tsai et al, A mortality and morbidity study of refinery and petrochemical employees in Louisiana, 60 Occupational and environmental medicine 627-633 (2003).

⁵⁷² Peter Baker, Meta-analysis of standardized incidence and mortality rates of childhood leukaemia in proximity to nuclear facilities, 16 European Journal of Cancer Care 355-363 (2007).

⁵⁷³ Id.

⁵⁷⁴ Smith, supra.

⁵⁷⁵ Umair Shahzad, The Need For Renewable Energy Sources, ITEE Journal 16-18 (2012).

⁵⁷⁶ Id.

⁵⁷⁷ Id.

⁵⁷⁸ Id.

⁵⁷⁹ Kjellstrom, Mauzerall, McKone, McMichael and Schneider, supra.

⁵⁸⁰ Id.

⁵⁸¹ Id.

There are many benefits, other than preventing climate change, of shifting from fossil fuels to renewable energy, given the abundance of renewable energy resources. Unlike fossil fuels, almost all regions have some renewable energy resources.⁵⁸² This will make many countries more secure with regard to their energy generation⁵⁸³ and not be at the mercy of some oil-producing countries that could control their source of energy.⁵⁸⁴ Moreover, developing and relying on renewable energy would satisfy future energy demands due to population growth. The International Energy Agency predicted that the use of energy will increase from 3.3 million megawatts in 2000 to 8 million megawatts in 2020.⁵⁸⁵ This made governments aim to secure their energy needs using any source of energy, especially renewable energy that all countries can rely on, even partly, in their regions. Most importantly, relying of fossil fuels would not be a wise long-term plan to secure a country's energy needs since this resource will start to run out between the years 2020 and 2060, according to the petroleum industry's best analysts.⁵⁸⁶ Shell International predicted that by 2060, 60% of the world's energy needs would be dependent on renewable energy.⁵⁸⁷ The World Bank also estimated that the global market for solar electricity will reach \$4 trillion in about 30 years.⁵⁸⁸

The ability to generate energy, whether from renewable or nonrenewable sources, is essential in maintaining modern civilization. Many studies illustrate that providing poor countries with access to modern energy (such as electricity or natural gas) is important to reach

⁵⁸² Bull and Billman, supra.

⁵⁸³ *Id.*

⁵⁸⁴ *Id.*

⁵⁸⁵ See the National Renewable Energy Laboratory report: SCIENCE PROJECTS IN RENEWABLE ENERGY AND ENERGY EFFICIENCY, available at: <https://www.nrel.gov/docs/gen/fy08/42236.pdf> (accessed June 17, 2020).

⁵⁸⁶ *Id.*

⁵⁸⁷ *Id.*

⁵⁸⁸ *Id.*

the Millennium Development Goals.⁵⁸⁹ Although many nations have exploited nonrenewable energy to generate electricity, almost 20% of the world population, mostly in rural areas, still lack access to electricity.⁵⁹⁰ The number of homes that do not have access to energy is not expected to change in the next decade owing to the absence of a concerted effort to improve energy access.⁵⁹¹ In fact, it is predicted that this number would decrease because of the tendency of countries to minimize the use of fossil fuels (the main source of modern energy) for energy generation owing to its negative impacts on the environment. The United Nations Development Programme has noted that that aside from the importance of fossil fuels in energy generation, access to clean energy from renewable resources is essential as a fundamental determinant of human development, including health, education, gender equality, and environmental safety.⁵⁹²

2. Solar energy

Solar energy simply means the use of sun radiation through specific technologies to generate energy. It is well known that the sun is the main source of energy on Earth as its radiation provides energy to plants that animals and human beings rely on. Two main technologies have been created in order to convert the radiation of the sun into energy that humans can use.⁵⁹³ These two technologies are photovoltaic (PV) plants and concentrated solar power (CSP) plants.⁵⁹⁴ These inventions enabled humans to use some of the sun's radiation to generate energy that can satisfy the needs of modern society, such as electricity. Moreover, these

⁵⁸⁹ Jayant Sathaye, Oswaldo Lucon, Atiq Rahman, John Christensen and Fatima Denton, *Renewable Energy in the Context of Sustainable Development*, University of Dayton: Physics Faculty Publication 710- 767 (2011).

⁵⁹⁰ *Id.*

⁵⁹¹ *Id.*

⁵⁹² *Id.*

⁵⁹³ Michael N. Widener, *Current Events: Reflections on Solar Power Generators' Ground Leasing of Vacant Tracts*, 4 *Ky. J. Equine Agric. & Nat. Resources L.* 339 (2011).

⁵⁹⁴ *Id.*

inventions are clean and sustainable, and there are many possibilities to develop these technologies to make them more efficient, as will be explained below.

2.1. Photovoltaic plants

PV technology is used to absorb some of the sun's light that touches the PV, which would cause electrons to be dislodged from the material's atoms.⁵⁹⁵ It means that the light absorbed by the PV would be able to generate energy that can be used to generate electricity.⁵⁹⁶ PV cells are designed such that the front surface is more receptive to free electrons, which leads these electrons to migrate to the surface.⁵⁹⁷ The movement of electrons would cause the formation of holes, and the migration of electrons, which have a negative charge, will cause a charge imbalance between the front and back surfaces, consequently creating a voltage potential.⁵⁹⁸ Then, an external load will be connected to the front and back surfaces, which leads to the flow of energy.⁵⁹⁹ PV cells are the main elements in the whole photovoltaic system, and they can vary from 1 to 10 centimeters across.⁶⁰⁰ Although a small cell can produce only 1 or 2 watts of power, the combination of these cells can provide large amounts of electricity.⁶⁰¹

2.2. Concentrated solar power plants

The other method that uses sun to provide energy is CSP.⁶⁰² Unlike PV, this system functions by converting the radiation of the sun indirectly.⁶⁰³ It relies on a large amount of

⁵⁹⁵ Lehigh University Environmental Initiative, *Solar Energy -- Energy from the Sun* (2007), available at <http://www.ei.lehigh.edu/learners/energy/readings/solar.pdf> (accessed 20 July, 2020).

⁵⁹⁶ Id.

⁵⁹⁷ Id.

⁵⁹⁸ Id.

⁵⁹⁹ Id.

⁶⁰⁰ Id.

⁶⁰¹ Id.

⁶⁰² Khan Academy, *Solar Power*, available at <https://www.khanacademy.org/partner-content/nova/energy/v/solarpower> (last visited 22th July, 2020).

⁶⁰³ Id.

mirrors to make the light of the sun focus on one central collector.⁶⁰⁴ By doing this, a high temperature will be released, which is sufficient to generate steam to power a turbine.⁶⁰⁵ This turbine then drives a generator that produces electricity.⁶⁰⁶ CSP is usually located in deserts where sunlight is abundant.⁶⁰⁷ It also uses thermal storage that enables it to supply solar power on demand, which is the main challenge for PV plants.⁶⁰⁸ This thermal storage is one of the possibilities in overcoming the issue of storing generated solar heat until electricity is needed, especially at night.⁶⁰⁹

2.3. Limitations of solar energy technology

Some have argued that solar energy could be promising in the future but not at present. There are many challenges facing solar energy, such as land use and other ecological impacts.⁶¹⁰ Solar plants need a large area in order to function properly.⁶¹¹ This can interfere with grazing, military use, and mineral production.⁶¹² Using a large area to generate energy from solar technology can also affect nearby wilderness areas, special recreation management areas, native vegetation, and wildlife.⁶¹³ This effect of solar plants can manifest in many ways, such as interference with rainfall, loss of habitat, and direct contact causing injury or death.⁶¹⁴ Moreover, solar plants can also harm soil health, as many studies indicate that the use of solar plants in large areas can result in soil compaction and erosion.⁶¹⁵ Most importantly, PV systems contain

⁶⁰⁴ Id.

⁶⁰⁵ Id.

⁶⁰⁶ Id.

⁶⁰⁷ Id.

⁶⁰⁸ Id.

⁶⁰⁹ Id.

⁶¹⁰ Solar Energy Development Programmatic EIS, *Solar Energy Development Environmental Considerations*, available at <http://solareis.anl.gov/guide/environment/> (accessed 22 July. 2020).

⁶¹¹ Id.

⁶¹² Id.

⁶¹³ Id.

⁶¹⁴ Id.

⁶¹⁵ Id.

hazardous materials, which means that any damage will lead to environmental contamination.⁶¹⁶ The EPA has classified hazardous materials contained in PV as Class I under the EPA's Prevention of Significant Deterioration regulations.⁶¹⁷

Other critics have said that the calculation of the value of solar technologies is complicated after considering their large-scale integration into electric power systems.⁶¹⁸ A comprehensive examination has revealed that the value of solar technologies cannot be calculated unless we consider it as a whole system.⁶¹⁹ If the deployment of PV increases, this means that in sunny midday periods, there would be a need to reduce the PV output in order to obtain a balance between electric supply and demand owing to the limited flexibility of conventional generators.⁶²⁰ This would lead to the decrease in the value and cost of PV,⁶²¹ which can be a barrier for investors when a new market is unstable, leading to a decrease in the amount of money invested in this sector.⁶²² For instance, for utility-scale PV with a baseline SunShot levelized cost of energy (LCOE) of 6¢/kWh, the increase in the annual energy demand from solar energy from 10% to 20% would increase the marginal LCOE of PV from 6¢/kWh to almost 11¢/kWh in a California grid system with limited flexibility.⁶²³

Another major issue that solar plants face is the need for water to cool the plants. PV systems seem to impact water resources owing to the continuous need for water to cool the

⁶¹⁶ Id.

⁶¹⁷ Id.

⁶¹⁸ EERS, Emerging Issues and Challenges with Integrating High Levels of Solar into the Electrical Generation and Transmission Systems (2016), available at: <https://www.energy.gov/eere/solar/downloads/emerging-issues-and-challenges-integrating-high-levels-solar-electrical> (accessed June July 29, 2020).

⁶¹⁹ Id.

⁶²⁰ Id.

⁶²¹ Id.

⁶²² Id.

⁶²³ Id.

system.⁶²⁴ This means that water demand can strain available water resources.⁶²⁵ The panels need to use 500–1000 gallons of water per MWp per year.⁶²⁶ The amount of water needed is increased if the power plant footprint is 2.5-fold larger than the area directly overlain by the panels.⁶²⁷ With the impact of climate change taken into account, the use of a large amount of water would affect many species as they also rely on water, and this decrease in water supply would alter the biodiversity in the biomes where these solar plants are found.⁶²⁸ In addition to the water issue, solar energy facilities require a large amount of land, and before the construction of the facilities, the land must be cleared of vegetation.⁶²⁹ This means that the amount of water will be further decreased since plants play an important role in storing water and providing food for both humans and animals.⁶³⁰

2.4. Competitiveness of solar energy

Nevertheless, despite the abovementioned disadvantages of solar energy, this source of energy seems to be relatively efficient and is both clean and sustainable. Renewable energy is not expected to have the same efficiency as fossil fuels in generating energy, as the latter has benefited from large amounts of funds for research, and development for more than a century. Owing to the chaos caused by fossil fuels, the shift towards renewable energy is expected, even if not totally, and a significant amount of money should be spent in developing renewable energy. This means that, although solar energy seems to have many shortcomings, it is cleaner

⁶²⁴ Solar Energy Development Programmatic EIS, available at: <https://solareis.anl.gov/guide/environment/> (accessed August 5, 2020).

⁶²⁵ Id.

⁶²⁶ Damon Turney, Vasilis Fthenakis, Environmental impacts from the installation and operation of large-scale solar power plants, 15 *Renewable and Sustainable Energy Reviews* 3261–3270 (2011).

⁶²⁷ Id.

⁶²⁸ Id.

⁶²⁹ U.S. Fish & Wildlife Service, *Solar Energy* (2018), available at: <https://www.fws.gov/ecological-services/energy-development/solar.html> (accessed August 5, 2020).

⁶³⁰ Id.

than fossil fuels, which is the main reason for shifting to new sources of energy owing to the toxic emissions and impact on the environment of fossil fuels.

The continuing development of solar energy technologies made it possible for them to compete with fossil fuels. It means that the efficiency of solar energy has increased, such that it can compete with fossil fuels and thus become commercially viable. The efficiency of solar energy varies between 29% in theory and 26.3% in practice.⁶³¹ The conversion efficiency of a PV cell is the percentage of the solar energy shining on a PV device that is converted into usable electricity.⁶³² The cost of a PV cell is taken into account in order to measure its efficiency. In other words, the cost of manufacturing PV panels is measured in dollars per watt.⁶³³ It means that if a PV cell can produce 200 watts of electricity with a manufacturing cost of US\$ 600, then it would be US\$ 3 per watt.⁶³⁴ This means that if the price of PV cells decreases, then it can compete with other energy sources such as gas and oil. In fact, the price of solar energy has decreased by about 85% since 2009, which makes it a promising source of energy that will be more competitive in the future.⁶³⁵ The cost of PV per watt has decreased from US\$ 100 in 2000 to only US\$ 5 in 2020.

Although the cost of manufacturing PV panels is important, it is not the most important economic measure for energy.⁶³⁶ Instead, LCOE is more important than the cost of manufacturing PV panels⁶³⁷, because it takes into account many other factors that determine the capital cost to finance the PV system, such as the operating cost and expected output of

⁶³¹ BRUCE, *supra*

⁶³² *Id.*

⁶³³ *Id.*

⁶³⁴ *Id.*

⁶³⁵ *Id.*

⁶³⁶ *Id.*

⁶³⁷ *Id.*

electricity.⁶³⁸ The LCOE of solar energy can be reduced in many ways. The capital cost of the PV system can be reduced by subsidies from the government, which can reduce the cost of establishing a solar plant. Another major step to reduce the LCOE of PV cells is by improving the efficiency of the PV system itself so that it can be more competitive even if the price does not decrease further.

The most popular material for solar cells is silicon.⁶³⁹ There are many reasons for choosing silicon over other materials, which are all related, to make the PV system more efficient and less expensive in order to compete with fossil fuels.⁶⁴⁰ For instance, silicon can convert 32% of light energy into electric energy, which is more efficient than most other materials.⁶⁴¹ Moreover, silicon is not expensive because it is the most abundant element on Earth, and the cost of refining it has decreased considerably since 1980.⁶⁴² This has enabled the solar cell and electronics industries to decrease the price of PV systems even further as they have developed better bulk purification techniques, further driving the demand for solar cells and consumer electronics.⁶⁴³

For instance, engineering tricks were used to increase the efficiency of silicon solar cells.⁶⁴⁴ The photons must be collide with an electron in order to be converted into energy.⁶⁴⁵ The trick involves patterning the silicon in solar cells in microscopic pyramid shapes. This would make the light of the sun absorbed into a pyramid travel further, thereby increasing the

⁶³⁸ Id.

⁶³⁹ See the blog of Emily Kerr, *The Future of Solar is Bright*, Harvard University (2019), available at: <http://sitn.hms.harvard.edu/flash/2019/future-solar-bright/> (accessed August 11, 2020).

⁶⁴⁰ Id.

⁶⁴¹ Id.

⁶⁴² Id.

⁶⁴³ Id.

⁶⁴⁴ Id.

⁶⁴⁵ Id.

possibility of this light to collide with the electrons in the silicon before escaping the cell.⁶⁴⁶ Similarly, other tactics were used to increase the efficiency of PV cells. The tactic used by chemists and material scientists is simply designing anti-reflective coatings that are put on the front of solar cells.⁶⁴⁷ This would prevent the useful light from escaping into space without ever hitting an electron in the solar cell.⁶⁴⁸

There are many other methods that can be used to increase the competitiveness of solar cells. For instance, a hardware can be added to allow the PV to capture more light without changing the current PV design, which will increase its manufacturing cost.⁶⁴⁹ Moreover, electronics could be installed in the PV to allow it to track the sun and move whenever the sun moves during the day.⁶⁵⁰ In this way, more sun radiation is received and more energy is generated.⁶⁵¹ Although this design is expensive, innovation on the tracking design front continues, which can address this issue.⁶⁵² Another method of increasing the competitiveness of solar cells is to add more than one layer of light-capturing material that can capture more sun radiation.⁶⁵³ This would increase the ability of solar cells to capture 46% of the incoming light energy hitting them.⁶⁵⁴ Although this percentage seems high and efficient, these cells are too expensive and difficult to make for commercial use.⁶⁵⁵

In addition to the methods that can be used to increase the competitiveness of solar cells, the price of silicon itself is decreasing, making solar cells even more competitive than other

⁶⁴⁶ Id.

⁶⁴⁷ Id.

⁶⁴⁸ Id.

⁶⁴⁹ Id.

⁶⁵⁰ Id.

⁶⁵¹ Id.

⁶⁵² Id.

⁶⁵³ Id.

⁶⁵⁴ Id.

⁶⁵⁵ Id.

energy sources. In the U.S, it is predicted that the price of silicon would decrease by 700% by 2050.⁶⁵⁶ At the same time, the search for other more efficient and less expensive materials for solar cells is continuing.⁶⁵⁷ It is predicted that materials other than silicon will be seen in the PV system in many rooftops, which can provide cheaper and more efficient energy from clean renewable resources.⁶⁵⁸ The decrease in the solar cell cost is important as fossil fuels are expected to increase in price. The increase in the price of fossil fuels would result from the decrease in their amount given that fossil fuels are not sustainable. It is estimated that energy extraction accounts for about 40% of the price of fossil fuels.⁶⁵⁹ This price would increase further as finding this resource would become more difficult over time, and thus the price of extraction would increase. Many researchers predict that the use of fossil fuels would decrease eventually as the planet's known supplies diminish, the difficulty and cost of tapping remaining reserves increase, and the effect of their continued use on our planet becomes more critical.⁶⁶⁰

As a result, many states have relied on solar energy for generating electricity, such as California. Clean energy accounts for 34% of the total energy generated in California,⁶⁶¹ and solar energy represents the majority of the renewable capacity installed in this state.⁶⁶² The state advanced the use of renewable energy through the Renewables Portfolio Standard (RPS), which aims to increase the procurement of eligible renewable energy resources to 60% of retail sales by

⁶⁵⁶ Id.

⁶⁵⁷ Id.

⁶⁵⁸ Id.

⁶⁵⁹ See the National Energy Technology Laboratory report: NETL LEADS DRIVE FOR EFFICIENCY IN FOSSIL FUEL-BASED POWER PLANTS, available at: <https://netl.doe.gov/node/9419> (accessed August 16, 2020).

⁶⁶⁰ See the National Academies of Science, Engineering, and Medicine report: OUR ENERGY SOURCES: Fossil Fuels, available at <http://needtoknow.nas.edu/energy/energy-sources/fossil-fuels/> (accessed August 16, 2020).

⁶⁶¹ See The State of California Energy Commission site: Renewable Energy, available at: <https://www.energy.ca.gov/programs-and-topics/topics/renewable-energy> (accessed August 16, 2020).

⁶⁶² Id.

2030.⁶⁶³ In 2018, the state of California generated 30,759 MW from clean energy.⁶⁶⁴ The state continues in its vision to reduce the amount of greenhouse gases and increase its renewable energy capacity.⁶⁶⁵ In 2010, Governor Edmund G. Brown Jr. announced a clean energy jobs plan that aims to support and grow the renewable energy industry.⁶⁶⁶ The plan set a goal of adding 20,000 MW of renewable capacity by 2020.⁶⁶⁷

2.5. Promising projects for solar technology

Moreover, it is expected that the use of solar energy would increase owing to the promising ongoing projects carried out by many entities such as NASA and MIT. For instance, NASA has developed a multi-junction solar cell that is highly efficient and uses a thin interlayer of selenium as the bonding material between wafers.⁶⁶⁸ It uses selenium because this element is a unique semiconductor given that it is transparent to light at photon energies below the band gap (infrared), which allows the light to pass from the multi-junction top cell to the silicon-based bottom cell.⁶⁶⁹ The multi-junction solar cell has been using a low-cost, robust silicon wafer as the supporting bottom substrate and bottom cell without using the constraint of lattice matching.⁶⁷⁰ This development would enable PV cells to be more rugged and efficient than existing space-based photovoltaic cells and at a lower cost.⁶⁷¹ The technology uses silicon because it is inexpensive, and thus it is also used for designing next-generation solar cells in

⁶⁶³ See The State of California Energy Commission report of the tracking progress of renewable energy, available at: https://www.energy.ca.gov/sites/default/files/2019-12/renewable_ada.pdf (accessed August 25, 2020).

⁶⁶⁴ Id.

⁶⁶⁵ Id.

⁶⁶⁶ Id.

⁶⁶⁷ Id.

⁶⁶⁸ NASA, High-Efficiency Solar Cell, available at <https://technology.nasa.gov/patent/LEW-TOPS-50> (accessed 2 September, 2020).

⁶⁶⁹ Id.

⁶⁷⁰ Id.

⁶⁷¹ Id.

space.⁶⁷² It is reported that for terrestrial applications, the NASA project can provide unprecedented efficiencies for auxiliary power units in vehicles.⁶⁷³ This would lead to a decrease in the value of fossil fuels as PV would become more competitive in vehicles.

Another promising project in developing solar cells is carried out by MIT experts.⁶⁷⁴ Chemists and electrical engineers at MIT have made the first solar cell in which two electrons are released for every incoming photon of sunlight in the visible spectrum.⁶⁷⁵ This would minimize the amount of heat wasted, and twice as much electrical energy is generated from those wavelengths as conventional solar cells do.⁶⁷⁶ These MIT experts broke a long-standing barrier on energy conversion efficiency in photovoltaic cells.⁶⁷⁷ They also provided a new quantitative understanding of the process by which “exotic” materials exhibiting that behavior produce extra current.⁶⁷⁸ These researchers have not replaced silicon that the PV cell is made from, but rather, they used their technology in conjunction with it.⁶⁷⁹ It is predicted that the new technology would increase the efficiency of solar energy conversion into electricity by 25%.⁶⁸⁰

The MIT project started when researchers faced a challenge in building a solar cell that generates extra electrons.⁶⁸¹ Researchers designed devices using pentacene combined with a fullerene, a hollow, all-carbon molecule that captures excitons and releases electrons as current.⁶⁸² Their results were mixed as they noticed that most of the excitons in the pentacene

⁶⁷² Id.

⁶⁷³ Id.

⁶⁷⁴ See the news written by NANCY W. STAUFFER at MIT University, Boosting solar cell efficiency: Less wasted heat, more useful current (2014), available at: <http://energy.mit.edu/news/boosting-solar-cell-efficiency-less-wasted-heat-more-useful-current/> (accessed 2 September, 2020).

⁶⁷⁵ Id.

⁶⁷⁶ Id.

⁶⁷⁷ Id.

⁶⁷⁸ Id.

⁶⁷⁹ Id.

⁶⁸⁰ Id.

⁶⁸¹ Id.

⁶⁸² Id.

were getting destroyed, by either the fullerene or by the conductive electrode under the pentacene layer.⁶⁸³ Thus, they added a polymer layer to their design aiming to protect the bottom interface of the pentacene layer, blocking the excitons but letting current flow through.⁶⁸⁴ They also changed the fullerene layers as well as the spacing of the pentacene.⁶⁸⁵ They finally added within the structure a tuned mirror that enhances light absorption by the pentacene layer.⁶⁸⁶ This led the design to be successful as about 126 electrons are released for every 100 photons that enter.⁶⁸⁷ This would lead to an improvement in efficiency from today's maximum of about 24% to more than 30%.⁶⁸⁸

3. Challenges and issues of renewable energy

The promising future for solar cells and renewable energy still faces two major issues: intermittency and energy storage. Renewable energy, including solar energy, supplies electricity intermittently and cannot be dispatched in the traditional sense.⁶⁸⁹ The reason for this intermittency is that the technologies that generate energy from the sun are deprived of this source during the night or on cloudy days. This means that the electricity generated from solar energy might not operate based on economic criteria in the same way as dispatchable technologies.⁶⁹⁰ In other words, generating electricity can vary daily. It will also vary from location to location depending on the availability of sun radiation.⁶⁹¹ The developed world's

⁶⁸³ Id.

⁶⁸⁴ Id.

⁶⁸⁵ Id.

⁶⁸⁶ Id.

⁶⁸⁷ Id.

⁶⁸⁸ Id.

⁶⁸⁹ Paul Joskow, Comparing the Costs of Intermittent and Dispatchable Electricity Generating Technologies, 101 *The American Economic Review*, 238–241 (2011).

⁶⁹⁰ Id.

⁶⁹¹ Id.

population would not accept the possibility that electricity would only be generated when the sun is shining.⁶⁹² Thus, this source of energy would become less favorable to consumers especially if solar radiation is unpredictable and not available during the entire day.⁶⁹³

3.1. Energy storage

Another major problem with renewable energy is energy storage. Storing energy is used as a solution to the intermittency of renewable energy. Because the sun is not shining the whole day, storing energy is important to satisfy the need for electricity during the night. Storing surplus energy is possible with batteries; however, batteries have many known issues. Among these is the fact that batteries cannot store a significant amount of energy, leading to energy shortage. Another common known issue of batteries is that they cannot store electricity for a long period of time. A third common problem is that batteries become less efficient in storing energy over time, as exemplified by the fact that old laptops and phones usually suffer from battery issues. It is strongly argued that energy storage is the biggest challenge for renewable energy to compete with fossil fuels, and solving this issue would make renewable energy resources more competitive.⁶⁹⁴ This issue does not exist for fossil fuels because the energy is already stored as a form of matter, whether as oil or coal, and thus oil turbines have the ability to start up quickly and/or vary their electric output as the demand changes.⁶⁹⁵ Thus, solving the issue of energy storage in renewable energy is a game changer.⁶⁹⁶

3.2. Expense of storing energy

⁶⁹² Jason Rugolo and Michael Aziz, *Electricity Storage for Intermittent Renewable Sources*, 5 Harvard School of Engineering and Applied Sciences, 7151–7160 (2012).

⁶⁹³ See the house of senate report: *Challenges and Opportunities For New Pumped Storage Development*, available at: https://www.energy.senate.gov/public/index.cfm/files/serve?File_id=214260C6-E4C8-4F51-91CF-8CADB0B196D1 (accessed 2 September, 2020).

⁶⁹⁴ BRUCE, *supra*.

⁶⁹⁵ Senate report, *supra*

⁶⁹⁶ BRUCE, *supra*.

In addition to the known issues of batteries, the U.S. Department of Energy (DOE) has identified other challenges that batteries face.⁶⁹⁷ First, the DOE says that energy storage is expensive, making renewable energy resources less competitive. The cost of storage systems, including their installation, all subsystem components, and integration, needs to be comparable to those of non-storage options available to electric utilities. The high cost of storage systems makes them less favorable to consumers as the storage component still constitutes 30% to 40% of the total system cost; thus, the focus needs to be on the entire system. Second, the DOE says that storage systems might face some issues regarding safety, as the overuse of batteries or energy storage systems could lead to fire.⁶⁹⁸ Thus, design practices that incorporate safety standards and safety testing procedures for the different storage technologies need to be developed and codified.⁶⁹⁹

3.3. Possible future solutions for the expense of storing energy

Although there are significant challenges to storing energy, the development of batteries and energy storage systems gives renewable energy resources a promising future. Batteries are created as an energy storage technology that uses chemicals to absorb and release energy on demand.⁷⁰⁰ The most common battery chemistry used to store electricity is lithium-ion (Li-ion).⁷⁰¹ Currently, most batteries are created from Li-ion, which is an advanced battery technology that uses lithium ions as a key component of its electrochemistry.⁷⁰² During a discharge cycle,

⁶⁹⁷ U.S. Department of Energy, Grid Energy Storage (2013), available at: https://www.sandia.gov/ess-ssl/docs/other/Grid_Energy_Storage_Dec_2013.pdf (accessed 2 September, 2020).

⁶⁹⁸ U.S. Department of Energy, Solar Performance and Efficiency (2013), available at: <https://www.energy.gov/eere/solar/articles/solar-performance-and-efficiency> (accessed 2 September, 2020).

⁶⁹⁹ Id.

⁷⁰⁰ See the Australian Renewable Energy Agency (ARENA) site: Battery storage, available at: <https://arena.gov.au/renewable-energy/battery-storage/> (accessed 2 September, 2020).

⁷⁰¹ Id.

⁷⁰² See the University of Washington's report: What is a lithium-ion battery and how does it work?, available at: <https://www.cei.washington.edu/education/science-of-solar/battery-technology/> (accessed 3 September, 2020).

lithium atoms in the anode are ionized and separated from their electrons.⁷⁰³ The lithium ions recombine with their electrons after they move from the anode and pass through the electrolyte until they reach the cathode.⁷⁰⁴ Thus, the recombination leads to electrical neutralization.⁷⁰⁵ Because lithium ions are sufficiently small to be able to move through a micro-permeable separator between the anode and the cathode, they are capable of having a very high voltage and charge storage per unit mass and unit volume.⁷⁰⁶

3.4. Li-ion batteries

There are many benefits in using Li-ion batteries in storing energy. One is that they have the highest energy densities among any battery technology today (100–265 Wh/kg).⁷⁰⁷ It means that they can deliver three times more energy than other competitive batteries, such as Ni-Cd or Ni-MH.⁷⁰⁸ Moreover, Li-ion batteries require low maintenance, which make them more competitive than other batteries.⁷⁰⁹ Moreover, they have a have low self-discharge, which is estimated to be about 1.5–2% per month.⁷¹⁰ These batteries do not contain toxic cadmium, which makes them more environment-friendly than other batteries.⁷¹¹

Li-ion batteries have displaced Ni-Cd batteries owing to these advantages and the use of Li ions in batteries.⁷¹² These batteries have been used significantly in electronic devices such as smartphones and laptops.⁷¹³ They have also been used to power electrical systems that require

⁷⁰³ Id.

⁷⁰⁴ Id.

⁷⁰⁵ Id.

⁷⁰⁶ Id.

⁷⁰⁷ Id.

⁷⁰⁸ Id.

⁷⁰⁹ Id.

⁷¹⁰ Id.

⁷¹¹ Id.

⁷¹² Id.

⁷¹³ Id.

large amounts of energy, such as planes.⁷¹⁴ In fact, they are used to deliver energy in the new and more environment-friendly Boeing 787, where weight is a significant cost factor.⁷¹⁵ Li-ion batteries are also used in some aerospace applications⁷¹⁶ and to deliver power to battery-powered cars.⁷¹⁷ Many electric car companies rely on Li-ion batteries, such as the Nissan Leaf and the Tesla Model S, as their primary power source.⁷¹⁸ In short, Li-ion batteries are used in most of the utility-scale battery systems used for energy storage in the U.S. as they are efficient and have fast response times and high energy density.⁷¹⁹ It is estimated that in the last five years in the U.S., nearly all of the utility-scale battery systems installed rely heavily on Li-ion batteries.⁷²⁰ By the end of 2018, the U.S., which has 862 MW of operating utility-scale battery storage power capacity and 1,236 MWh of battery energy capacity, has used Li-ion batteries in storing 90% of its energy.⁷²¹

The price of Li-ion batteries has decreased considerably (by 80%) over the past five years.⁷²² This means that their use will become more widespread owing to their decreased price, allowing more energy from renewable resources such as solar energy to be stored.⁷²³ For instance, the amount of storage deployed in the third quarter of 2019 in the U.S. significantly increased by 93%.⁷²⁴ This number is expected to increase by even more than 93% by 2024,

⁷¹⁴ Id.

⁷¹⁵ Id.

⁷¹⁶ Id.

⁷¹⁷ Id.

⁷¹⁸ Id.

⁷¹⁹ U.S Energy Information Administration (EIA), Most utility-scale batteries in the United States are made of lithium-ion (2019), available at: <https://www.eia.gov/todayinenergy/detail.php?id=41813> (accessed 3 September, 2020).

⁷²⁰ Id.

⁷²¹ Id.

⁷²² See the National Renewable Energy Laboratory (NREL) news: Declining Renewable Costs Drive Focus on Energy Storage (2020), available at: <https://www.nrel.gov/news/features/2020/declining-renewable-costs-drive-focus-on-energy-storage.html> (accessed 3 September, 2020).

⁷²³ Id.

⁷²⁴ Id.

according to the market research firm Wood Mackenzie Power & Renewables.⁷²⁵ More specifically, it has been estimated that the market value of renewable energy would increase from US\$ 720 million to US\$ 5.1 billion in 2024.⁷²⁶ This would add the renewable energy market to the nation's grid.⁷²⁷

Paul Denholm, a principal energy analyst at the National Renewable Energy Laboratory (NREL), said that from the last decade, renewable energy has become an economic possibility that can compete with other sources.⁷²⁸ He and NREL analysts argued that their goal was to provide 20% of the nation's energy supply from renewable sources, but now and because of the developments in renewable energy technology, they are aiming much higher.⁷²⁹ In a study, the NREL estimated that 120 GW of storage would be needed across the continental U.S. by 2050 in a scenario wherein 80% of the electricity will come from renewable resources.⁷³⁰ This means that the renewable energy market is a promising market that can deliver clean energy that is beneficial to the environment.⁷³¹

However, energy storage, whether by batteries or by any other method, faces many serious issues, which makes renewable energy less competitive than fossil fuels that are stored as raw materials such as oil, the energy from which could be released anytime whenever it is needed.⁷³² For instance, energy is stored and maintained within the oil material, which means that the energy can be used whenever it is needed by heating the oil. Renewable energy tries to address this issue by storing energy in different ways, such as through batteries. Nevertheless, as

⁷²⁵ Id.

⁷²⁶ Id.

⁷²⁷ Id.

⁷²⁸ Id.

⁷²⁹ Id.

⁷³⁰ Id.

⁷³¹ Id.

⁷³² The senate report, supra

mentioned earlier, batteries face many serious issues, which makes storing energy from renewable energy sources still an issue. In fact, energy storage is seen as the most important issue facing the shift to renewable energy.

3.5. Issues of Li-ion batteries

Li-ion batteries face many serious issues; thus, they might be replaced with different types of batteries in the future. Starting with their design, these batteries store energy in small cells.⁷³³ This means that increasing the size of these batteries requires increasing the number of cells, and thus the price of Li-ion batteries would increase. This could be problematic when a large amount of energy is needed in a small design, such as space applications.⁷³⁴ Space applications require lightweight technology owing to the finite lift capacity of launch vehicles.⁷³⁵ This means that even if a large amount of energy is needed, the battery must still be small, leading users to seek much lighter energy storage technologies.⁷³⁶ The second issue that Li-ion batteries face is their lifetime. After repeated charging and discharging, these batteries lose structural integrity.⁷³⁷ This means that they would store and provide less energy for use,⁷³⁸ and that these batteries would be less favorable for long-term use because of their limited lifetime. It would also not provide a compelling economic interest for its users in the long term.

⁷³³ Hsin Wang et al, Progressive mechanical indentation of large-format Li-ion cells, 341 *Journal of Power Sources* (2016).

⁷³⁴ See the 3rd Responsive Space Conference RS3-2005-5003 (LA), Small Cell Lithium-Ion Batteries: The Responsive Solution for Space Energy Storage (2005), available at: <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.125.1603&rep=rep1&type=pdf> (accessed 3 September 2020).

⁷³⁵ Id.

⁷³⁶ Id.

⁷³⁷ U.S. Department of Energy, Office of Science, Extending the Life of Lithium-Ion Batteries (2017), available at: <https://www.energy.gov/science/ber/articles/extending-life-lithium-ion-batteries> (accessed 3 September 2020).

⁷³⁸ Id.

Moreover, Li-ion batteries also face many issues regarding safety. The first safety issue is that these batteries are flammable.⁷³⁹ Their fire hazard is associated with their high energy densities coupled with flammable organic electrolytes.⁷⁴⁰ This comes from the fact that these batteries are generally a function of a number of parameters, including battery size, chemistry, construction, and the battery state of charge.⁷⁴¹ In any battery reaction, hazardous components that contain carbon dioxide (CO₂), carbon monoxide (CO), hydrogen (H₂) and hydrocarbons (C_xH_x) are produced.⁷⁴² These gases are flammable if the battery is overused or subjected to heat.⁷⁴³ Furthermore, Li-ion batteries seem to have many serious environmental impacts associated with their production, use, and disposal.⁷⁴⁴ This comes from the fact that Li-ion batteries contain many hazardous components, such as CO₂ and H₂,⁷⁴⁵ which increase the risks of energy waste and land and groundwater pollution, leading to ecotoxicity and human health effects.⁷⁴⁶

3.6. Flow batteries

However, many new batteries, known by “flow batteries,” are being developed to replace Li-ion batteries.⁷⁴⁷ These new batteries provide opportunities in large-scale applications.⁷⁴⁸ Flow batteries could be seen as an opportunity for renewable storage as they are more affordable,

⁷³⁹ See the University of Washington report: LITHIUM BATTERY SAFETY (2018), available at: <https://www.ehs.washington.edu/system/files/resources/lithium-battery-safety.pdf> (accessed 3 September 2020).

⁷⁴⁰ *Id.*

⁷⁴¹ *Id.*

⁷⁴² *Id.*

⁷⁴³ *Id.*

⁷⁴⁴ Mario Delgado et al., Comparative Life Cycle Assessment of a Novel Al-Ion and a Li-Ion Battery for Stationary Applications, 12 Materials 3270 (2019).

⁷⁴⁵ The University of Washington report: LITHIUM BATTERY SAFETY, *supra*.

⁷⁴⁶ Delgado et al., *supra*.

⁷⁴⁷ Justine Lovell, Batteries going with the flow, Australian Energy Council (2019).

⁷⁴⁸ *Id.*

which would increase the prospects for utility-scale development of solar energy storage.⁷⁴⁹ This means that, unlike Li-ion batteries, flow batteries can provide energy to cities and many other large-scale applications.⁷⁵⁰ These new batteries rely on liquid electrolytes that are stored in external tanks, separated by a membrane, and pumped through electrochemical cells.⁷⁵¹ Flow batteries can be recharged by replacing the electrolyte liquid while simultaneously recovering the spent material for re-energization. These batteries can be discharged to 100% with no negative effects on their performance and lifetime (unlike Li-ion batteries whose performance and lifetime decrease over time).⁷⁵² It is estimated that the lifespan of flow batteries is approximately 25 years before needing replacement.⁷⁵³ This would make them a promising alternative to Li-ion batteries.⁷⁵⁴

There are many benefits of flow batteries for storing energy compared with Li-ion batteries. Flow batteries, which rely on chemistry to store energy, tend to be less reactive.⁷⁵⁵ This means that flow batteries are not flammable since they use non-flammable chemicals.⁷⁵⁶ Moreover, flow batteries are not prone to overheating, which means that a hot environment does not affect their lifespan.⁷⁵⁷ Furthermore, they are easily recyclable as their components could be easily recycled, unlike Li-ion batteries.⁷⁵⁸ This development would allow renewable energy to compete with fossil fuels as the issue of energy storage has been addressed and the cost of clean

⁷⁴⁹ Id.

⁷⁵⁰ Id.

⁷⁵¹ Id.

⁷⁵² Id.

⁷⁵³ Id.

⁷⁵⁴ Id.

⁷⁵⁵ Id.

⁷⁵⁶ Id.

⁷⁵⁷ Id.

⁷⁵⁸ Id.

energy is reduced. The market research firm “Markets and Markets” estimated that the flow batteries market would grow by approximately US\$ 1 billion annually in the next 5 years.⁷⁵⁹

There are many types of flow batteries that can store energy through chemistry. For instance, iron flow batteries have been widely used to store energy. These batteries rely on the iron (II) chloride/iron (III) chloride couple at the positive electrode and the iron (II) chloride/metallic iron couple at the negative electrode.⁷⁶⁰ During discharge of the battery, iron (III) chloride is reduced to iron (II) chloride at the positive electrode.⁷⁶¹ At the negative electrode, metallic iron is dissolved into the electrolyte as iron (II) chloride; these processes are reversed during battery charging.⁷⁶² Recently, a new configuration of the all-iron redox flow battery using an anion-exchange membrane separator has been discovered, which can increase the efficiency of these batteries.⁷⁶³ The anion-exchange membrane facilitates the transfer of chloride ions between the positive and negative sides of the cell without mixing of the positive and negative electrolytes.⁷⁶⁴ Thus, the self-discharge resulting from the transfer of iron ions across the membrane could be avoided.⁷⁶⁵ These iron flow batteries are beneficial because they will not corrode the components of the battery system,⁷⁶⁶ and they can be a proper energy storage system especially when the electrolytes have pH values greater than 6.⁷⁶⁷

Flow batteries are predicted to be further developed even if they are still new. For instance, USC scientists have developed a new battery aiming to increase the energy storage

⁷⁵⁹ Id.

⁷⁶⁰ See the site of the University of South California, All-Iron Redox Flow Battery, available at: <https://dornsife.usc.edu/labs/narayan/all-iron-redox-flow-battery/> (accessed 3 September, 2020).

⁷⁶¹ Id.

⁷⁶² Id.

⁷⁶³ Id.

⁷⁶⁴ Id.

⁷⁶⁵ Id.

⁷⁶⁶ See the U.S Department of Energy site: Iron-sulfide Redox Flow Batteries, available at: <https://availabletechnologies.pnnl.gov/technology.asp?id=399> (accessed 3 September, 2020).

⁷⁶⁷ Id.

efficiency, thus enabling renewable energy to be more competitive.⁷⁶⁸ The technology is designed on the basis of flow batteries that have been around for a while, but the USC researchers have built a better version based on low-cost and readily available materials.⁷⁶⁹ Professor Narayan said that the new development can make flow batteries inexpensive, safe, environment-friendly, and durable with a long lifetime.⁷⁷⁰ The scientists' innovation involves using different fluids, which are an iron sulfate solution and a type of acid.⁷⁷¹ Iron sulfate is used because it is plentiful and inexpensive.⁷⁷² The other material is anthraquinone disulfonic acid, which is an organic material already used in some redox flow batteries because of its stability, solubility, and energy storage potential.⁷⁷³ These two compounds are used separately in flow batteries but the USC scientists have developed a flow material that contains both materials in the same battery.⁷⁷⁴

Another promising improvement in flow batteries was achieved at Case Western Reserve University,⁷⁷⁵ which is developing a water-based, all-iron flow battery for grid-scale energy storage at a low cost.⁷⁷⁶ Flow batteries store chemical energy in external tanks instead of within the battery container.⁷⁷⁷ Thus, a storage system using low-cost iron is safer because iron is both nontoxic and abundant.⁷⁷⁸ Also, this development would improve the energy storage capacity of

⁷⁶⁸ See the University of South California's news, New flow battery could help unleash renewable energy (2020), available at: <https://news.usc.edu/166306/flow-battery-renewable-energy-electricity-storage-usc-study/> (accessed 3 September. 2020).

⁷⁶⁹ Id.

⁷⁷⁰ Id.

⁷⁷¹ Id.

⁷⁷² Id.

⁷⁷³ Id.

⁷⁷⁴ Id.

⁷⁷⁵ U.S Department of Energy, ALL-IRON FLOW BATTERY (2013), available at: <https://arpa-e.energy.gov/?q=slick-sheet-project/all-iron-flow-battery> (accessed 3 September. 2020).

⁷⁷⁶ Id.

⁷⁷⁷ Id.

⁷⁷⁸ Id.

stationary batteries at 10–20% of today's cost.⁷⁷⁹ It would also reduce the cost of batteries, making renewable energy more competitive than fossil fuels.⁷⁸⁰ In short, energy storage, which is considered one of the most important issues in renewable energy, is being extensively investigated, and it is expected that this issue will be addressed to a large extent in the near future and make renewable energy more competitive.

4. Renewable energy laws and incentive policies

4.1. Investments in the new clean energy sector

The renewable energy sector is a new sector that is attracting many companies to invest in it.⁷⁸¹ This motivation in investing in the renewable energy sector comes from the fact that renewable energy can stabilize electricity prices, which are dependent only on the initial invested capital and independent of the fluctuating costs of coal, oil, and natural gas.⁷⁸² In addition, oil prices depend on many factors, such as the political stability in oil-producing countries, which means that any political discord can cause an increase in oil prices.⁷⁸³ On the other hand, renewable energy can be established in all countries, which means that it is not vulnerable to distant political disturbances.⁷⁸⁴ Renewable energy also seems promising to investors since explosions on oil platforms are unheard of in renewable energy.⁷⁸⁵ Furthermore, nonrenewable resources are buried deep underground or under the ocean, which means that finding new resources can be expensive, and utilizing them becomes tougher and sometimes risky as well.⁷⁸⁶

⁷⁷⁹ Id.

⁷⁸⁰ Id.

⁷⁸¹ Shahzad, supra.

⁷⁸² Id.

⁷⁸³ Id.

⁷⁸⁴ Id.

⁷⁸⁵ Id.

⁷⁸⁶ Id.

In renewable energy, finding new resources is as effortless as finding wind or sunlight.⁷⁸⁷ In the long term, renewable energy is safer and sustainable, which can motivate investors to invest in this sector.⁷⁸⁸

4.2. European Union (EU) incentives for renewable energy investments

The investment in renewable energy is observed noticeably in Europe.⁷⁸⁹ It is argued that Europe has dominated the global PV market for the past decade.⁷⁹⁰ Germany and Italy alone control half of the global PV market.⁷⁹¹ This clearly shows that industrialized countries tend to focus on the renewable energy sector after recognizing its long-term importance. The renewable energy market is not only dominated by European countries, but countries around the world also seem to invest in this market as well.⁷⁹² In 2011, European countries accounted for a whopping 74% of the world's new PV installations.⁷⁹³ After one year (in 2012), this percentage has decreased to 55%, which shows that the world is recognizing the importance of renewable energy, and thus investments in this sector are increasing.⁷⁹⁴ Statistically, it is observed that the renewable energy market is becoming truly global.⁷⁹⁵

4.3. Corporate Renewable Energy Buyers' Principles

The shift to renewable energy could be observed not only in some countries but also in some companies.⁷⁹⁶ Many companies have joined groups such as RE100, and they have signed

⁷⁸⁷ Id.

⁷⁸⁸ Id.

⁷⁸⁹ See the Lafayette College report at: <https://sites.lafayette.edu/egrs352-sp14-pv/global-perspective/> (accessed June 25, 2020).

⁷⁹⁰ Id.

⁷⁹¹ Id.

⁷⁹² Id.

⁷⁹³ Id.

⁷⁹⁴ Id.

⁷⁹⁵ Id.

⁷⁹⁶ Sofia O'Connor, James McElfish & Lovinia Reynolds, Corporate Renewable Energy Goals: What Does 100% Renewable Really Mean, 49 *Envtl. L. Rep. News & Analysis* 10648 (2019).

the Corporate Renewable Energy Buyers' Principles pledging that they would go 100% renewable in the future.⁷⁹⁷ The companies that joined RE100 are not related to environmental business but rather large corporations such as Apple, Facebook, and Google.⁷⁹⁸ These large corporations have put plans to rely fully on renewable energy in the future in compliance with the RE100 rules.⁷⁹⁹ RE100 says that corporations can join this group if they plan to shift to 100% renewable by 2050 with interim steps of at least 30% by 2020 and 60% by 2030.⁸⁰⁰ As a result, the number of corporations that have joined RE100 has increased to 179, and these companies come from a variety of sectors, such as General Motors (GM), Microsoft, and Walmart.⁸⁰¹ Some companies such as Intel, Samsung, and Amazon are not part of RE100, but have committed to shift partly to renewable energy, .⁸⁰² These companies have also set goals for themselves.⁸⁰³ For instance, Cisco has committed to shift to 85% renewable energy by 2022, and IBM has also planned to shift to 55% renewable energy by 2025.⁸⁰⁴ This clearly shows that corporations that seek profit believe that renewable energy resources are the future sources of energy, which are both safe and secure.

However, it could be argued that all these efforts to shift towards renewable energy are seen as a social service. It means that although shifting to renewable energy is not profitable, companies still committed to shift partly to clean energy for public service only. Admittedly, domestic fossil fuels are better than renewables in terms of cost-effectiveness.⁸⁰⁵ This means that

⁷⁹⁷ Id.

⁷⁹⁸ Id.

⁷⁹⁹ Id.

⁸⁰⁰ Id.

⁸⁰¹ Id.

⁸⁰² Id.

⁸⁰³ Id.

⁸⁰⁴ Id.

⁸⁰⁵ See the blog of Kai Graylee, Harvard University, "BEYOND THE DEBATE: THE ROLE OF GOVERNMENT IN RENEWABLE ENERGY FINANCE," available at: <http://sitn.hms.harvard.edu/flash/2012/energy-finance/> (accessed on 25 June 2020).

it is profitable for companies to rely on fossil fuels for generating energy if profit is the only deciding factor. Moreover, gas has become cheap in recent years owing to the discoveries of new gas sources, which are driving down prices and are likely to render this option affordable in the medium term.⁸⁰⁶ This also means that gas is even cheaper than renewable energy in terms of generating energy in a profitable way using risk–benefit analysis. Furthermore, the fact that renewable energy cannot compete without governmental policies and incentives shows the inefficiency of renewable energy economically. Although the cost-effectiveness of renewable technologies has increased over time, parallel improvements in fossil fuel technologies make it harder for the economics of renewables to stack up by themselves.⁸⁰⁷

In his blog published in Columbia University, Professor Steve Cohen responded to this argument by saying that the incentives of renewable energy do not mean that the source of energy is inefficient.⁸⁰⁸ He continued by saying that fossil fuels have extremely benefited from a series of public policies that greatly facilitated their development and adoption, which made them more efficient than in the past.⁸⁰⁹ Even with such development on solid fuels, electric and gas utilities are monopolies regulated at the state level.⁸¹⁰ This means that there is no competition, and policies that set prices are provided and adopted by the government to ensure return on capital investment.⁸¹¹ This denotes that without such support by the government, the fossil fuel industry cannot stand on its own, especially in the beginning.⁸¹² Each state protects the interests of the fossil fuel and gas industries by huge investments in interstate and local

⁸⁰⁶ Id.

⁸⁰⁷ Id.

⁸⁰⁸ Steve Cohen, Why Renewable Energy Will Replace Fossil Fuels, GENERAL EARTH INSTITUTE: Columbia University (2017).

⁸⁰⁹ Id.

⁸¹⁰ Id.

⁸¹¹ Id.

⁸¹² Id.

highways.⁸¹³ There is also a billion-dollar bailout of the American auto industry, which makes products that are mostly powered by fossil fuels.⁸¹⁴ He finally explains that the nervousness in the leaders of the solid fuel industry is understandable since time is not on their side, as these solid fuels are not sustainable, and they cause undesirable problems that make many people invest on new renewable energy sources that are both clean and efficient.⁸¹⁵

4.4. United States laws in the renewable energy sector

Notably, many states in the U.S. have made long-term plans to use renewable energy and to create renewable energy sources for both present and future generations.⁸¹⁶ For instance, Maryland expressed clearly that renewable energy must be adopted in the long term in order to have a healthier environment and increased energy security.⁸¹⁷ New Mexico also declared that renewable energy is crucial in energy self-sufficiency, and that it will preserve the state's natural resources and pursue an improved environment.⁸¹⁸ In Illinois, the state government said that in order to have health, welfare, and prosperity, a clean and sustainable energy source must be adopted and used.⁸¹⁹ The state of Oregon has created the "Energy Trust of Oregon," which aims to convince its residents to invest in energy-efficient and renewable resources.⁸²⁰ This has led many large corporations that generate electricity from solid fuels to close as a result of the new focus on renewable energy.⁸²¹ For instance, Luminant, the largest electricity generator in Texas,

⁸¹³ Id.

⁸¹⁴ Id.

⁸¹⁵ Id.

⁸¹⁶ Alexandra B. Klass, *Renewable Energy and the Public Trust Doctrine*, 45 U.C.D. L. Rev. 1021 (2012).

⁸¹⁷ Id.

⁸¹⁸ Id.

⁸¹⁹ Id.

⁸²⁰ Id.

⁸²¹ See Brooke Holleman's report written in *The University of Texas: Coal Belt to Sun Belt? Texas Has a Golden Opportunity for Clean Energy*, available at: <https://news.utexas.edu/2017/12/11/texas-has-a-golden-opportunity-for-clean-energy/> (accessed June 28, 2020).

has recently announced the closure of three coal-fired power plants.⁸²² This shows that the renewable energy is a trivial topic discussed only among elites' discussions on saving the planet but rather a realistic approach that many countries can develop as well as saving the environment.

4.5. Incentives of developing countries for shifting towards renewable energy

Developing countries could benefit the most with the shift to renewable energy. As explained earlier, developing countries could secure their energy and electricity needs, which are important in modern civilization. China, which is one of the largest, fastest growing, and wealthiest countries in the world, has a GDP per capita of still less than \$9,000.⁸²³ Moreover, large segments of its population are still facing serious issues, such as health, housing, and other development challenges.⁸²⁴ According to OECD, China has not yet achieved the ideal income per capita, infrastructure, and standard of living, although the country has a high GDP with a high annual growth rate.⁸²⁵ For some countries to meet their current and present energy demands, they should significantly increase their domestic production capacity.⁸²⁶ For example, it is estimated that China should expand its renewable power generation capacity by nearly 900,000 MW in the next 15 years.⁸²⁷ This means that China should be less reliant on other countries in terms of importing fossil fuels for generating energy in the future, as energy would be generated locally.⁸²⁸ Thus, they can put more focus on other sectors that would improve an individual's

⁸²² Id.

⁸²³ PHILIPPE BENOIT, *Energy and Development in a Changing World: A Framework for the 21st Century*, Center on Global Energy Policy at Columbia University SIPA (2019).

⁸²⁴ Id.

⁸²⁵ Id.

⁸²⁶ Id.

⁸²⁷ Id.

⁸²⁸ Id.

life, such as building and operating the infrastructure that can deliver improved health and education services.⁸²⁹

Developing countries can directly leapfrog to clean energy since money has not been put heavily on energy production and existing grids, which would be expensive to replace.⁸³⁰ It means that developed countries have to change the existing solid fuel infrastructure in order to shift to clean energy, which is not the case for developing countries.⁸³¹ This might be a motivation for developing countries to jump from the present situation to a situation wherein it does not need this obsolete and polluting infrastructure.⁸³² By making this shift, developing countries can avoid the short-term consequences of the overuse of solid fuels, which cause much environmental damage and affect many sectors such as the agriculture industry. In other words, jumping to clean energy directly will not only allow developing countries to save, as they do not need to shift again from a polluting infrastructure to a clean infrastructure, but it would also save the soil, climate, and food industry in these countries. This would improve the welfare of the citizens of these countries, leading to political stability and a secure economy since energy will be produced locally.

In fact, many developing countries are considered sunbelt countries,⁸³³ which are located within 35 degrees longitude of the equator, putting them under optimal exposure to sunlight.⁸³⁴

This will give sunbelt countries an advantage if they rely on solar energy for generating

⁸²⁹ Id.

⁸³⁰ See the Proceedings of a conference organised by the European Office of the Konrad-Adenauer-Stiftung and the EastWest Institute, "Renewable energy: potential and benefits for developing countries," available at: https://www.kas.de/c/document_library/get_file?uuid=165ba899-b4c3-abc9-ae6b-038b643c5962&groupId=252038 (accessed July 1, 2020).

⁸³¹ Id.

⁸³² Id.

⁸³³ See the Lafayette College report at: <https://sites.lafayette.edu/egrs352-sp14-pv/global-perspective/> (accessed July 1, 2020).

⁸³⁴ Id.

electricity by taking the maximum potential for solar PV applications.⁸³⁵ According to EPA, 66 countries are located in the sunbelt.⁸³⁶ In 2009, sunbelt countries made up only 9% of the PV global market.⁸³⁷ Nevertheless, many researchers expect that sunbelt countries have the potential to represent approximately 58% of the forecasted global PV installed capacity by 2030.⁸³⁸ This would make sunbelt countries expand the PV market as well as attract investments in the development of solar energy, making PV energy the number one renewable energy source in the future.⁸³⁹

Some sunbelt countries have made serious steps in using solar energy. It is estimated that the PV production in China has grown to a whopping 320% more than what is needed.⁸⁴⁰ Saudi Arabia has also made a serious plan to shift to renewable energy, namely, solar energy. Saudi Arabia has witnessed many projects that have been established to invest in clean energy, such as solar energy. For instance, in 2018, the Saudi government and Softbank agreed to build the largest solar power plant in the Middle East, which produces over 200 GW of electricity.⁸⁴¹ Many other renewable energy projects have been started in these countries in the last three years. For instance, in 2019, the government planned to build an Integrated Solar Complex with Longi Solar, a Chinese company.⁸⁴² More details about Saudi Arabia's plan to shift to renewable energy will be discussed extensively in the next chapters. Singapore has used solar energy since

⁸³⁵ Id.

⁸³⁶ Id.

⁸³⁷ Id.

⁸³⁸ Id.

⁸³⁹ Id.

⁸⁴⁰ Id.

⁸⁴¹ Unfortunately, there is no official source for this project; nevertheless, many well respected journals covered this news, such as The Wall street Journal, available at: <https://www.wsj.com/articles/saudi-arabia-shelves-work-on-softbanks-200-billion-solar-project-1538328820> (accessed July 1, 2020).

⁸⁴² Unfortunately, there is no official source for this project; nevertheless, this news was published in PV tech.org (which covers news and articles on the solar PV supply chain internationally). The source is available at: <https://www.pv-tech.org/news/saudi-arabia-reignites-plans-for-integrated-solar-manufacturing> (accessed July 1, 2020).

it is commercially the most viable renewable energy option.⁸⁴³ Singapore enjoys an average annual solar irradiance of 1,580 kWh/m²/year.⁸⁴⁴ This could help convince other sunbelt countries to take the opportunity of using solar power to generate electricity locally, leading to secure energy and improvement in the life of their citizens.

4.6. Soft laws and protection of the environment

Laws have often been used to protect the environment in recent decades.⁸⁴⁵ Likewise, international energy collaboration has increased, especially since the World Summit on Sustainable Development (WSSD) in 2002.⁸⁴⁶ After the WSSD, international groups began to apply “soft laws” to promote the use of renewable energy.⁸⁴⁷ In this context, soft laws refer to non-binding policies and agreements that encourage countries to promote the use of clean energy.⁸⁴⁸ The international community has increasingly relied on soft laws to address environmental issues that are not easily regulated by legally binding instruments.⁸⁴⁹ Soft laws are important for developing renewable energy laws due to their flexibility and evolutionary capacity.⁸⁵⁰ In addition, they also account for poor countries that are unable to cover and regulate rapidly evolving areas, including the renewable energy sector.⁸⁵¹

⁸⁴³ Energy Market Authority in Singapore Government (2018), available at: https://www.ema.gov.sg/Renewable_Energy_Overview.aspx (accessed July 2, 2020).

⁸⁴⁴ Id.

⁸⁴⁵ Stuart Bruce, *International Law and Renewable Energy: Facilitating Sustainable Energy for All*, 14 MELB. J. INT'L L. 18 (2013).

⁸⁴⁶ Id.

⁸⁴⁷ Id.

⁸⁴⁸ Id.

⁸⁴⁹ Id.

⁸⁵⁰ Id.

⁸⁵¹ Pierre-Marie Dupuy, *Soft Law and the International Law of the Environment*, 12 Michigan Journal of International Law 420-435 (1991).

The use of soft laws to encourage countries to adopt environmental laws has been recognized by many directives. For instance, the Stockholm Conference functioned as a soft law that encouraged countries to protect the climate, and it resulted in the creation of a special subsidiary organ of the UN General Assembly devoted to the promotion of both universal and regional environmental laws.⁸⁵² Likewise, the Organization for Economic Cooperation and Development (OECD) used the Stockholm Conference recommendations to protect the environment and present standards that countries can adapt.⁸⁵³ Plus, many soft laws have helped promote environmental repairs, such as the 1978 UNEP Draft Principles of Conduct on Shared Natural Resources, the UN General Assembly Resolutions (XXVIII) of December 1973, and the Implementation of a Regime of Equal Right of Access and Non-Discrimination in Relation to Transfrontier Pollution.⁸⁵⁴

However, because the international community has recognized the climate change crisis, it has also started to use hard laws to promote the use of environmental laws. The UN General Assembly Resolution 43/53 of January 27, 1989 recognized “that climate change is a common concern of mankind.”⁸⁵⁵ Significantly, the Hague Declaration (1989) was signed by representatives of 24 states following the efforts of France, the Netherlands, and Norway. The declaration stated that the “duty of the community of nations vis-A-vis present and future generations to do all that can be done to preserve the quality of the atmosphere.”⁸⁵⁶ With a similar goal, the International Meeting of Legal and Policy Experts hosted by the Canadian

⁸⁵² Id.

⁸⁵³ Id.

⁸⁵⁴ Id.

⁸⁵⁵ Id.

⁸⁵⁶ Id.

government in Ottawa (1989) declared that “the atmosphere ... constitutes a common resource of vital interest to mankind.”⁸⁵⁷

4.7. Soft laws in Germany

Many countries have employed comprehensive legislation to address energy use and promote renewable energy.⁸⁵⁸ For example, Germany rewarded and increased efficiency in its manufacturing sector.⁸⁵⁹ Germany created voluntary energy-saving targets for manufacturers to increase the efficiency of their energy use by 1.3% per year.⁸⁶⁰ Since the private sector is driven by economic incentives, the German government provided subsidies for upgrading technology and equipment.⁸⁶¹ Overall, the government aims to help small and medium businesses by contributing 30% of the funding for energy-efficient motors, pumps, air-conditioning systems, and compressed air devices.⁸⁶²

4.8. Soft laws in Japan

Japan also adopted laws to encourage the use of clean energy. In particular, Japan applied financial incentives, voluntary actions, and regulatory measures to support the use of renewable energy in its industrial sector.⁸⁶³ Japan enacted the Concerning the Rational Use of Energy Act, which placed mandatory energy efficiency requirements on designated industries in 1978.⁸⁶⁴ Following this law, the industrial sector needed to meet minimum requirements in the short term (2015) and the long term (2020).⁸⁶⁵ Satisfying these requirements still provides businesses with

⁸⁵⁷ Id.

⁸⁵⁸ Richard L. Ottinger, UN Environment Guide for Energy Efficiency and Renewable Energy Laws, Pace Law Faculty Publications 1-370 (2016).

⁸⁵⁹ Id.

⁸⁶⁰ Id.

⁸⁶¹ Id.

⁸⁶² Id.

⁸⁶³ Id.

⁸⁶⁴ Id.

⁸⁶⁵ Id.

tax incentives, and low-interest loans were also available for the installation of cogeneration systems.⁸⁶⁶

4.9. Soft laws in New Zealand

Notably, New Zealand intends to significantly promote renewable energy use by 2025.⁸⁶⁷ Its strategy aims to generate 90% of its electricity from renewable energy without affecting supply security.⁸⁶⁸ The Resource Management Act (RMA) is the main law in New Zealand that promotes renewable energy use, and it addresses the preparation and implementation of policy-making, planning, and decision-making regarding renewable energy developments.⁸⁶⁹ The law states that the government is responsible for protecting the country's natural resources to benefit from them socially, economically, and culturally.⁸⁷⁰ The law is also designed to provide welfare for future generations through the sustainable use of natural resources.⁸⁷¹ This includes safeguarding the life-supporting capacity of the air, water, soil, and ecosystems.⁸⁷²

4.10. Soft laws in Malaysia

Moreover, Malaysia encourages the use of renewable energy through state programs and by offering attractive financing and other incentives to companies that generate renewable energy.⁸⁷³ In particular, the Malaysian government enacted the Sustainable Energy Development Authority Act in 2011 to increase the use of renewable energy.⁸⁷⁴ The act seeks to increase

⁸⁶⁶ Id.

⁸⁶⁷ Kenneth Palmer & David Grinlinton, Developments in Renewable Energy Law and Policy in New Zealand, 32 J. ENERGY & NAT. Resources L. 245 (2014).

⁸⁶⁸ Id.

⁸⁶⁹ Id.

⁸⁷⁰ Id.

⁸⁷¹ Id.

⁸⁷² Id.

⁸⁷³ Loh Wei Lian & Amin Abdul Majid, Renewable Energy Law and Policy in Malaysia, 7 RENEWABLE ENERGY L. & POL'y REV. 85 (2016).

⁸⁷⁴ Id.

renewable energy use in the private sector by offering financial incentives and tax exemptions.⁸⁷⁵ Further, the government also implemented the Renewable Energy Act in 2011, which introduced the feed-in tariff system and thus encouraged the private sector to invest in renewable energy and sell surplus electricity at a premium to utilities.⁸⁷⁶ The law has motivated both business owners and individuals to produce electricity with renewable energy and take advantage of the offered financial incentives.⁸⁷⁷ These efforts and legislation have increased renewable energy use in the country.⁸⁷⁸

4.11. Efficiency of “Hard Laws”

However, so-called hard laws seem to be more efficient than soft laws when it comes to making countries more credibly commit to international agreements related to climate change.⁸⁷⁹ Hard laws make a country responsible for enacting domestic laws, and its reputation can suffer if it violates its legal commitments.⁸⁸⁰ Hence, laws and regulations are proper mechanisms that the international community can utilize to monitor treaty obligations alongside dispute-settlement bodies, such as courts.⁸⁸¹ Yet, hard laws can be problematic for many countries. Because these laws may infringe on national sovereignty in potentially sensitive areas,⁸⁸² many countries are hesitant to join agreements that address climate change. Thus, hard laws might force many countries to bargain fiercely over their legally binding commitments.⁸⁸³ Nevertheless, these laws

⁸⁷⁵ *Id.*

⁸⁷⁶ *Id.*

⁸⁷⁷ *Id.*

⁸⁷⁸ *Id.*

⁸⁷⁹ Gregory Shaffer and Mark Pollack, *Hard vs. Soft Law: Alternatives, Complements, and Antagonists in International Governance*, 94 MINNESOTA LAW REVIEW 706-798 (2009).

⁸⁸⁰ *Id.*

⁸⁸¹ *Id.*

⁸⁸² *Id.*

⁸⁸³ *Id.*

and policies have proven to be effective in increasing the use of renewable energy and addressing climate change issues.⁸⁸⁴

Conclusion

In this paper, I have examined and discussed, in its first part, the existence and development of the use of energy. It explains how human beings throughout history shifted from one source of energy to another when there was a need to do so. A shift from the use of wood as the main source of energy to fossil fuels occurred because these sources are more efficient and cheaper than other types of fuel. This shift had indeed occurred but it took much time. This led us to predict that countries might shift from fossil fuels to renewable energy owing to climate change as well as the ongoing advancements in renewable energy technologies. In the second part of this chapter, I discussed the importance of shifting to renewable energy owing to the chaos caused by fossil fuels, which is climate change. The issue of climate change became serious in a way that it threatens our existence as human beings on this planet. The shift is also urgent as fossil fuels are a nonrenewable source of energy, which means that modern civilization is dependent on a nonrenewable source. In this part, I also discuss the importance of shifting to renewable energy for poor countries, as they would be able to satisfy their electricity demand. Moreover, almost all regions have some renewable energy resources. This will make many countries more secure with regard to energy generation and not be at the mercy of some oil-producing countries that could control their source of energy. The third part of this chapter focuses on solar energy as the main clean source of energy in Saudi Arabia. It explains the development of solar panels and how energy is generated from these panels. This part also explains the development of solar cells,

⁸⁸⁴ Id.

making them more competitive in the market. The last part of this chapter focuses on the issues that solar energy faces, namely, intermittency and energy storage. It also explains the development of energy storage and how the battery industry has evolved in this regard. For instance, flow batteries have come into existence very recently, making them a promising means of storing energy in comparison with Li-ion batteries.

We can conclude that the advancement of renewable energy technology is ongoing, and the use of renewable energy is increasing globally. It is predicted that renewable energy would replace fossil fuels as the main source of energy owing to the catastrophic effects of fossil fuels on the climate. In other words, not shifting to another source of energy would threaten human existence. It is argued that shifting to renewable energy is an ethical duty of the current generation to ensure a high quality of life for future generations. The future survival of human beings will depend on finding clean sources of energy that are sustainable and not harmful to the environment . Although there are many issues with renewable energy, which makes it less competitive, the ongoing and rapid advancement of renewable energy technologies will make this source of energy more promising to be used as the main source of energy in the future.

Chapter 4 Saudi Arabia's 2030 vision

Introduction

Saudi Arabia is well known for having the largest economy in the Middle East, and the country has used its vast natural resources to generate much of this wealth.⁸⁸⁵ Saudi Arabia has the world's second-largest proven petroleum reserves, approximately 17% of global reserves,⁸⁸⁶ and the fifth-largest proven natural gas reserves.⁸⁸⁷ Notably, the country is the largest exporter of petroleum worldwide.⁸⁸⁸ Because fossil fuels, mainly oil and gas, account for roughly 50% of its gross domestic product (GDP) and about 70% of export earnings,⁸⁸⁹ the country relies heavily on its fossil fuels revenues. The natural resources of Saudi Arabia are owned by the government according to its energy laws, which are rooted in the Maliki school of thought.⁸⁹⁰ Oil revenue has historically functioned as the engine of economic growth in Saudi Arabia,⁸⁹¹ and it caused the GDP to double between 2003 and 2011, increasing household income by 75%.⁸⁹² Using this revenue, the country has increased the welfare of its citizens, such as by providing them with free health care and education, without needing to tax them for new services.⁸⁹³

However, because the oil price is unstable and often decreases, Saudi Arabia faces serious economic challenges. The International Monetary Fund (IMF) reported that the financial reserves of Gulf region countries will only be able to fill their budget deficits for the next 15

⁸⁸⁵ Look at the IMF report at: <https://www.imf.org/external/np/pp/eng/2016/042916.pdf>

⁸⁸⁶ Look at OPEC report at: https://www.opec.org/opec_web/en/about_us/169.htm

⁸⁸⁷ Look at the World Factbook in the CIA's official site at: <https://www.cia.gov/library/publications/the-world-factbook/rankorder/2253rank.html>

⁸⁸⁸ Look at the U.S Energy Information Database at: <https://www.eia.gov/international/overview/world?view=production>

⁸⁸⁹ Id.

⁸⁹⁰ Maliki school of thought is one of the Sunni schools of jurisprudence, which will be explained in the chapter.

⁸⁹¹ Bina Hussein, ENERGY: Driving Force Behind Increasing Female Participation in the Gulf?, Atlantic Council 6-9 (2018).

⁸⁹² Id.

⁸⁹³ Id.

years.⁸⁹⁴ The IMF observed that the decreasing demand for fossil fuels has contributed to this problem, as many countries are now prioritizing gas extraction, which is less disruptive to the environment, over fossil fuels.⁸⁹⁵ In addition, there is worldwide interest in renewable energy as the future alternative energy.⁸⁹⁶ Therefore, oil-producing countries reliant on fossil fuels for the main source of their GDP will face crises in the future if they do not diversify their economies.

To face these challenges, Saudi Arabia has adopted the guidelines of the report “Saudi Arabia Beyond Oil: The Investment and Productivity Transformation” (Vision 2030) by McKinsey & Company.⁸⁹⁷ Vision 2030 proposes radical changes to the Saudi economy⁸⁹⁸ and aims to increase its non-oil revenue from 10% to 70% of the total government revenue by 2030.⁸⁹⁹ Private sector wages would increase from 19% to 58%, and more than 6 million jobs would be provided. Saudi Arabia is also determined to prioritize renewable energy production.⁹⁰⁰ Vision 2030 recommends that Saudi Arabia should deploy 58.7 GW of renewable energy to reduce the proportion of oil used for its electricity.⁹⁰¹ This would increase the renewable energy share to 30% of the kingdom’s total generation capacity.⁹⁰² To support renewable energy

⁸⁹⁴ See the IMF report: The Future of Oil and Fiscal Sustainability in the GCC Region (2020) available at: <https://www.imf.org/en/Publications/Departmental-Papers-Policy-Papers/Issues/2020/01/31/The-Future-of-Oil-and-Fiscal-Sustainability-in-the-GCC-Region-48934>

⁸⁹⁵ Id.

⁸⁹⁶ Look at the official site of the Saudi Electricity & Cogeneration Regulatory Authority: The Development of National Renewable Energy Policy for Saudi Arabia. available at: <https://www.ecra.gov.sa/en-us/Events/Pages/8thEvent.aspx?Eventid=20>

⁸⁹⁷ Look at the full report of McKinsey Global Institute (Hereinafter: the Saudi 2030 vision): SAUDI ARABIA BEYOND OIL: THE INVESTMENT AND PRODUCTIVITY TRANSFORMATION. available at: https://www.mckinsey.com/~/media/McKinsey/Featured%20Insights/Employment%20and%20Growth/Moving%20Saudi%20Arabias%20economy%20beyond%20oil/MGI%20Saudi%20Arabia_Full%20report_December%202015.pdf

⁸⁹⁸ Id.

⁸⁹⁹ Id.

⁹⁰⁰ Id.

⁹⁰¹ Jorge Blazquez, Lester Hunt and Baltasar Manzano, Oil Subsidies and Renewable Energy in Saudi Arabia: A General Equilibrium Approach. 38 *The Energy Journal* 29-45 (2017).

⁹⁰² Look at the ministry of investment report regarding the application of the 2030 vision regarding the renewable energy sector Hereinafter: (Hereinafter: the Saudi’s Renewable energy plan 2030). available at: <https://investsaudi.sa/media/1375/renewable-energy-17th-feb.pdf>

development, many projects, standards, policies, and laws have been implemented in Saudi Arabia.

This chapter provides the context for environmental reforms and renewable energy generation in Saudi Arabia, including the measures outlined in Vision 2030, and explores the actions that the kingdom will take to support its non-oil sectors. The first section of this chapter discusses environmental norms under Islam as a religion. In particular, it examines the main sources of Islam and the extent to which these sources encourage individuals to protect the environment. These sources have strongly influenced modern environmental legislation in Saudi Arabia, and they can also support the country's environmental reforms. The second part summarizes the debate on the ownership of energy under Islamic law and how the four main Sunni schools of jurisprudence view this ownership. This part emphasizes how modern Muslim countries have been influenced by the old debate, as can be seen in their respective energy laws. The third part sheds light on the constitution of Saudi Arabia. Crucially, it grants citizens the right to a clean environment. Therefore, the country has the constitutional authority to make any reforms that would protect the environment. The fourth part focuses on the OPEC statute, its purpose, and its roles for oil-producing countries. In this part, it is clarified that because relying only on fossil fuels will lead to an unsustainable economy, significant reforms must occur in Saudi Arabia. The final part of the chapter analyzes the goals of Vision 2030 and outlines how the country will support its non-oil sectors, including those related to renewable energy.

1. Environmental norms under Islam

1.1. Holy Qur'an

The two main sources of Islam that all Muslims agree on are the Qur'an and Sunnah. The Qur'an contains the words of God sent through a prophet, while the Sunnah refers to the sayings

and practices of the Prophet Muhammad. These two sources provide many rules and directions for how humans should respect the environment as its creatures.⁹⁰³ Moreover, these two sources present humans as a part of the planet rather than separate from it. This philosophy is important because it may guide future practices related to environmental reforms in Islamic countries. In fact, these sources present environmental devastation as a form of corruption.

One might argue that because Islamic countries do not apply all Islamic rules, the environmental rules might not affect how the countries use their natural resources. However, even if many Islamic countries do not apply all of these rules, the general Islamic rules tend to be present in the citizens' modern lives. For example, modern Islamic countries' constitutions are often similar to these two written sources. Because the two sources advocate for protecting the environment, citizens of Islamic countries may be persuaded to accept environmental reforms and also any difficulties caused by these reforms, such as the price of electricity increasing when renewable energy sources are used instead of fossil fuels. Thus, before making a strong shift to renewable energy to achieve its Vision 2030 goals, Saudi Arabia may benefit from emphasizing to its citizens that Islamic philosophy advocates for environmental protection.

The Qur'an instructs people to consider the creations of the universe, such as when it encourages them to look at the sky and reflect on how it exists⁹⁰⁴ or to admire creations such as the Earth.⁹⁰⁵ The Earth is mentioned more than four hundred times in the Qur'an, whereas the sky and beyond are only mentioned roughly three hundred times.⁹⁰⁶ According to the Qur'an, humans must meditate and reflect on the existence and creation of the Earth,⁹⁰⁷ and the text

⁹⁰³ Mawil Dien, Islam and the Environment: theory and practice, 18 *Journal of Beliefs & Values* 47-57 (2006).

⁹⁰⁴ Qur'an: Surat Qāf, ayah 06

⁹⁰⁵ Qur'an: Surat Aal-i- Imran, ayah 191

⁹⁰⁶ Kamaruzaman Jusoff and Siti Abu-Samah, Environmental Sustainability: What Islam Propagates, 12 *World Applied Sciences Journal* 46-53 (2011).

⁹⁰⁷ Qur'an: Surat Aal-i- Imran, ayah 191

provides many examples of how to interpret the natural world. It observes that the Earth satisfies humans' needs, such as by giving them sustenance from planted fruits and vegetables as well as water.⁹⁰⁸ The processes of the Earth provide water and produce food for both humans and animals.⁹⁰⁹ Moreover, the Qur'an describes the rule of stars and how it can be used to direct travelers,⁹¹⁰ and it notes that there are mysteries about the stars that humans are not even aware of.⁹¹¹ Furthermore, the holy book directs people to think about how mountains are created⁹¹² and also how they themselves are created.⁹¹³ Therefore, the Qur'an's focus on the Earth is clear, as is its emphasis on humans appreciating the planet that supports them.

The Qur'an contains the principle of vicegerency, which means that humans who live on Earth are responsible for it.⁹¹⁴ Because God created the universe and human beings are capable of living on Earth, this planet must not be disrupted by those humans who rely on it. This does not mean, however, that humans cannot use plants and animals for food or wood for setting fires. Resources should be taken by humans to satisfy their needs, and these uses must be balanced.⁹¹⁵ Following the Qur'an, humans should thrive on Earth in harmony with nature, and treating other humans and animals well is one of the most noble things that a person can do.⁹¹⁶ The Qur'an states that if an individual saves one life of one, he would be considered as if he saves the world entire lives.⁹¹⁷ Ultimately, the guidance and rules of the Qur'an clearly assert that humans must protect the environment.

⁹⁰⁸ Qur'an: Surat Yaseen, ayah 33-35.

⁹⁰⁹ Qur'an: Surat Yaseen, ayah 33-35.

⁹¹⁰ Qur'an: Surat Al-Anaam, ayah 97

⁹¹¹ Qur'an: Surat Al-Waqia, ayah 95

⁹¹² Qur'an: Surat Al-Ghashiya, ayah 19.

⁹¹³ Qur'an: Surat At-Tariq, ayah 5.

⁹¹⁴ Qur'an: Surat Al-A'raaf, ayah 56.

⁹¹⁵ Qur'an: Surat Al-Baqara, ayah 60.

⁹¹⁶ Qur'an: Surat Al-Maaida, ayah 32.

⁹¹⁷ Qur'an: Surat Al-Maaida, ayah 32.

1.2. Sunnah

The Sunnah also stresses that humans must use all creatures of this universe wisely and ensure the safety of the environment.⁹¹⁸ For instance, the prophet explains that people must not kill an animal or harvest a plant unless it will be eaten.⁹¹⁹ Hence, it is forbidden to kill animals for pleasure.⁹²⁰ In addition, the Sunnah provides rules for how to use animals for food. For example, it is forbidden to kill an animal if another animal can see this action. The Sunnah also specifies that the animal must be killed quickly and without pain, and it states that people are obligated to feed their animals while they are alive and not use them for damaging work. According to the Sunnah, hurting animals is one of the worst things that a person can do. In contrast, being kind to animals is one of the greatest acts. Moreover, the Sunnah makes it clear that humans must ensure that they are not wasting environmental resources. For instance, it advises people to not waste water and declares that cleaning a road or any place from dirt is a good deed. The Sunnah also proposes that people should increase their natural resources even if it may seem illogical to do so. It states that even when the end of world comes, a person must plant a seedling if they are able to.

Overall, these two undisputed sources of Islam explicitly support the protection of the environment and its resources. By following the teachings and principles of Islam, citizens of Islamic countries should come to value their own morality as well as the purity of the Earth.⁹²¹ Thus, environmental reforms in Saudi Arabia may receive significant public support as the foundational Islamic texts defend and encourage such reforms.

⁹¹⁸ Gar Smith, Islam and the Environment, Earth Island Journal (2002).

⁹¹⁹ Id.

⁹²⁰ Id.

⁹²¹ Jusoff and Abu-Samah, supra.

2. Ownership of energy under Islamic law and other jurisdictions

2.1. Ownership of energy under the Roman Empire

Natural resource ownership is an age-old problem.⁹²² The Roman Empire adopted the absolute right of property,⁹²³ which gave landowners the right to the natural resources below their land, and thus provided people with the unlimited right to use or destroy an object.⁹²⁴ The ancient Greeks took a similar approach to natural resource ownership. Democritus (460–370 BC) and Aristotle (384–322 BC) argued that natural resources located below private land must belong to the owner of that land, as this would incentivize productivity and therefore must be encouraged.⁹²⁵

2.2. Terra nullius doctrine

Since the 16th century, European empires have treated their occupied lands in the Americas as *terra nullius*.⁹²⁶ These empires justified their occupations while they openly competed with each other for sovereignty during their overseas expansions.⁹²⁷ *Terra nullius* is still being used by nations such as England and Holland as a political approach, as they lacked the papal bulls that Spain and Portugal used to claim their new lands.⁹²⁸ Likewise, the English and Dutch empires used *terra nullius* without making any distinctions between themselves and the Amerindians.⁹²⁹ In this context, Hugo Grotius redefined private property as property that the

⁹²² El-Walied M. H. El-Malik, Minerals Investment under Shari'a Law, 8 ARAB L.Q. 106 (1993).

⁹²³ Id.

⁹²⁴ Id.

⁹²⁵ Id.

⁹²⁶ Yogi Hendlin, From Terra Nullius to Terra Communis: Reconsidering Wild Land in an Era of Conservation and Indigenous Rights, 11 Environmental Philosophy 141-174 (2014).

⁹²⁷ Id.

⁹²⁸ Id.

⁹²⁹ Id.

owner can individually consume or transform.⁹³⁰ Grotius’s definition refers to the idea that although God gave nature to humanity, civilization can convert things within nature into owned property through the use and seizure of it. In other words, following the *terra nullius* approach, civilized European empires have justified their seizure and ownership of occupied lands.

In 1552, Alberico Gentili clarified the definition of *terra nullius* that European empires used to claim their occupied lands in the Americas.⁹³¹ Such an effort was needed to legally justify the seizure of large amounts of land.⁹³² Gentili claimed that “God did not create the world to be empty,” and he then concluded that “the seizure of vacant places is regarded as a law of nature ... because of that law of nature which abhors a vacuum, they will fall to the lot of those who take them, though the sovereign will refrain jurisdiction over them.”⁹³³ According to Gentili, nature “abhors a vacuum,” and thus empty space signals a regression from civilization to primeval times.⁹³⁴ Gentili also asserted that any uncultivated land cannot be considered property. Therefore, the large amounts of uncultivated land in the Americas can be taken by any government without legal challenges. Gentili also helped the Dutch and English to overturn Spanish, French, and Portuguese claims of wide lands that had not been seen or contacted by their representatives.⁹³⁵

Unlike these European empires, the Roman Empire used the novel concept of *res nullius*, which means the “property of no one.”⁹³⁶ Hence, no private owner can claim *res nullius* lands.⁹³⁷

⁹³⁰ Id.

⁹³¹ Id.

⁹³² Id.

⁹³³ Id.

⁹³⁴ Id.

⁹³⁵ Id.

⁹³⁶ F. S. Ruddy, *Res Nullius and Occupation in Roman and International Law*, 36 U. MO. KAN. CITY L. REV. 274 (1968).

⁹³⁷ Id.

Although the genesis of Roman property concepts is unclear, the Roman philosopher Seneca believed that the idea of ownership was unnecessary and created from an increase in human vice and avarice.⁹³⁸ Seneca asserted that because humans are selfish, they try to possess the things of the world.⁹³⁹ According to Seneca, humans have moved away from the state of nature and created the idea of ownership after fictionalizing a social organization that recognized human avarice.⁹⁴⁰ Seneca's point of view seems to agree with Savigny's aphorism that "property is founded on adverse possession ripened by prescription."⁹⁴¹

2.3. *Res communes* doctrine

The Romans also established the legal doctrine of *res communes*.⁹⁴² This doctrine is explained in a short passage from the Institutes of Justinian.⁹⁴³ Roman law held that "things common to mankind by the law of nature, are the air, running water, the sea, and consequently the shores of the sea."⁹⁴⁴ Hence, *res communes* simply means "things common to all."⁹⁴⁵ When applied by the Romans, *res communes* usually covered natural resources, such as the land beneath navigable waters.⁹⁴⁶ Moreover, the Roman government had a fiduciary obligation to deal with certain properties that were held publicly.⁹⁴⁷

The concept of *res communes* has affected modern legal systems. For instance, Article 2 of the Geneva Convention on the High Seas and Article 89 of the 1982 Convention on the Law

⁹³⁸ Id.

⁹³⁹ Id.

⁹⁴⁰ Id.

⁹⁴¹ Id.

⁹⁴² J.B. Ruhl and Thomas McGinn, The Roman Public Trust Doctrine: What Was It, and Does It Support an Atmospheric Trust?, 47 *ECOLOGY LAW QUARTERLY* 117-178 (2020).

⁹⁴³ Id.

⁹⁴⁴ Id.

⁹⁴⁵ Id.

⁹⁴⁶ Joseph L. Sax, Liberating the Public Trust Doctrine from Its Historical Shackles, 14 *U.C. Davis L. REV.* 185 (1980).

⁹⁴⁷ Id.

of the Sea use the common heritage of humankind as a principle.⁹⁴⁸ Arvid Pardo, the then ambassador of Malta, stated at the 1967 United Nations General Assembly that natural resources are a common heritage of humankind.⁹⁴⁹ Such a statement is rooted in Roman jurisdiction regarding the appropriate use of natural resources, which reaches back to the beginning of recorded history.⁹⁵⁰ This point of view seems to agree with the ancient Greek view expressed by Aristotle, which outlines that “water is not bounded by a boundary of its own substance.”⁹⁵¹ Evidently, Roman law has impacted modern legal systems and international laws.

Crucially, the equitable sharing of resources does not entail unchecked freedom when using the commons.⁹⁵² Garrett Hardin described the tragedy of the commons, which occurs if unchecked freedom is permitted: “Each man is locked into a system that compels him to increase his herd without limit in a world that is limited[.] ... Ruin is the destination toward which all men rush, each pursuing his own best interest in a society that believes in the freedom of the commons.”⁹⁵³ Thus, if freedoms are unchecked and uncontrolled, then the idea of *res communes* is pointless. Consequently, states must place restrictions on freedom to enable society to pursue life within the framework of a distinctive cultural heritage molded by language, religion, and history.⁹⁵⁴

Texas groundwater law is an example of the unchecked freedom of natural resources, which has caused many issues for the state. Before the case of Edwards Aquifer Authority v. Day

⁹⁴⁸ Look at Oxford reference: *res communis*, available at:

<https://www.oxfordreference.com/view/10.1093/oi/authority.20110803100408305>

⁹⁴⁹ CHARLOTTE Ku, The concept of *res communis* in international law, 12 *History of European Ideas* 459-477 (1990).

⁹⁵⁰ *Id.*

⁹⁵¹ *Id.*

⁹⁵² *Id.*

⁹⁵³ *Id.*

⁹⁵⁴ Ku, *supra*.

(2012), Texas used the capture doctrine to manage its groundwater.⁹⁵⁵ Capture doctrine allows anyone to withdraw water from the ground without limitations.⁹⁵⁶ However, the doctrine does not give ownership of groundwater to the landowner until it has been reduced to possession at the surface.⁹⁵⁷ This made the state enact laws that put limits on withdrawing groundwater. After the Day case, the court held for the first time that groundwater was owned by landowners.⁹⁵⁸ Consequently, the court also confirmed that the state cannot limit the use of groundwater without compensation to landowners, given that the state also limits their property rights.⁹⁵⁹ Hence, Texas may not be able to effectively manage its natural resources because if it restricts landowners, then it must compensate them as well. In other words, enacting laws to manage groundwater could be pointless for the state. Such unchecked freedom is what Hardin described as the tragedy of the commons, and the issue clearly still exists in modern times.

Mcdade has argued that natural resource ownership must be given based on the principle of first possession.⁹⁶⁰ This principle is widely recognized as a method to establish original ownership.⁹⁶¹ Following this principle, if an individual is given ownership of unused natural resources, then this will lead to productivity because the individual will exploit these resources. Thus, ownership is awarded to the first person who demonstrates a sufficient degree of control over some portion of these resources, and they are deemed to be in “possession” of them.⁹⁶²

2.4. Debate over the ownership of natural resources in modern times

⁹⁵⁵ Barton Thompson Jr, John Leshy, Robert Abrams and Sandra Zellmer, *Legal Control of Water Resources* 472-473 (6th ed, 2018).

⁹⁵⁶ *Id.*

⁹⁵⁷ Marvin W. Jones; C. Brantley Jones, *The Evolving Legacy of EAA v. Day: Toward an Effective State Water Plan*, 68 *Baylor L. Rev.* 765, 796 (2016).

⁹⁵⁸ *Edwards Aquifer Auth. v. Day*, 369 S.W. 3d 814 (Tex. 2012).

⁹⁵⁹ *Id.*

⁹⁶⁰ Thomas W. Merrill, *Accession and Original Ownership*, 1 *J. LEGAL Analysis* 459 (2009).

⁹⁶¹ *Id.*

⁹⁶² *Id.*

Natural resource ownership continues to be debated in the modern day. For example, the United States has adopted many doctrines regarding this issue. The correlative rights doctrine governs the use of groundwater resources in the state of Nebraska, and it allows landowners to extract groundwater from an underlying aquifer if it is deemed beneficial by the public.⁹⁶³ However, a landowner cannot extract this resource if it is injurious to others who have substantial rights to the water or if the natural underground supply is insufficient for all owners.⁹⁶⁴ On the other hand, the state of Texas follows the capture doctrine, which allows anyone to withdraw groundwater for any purpose and without limitations.⁹⁶⁵ The doctrine implies that the landowner does not own the water until it has been reduced to possession at the surface.⁹⁶⁶ However, following the Day case, The Texas Supreme Court declared that groundwater belongs to the landowner even if it is not reduced to possession at the surface.⁹⁶⁷ This means that the groundwater belongs to the landowner and thus any limitation of this right must be compensated.

2.5. Energy ownership in Islam

Because the main Islamic texts do not offer guidelines for natural resource ownership, Muslims must regulate it themselves following the general principles of Islamic law.⁹⁶⁸ While the Qur'an and Sunnah contain broad principles that must be followed, these texts leave most matters related to daily life, such as societal organization and economic systems, to the public.

⁹⁶³ See the article written in the University of Nebraska, Nebraska Surface Water First-in-Time Rule, available at: <https://water.unl.edu/article/agricultural-irrigation/regulations-policies>.

⁹⁶⁴ See the Memo written by the State of Nebraska, Surface and Groundwater Controls, available at: https://lprbc.nebraska.gov/MtgMaterials/LPRBC_BWMP_AppendixD_ExistingSW&GWControls.pdf.

⁹⁶⁵ Barton Thompson Jr, John Leshy, Robert Abrams and Sandra Zellmer, Legal Control of Water Resources 472-473 (6th ed, 2018).

⁹⁶⁶ Marvin W. Jones; C. Brantley Jones, The Evolving Legacy of EAA v. Day: Toward an Effective State Water Plan, 68 Baylor L. Rev. 765, 796 (2016).

⁹⁶⁷ Edwards Aquifer Authority v. Day, Supreme court of Texas, 2012. 369 S.W. 3d 814.

⁹⁶⁸ Walied El-Malik, State Ownership of Minerals under Islamic Law, 14 J. ENERGY & NAT. Resources L. 310 (1996).

Most of the fatawas (legal opinions) concerning the mining industry are attributed to the four Sunni schools of jurisprudence:⁹⁶⁹ the Hanafi, Shafie, Hanbali, and Maliki schools. To promote investment in its natural resources, Saudi Arabia must clearly answer sociological and economic questions about natural resource ownership.⁹⁷⁰ Moreover, the country must decide how disputes over natural resources will be resolved, either with public international law or domestic law.⁹⁷¹ In particular, the viewpoints of the four Sunni schools of jurisprudence are important because of their influence on natural resource ownership in Saudi Arabia.

2.5.1. Hanafi school

The Hanafi school distinguishes between visible and hidden natural resources.⁹⁷² Like the other schools, the Hanafi school claims that visible natural resources are owned by the public⁹⁷³ and the government cannot assign these resources to particular individuals.⁹⁷⁴ The school argues that the landowner owns all minerals below the land, which are hidden resources.⁹⁷⁵ However, these minerals are subject to tax.⁹⁷⁶ The school considers the creation of mining rights to be a private treaty distinct from state contracts.⁹⁷⁷ On the topic of private investors, the school proposes that they may have a right on the minerals located under a country's land if they have acquired permission to use them from the state.⁹⁷⁸

⁹⁶⁹ Id.

⁹⁷⁰ Id.

⁹⁷¹ Id.

⁹⁷² Umar F. Moghul & Samir H.K. Safar-Aly, *Green Sukuk: The Introduction of Islam's Environmental Ethics to Contemporary Islamic Finance*, 27 *GEO. INT'L ENVTL. L. REV.* 1 (2014).

⁹⁷³ Id.

⁹⁷⁴ Id.

⁹⁷⁵ El-Malik, *supra*.

⁹⁷⁶ Id.

⁹⁷⁷ Id.

⁹⁷⁸ Toriguian Shavarsh, *Legal aspects of oil concessions in the Middle East* (Hamaskaine Press, 1972).

2.5.2. Shafie school

Like the Hanafi school, the Shafie school also distinguishes between visible and hidden minerals.⁹⁷⁹ Regarding visible minerals, the Shafie school agrees with the Hanafi school in that these minerals are owned by the public and thus no exclusive private rights to them shall be granted.⁹⁸⁰ Unlike the Hanafi school, the Shafie school argues that visible natural resources can have a reasonable amount extracted by anyone to satisfy their needs.⁹⁸¹ Regarding hidden minerals, the school also claims that they belong to the landowner and are subject to tax.⁹⁸² The school specifies that ownerless minerals cannot be acquired merely by digging them out. Rather, a person can take ownership of the deadland and its minerals by cultivating it.⁹⁸³ Regarding minerals found in state-owned lands, the school states that these resources belong to the government, although the government can give the rights to these minerals to private individuals.⁹⁸⁴

2.5.3. Hanbali school

The Hanbali school asserts that visible resources cannot be privately owned whether the land is private, dead, or state-owned.⁹⁸⁵ Following this school, visible resources are necessary for public welfare and thus cannot benefit a single individual over the public.⁹⁸⁶ The Hanbali school maintains that Islam generally focuses on society as a group rather than as individuals.⁹⁸⁷ Thus, although the school believes in giving and protecting private rights, it notes that there must be

⁹⁷⁹ Id.

⁹⁸⁰ El-Malik, *supra*.

⁹⁸¹ Id.

⁹⁸² Id.

⁹⁸³ Id.

⁹⁸⁴ Id.

⁹⁸⁵ Henry Cattan and Willis Reese, *The Law of Oil Concessions in the Middle East and North Africa* (Oceana Publications, 1967).

⁹⁸⁶ Id.

⁹⁸⁷ Id.

limits on these private rights to avoid causing hardships.⁹⁸⁸ The school supports this argument with the hadith of the prophet (Sunnah): “People are partners in three commodities: water, fire and green herbage.”⁹⁸⁹ Ultimately, the Hanbali school views visible minerals as separate from the land, meaning that private rights cannot be given to these resources.⁹⁹⁰ In other words, these minerals and natural resources are owned by the general public, and the state only manages this right on its behalf.⁹⁹¹

In the case of hidden minerals, the Hanbali school affirms that deadland minerals cannot be granted to any private person who simply digs them out.⁹⁹² To gain access to the minerals, the private person or investor must first bring life to the deadland or be granted a concession to work the minerals by the state.⁹⁹³ This does not give the private person ownership of these minerals nor an exclusive right to use them. Instead, the needs of the private person are prioritized over those of others. After satisfying these needs, this person must allow others to also satisfy their needs.⁹⁹⁴⁹⁹⁵ In other words, the school argues that Islamic law recognizes the acquisition of the right to a mine by first discovery but without ownership of the minerals.⁹⁹⁶

2.5.4. Maliki school

The Maliki school takes a different approach to mineral ownership than the other Sunni schools. It contends that all minerals belong to the Muslim community and are under the direct

⁹⁸⁸ El-Malik, *supra*.

⁹⁸⁹ *Id.*

⁹⁹⁰ Mohammed Madani, *The relationship between Saudi Arabian Domestic Law and International Law: A study of the Oil Agreements with Foreign Companies*. (A Dissertation Submitted to the Faculty of Law School of the George Washington University in Partial Fulfilment of the Requirements for the Degree of Doctor of Juridical Science, (1970).

⁹⁹¹ *Id.*

⁹⁹² El-Malik, *supra*.

⁹⁹³ *Id.*

⁹⁹⁴ *Id.*

⁹⁹⁵ *Id.*

⁹⁹⁶ *Id.*

control of the country.⁹⁹⁷ The Maliki school reasons that minerals cannot be owned exclusively by landowners because these minerals are not created nor developed by them.⁹⁹⁸ Instead, the school argues that all minerals are created by God and thus must be shared for the good of the community.⁹⁹⁹ Consequently, the Maliki school does not distinguish between visible and hidden minerals.¹⁰⁰⁰ The wealth created by all minerals must be shared by the society.¹⁰⁰¹ In general, the contemporary Islamic opinion on mineral wealth supports the state owning all such resources and assuming the responsibility for them.¹⁰⁰² While private rights are granted, they cannot exceed to the harm done to the general public's rights.¹⁰⁰³ Private investors may be granted concessions but not the ownership of these minerals.¹⁰⁰⁴ Similar to the Hanbali school, the Maliki school ultimately believes that the general public owns all minerals, which are managed by the government on their behalf.¹⁰⁰⁵

The four Sunni schools of jurisprudence have greatly influenced how Islamic countries treat their natural resources.¹⁰⁰⁶ Many modern constitutions of Muslim countries use Islam as their main source of legislation.¹⁰⁰⁷ Accordingly, most general civil laws in these countries conform with Islamic principles, including inheritance, family, marriage, and divorce laws.¹⁰⁰⁸ While many laws regarding the ownership of minerals have been affected by the rules of Islam, these laws differ between countries. In 1983, Sudan adopted a mining act that gives the landowner

⁹⁹⁷ Toriguian, *supra*.

⁹⁹⁸ El-Malik (1996), *supra*.

⁹⁹⁹ El-Malik (1993), *supra*.

¹⁰⁰⁰ *Id.*

¹⁰⁰¹ *Id.*

¹⁰⁰² *Id.*

¹⁰⁰³ *Id.*

¹⁰⁰⁴ Siddiqi Nagatallah, *Muslim economic thinking: a survey of contemporary literature* (Leicester Islamic Foundation, 1981).

¹⁰⁰⁵ El-Malik (1993), *supra*.

¹⁰⁰⁶ *Id.*

¹⁰⁰⁷ *Id.*

¹⁰⁰⁸ Muhammad Chapra, *The Islamic welfare state and its role in the economy* (Islamic Foundation, 1979).

ownership of the surface and subsurface of their land,¹⁰⁰⁹ which follows the Hanafi school's view of mineral ownership.¹⁰¹⁰ Saudi Arabia, Kuwait, and Egypt, amongst other countries, have adopted the Maliki school of thought,¹⁰¹¹ as it subjects natural resources to the interests of the nation.¹⁰¹² Moreover, according to the Maliki school, a person only owns what has been produced or developed by their own efforts.¹⁰¹³ Thus, many countries have used this idea of ownership in their constitutions.¹⁰¹⁴ For instance, Article 1 of the Mining Code of Saudi Arabia states that all natural deposits of minerals in any form or combination, either in soil or subsoil, belong exclusively to the state.¹⁰¹⁵ This includes both the land and the sea territories comprising the continental shelf.¹⁰¹⁶ While most Muslim countries do not apply all ideas from the Sunni schools, these schools have had a noticeable impact on the legal systems of these countries.

3. Constitution of Saudi Arabia

The rise of Saudi Arabia as a country started in the mid-eighteenth century, when many communities in central Arabia decided to make religious reforms and unify disparate groups into one country.¹⁰¹⁷ The success of this unification varied over time.¹⁰¹⁸ After King Abdulaziz came to power, Saudi Arabia experienced significant success in unifying different groups from 1902–

¹⁰⁰⁹ El-Malik (1993), *supra*.

¹⁰¹⁰ *Id.*

¹⁰¹¹ *Id.*

¹⁰¹² *Id.*

¹⁰¹³ *Id.*

¹⁰¹⁴ *Id.*

¹⁰¹⁵ The Saudi's Mining investment Law (Article 2): available at:

<https://laws.boe.gov.sa/BoeLaws/Laws/LawDetails/f8ddb943-7ed5-4856-a448-a9a700f29aa7/1>

¹⁰¹⁶ *Id.*

¹⁰¹⁷ Abdulaziz H. Al-Fahad, Ornamental Constitutionalism: The Saudi Basic Law of Governance, 30 YALE J. INT'L L. 375 (2005).

¹⁰¹⁸ *Id.*

1930.¹⁰¹⁹ Traditional norms of governance, which emphasize consensus, prevailed throughout this time.¹⁰²⁰ These norms were strongly influenced by classical Islamic notions of rule.¹⁰²¹

After the Gulf War, Saudi Arabia implemented the Basic Law of Saudi Arabia, otherwise known as the constitution, on March 1, 1992.¹⁰²² The constitution did not establish a new constitutional framework. Instead, it only codified principles and rules adopted by the kingdom throughout its history.¹⁰²³ Therefore, there was not, as some argue, a constitutional vacuum in the kingdom.¹⁰²⁴ King Fahad observed that the constitution came only to reflect traditional, Islamic, and international characteristics of the society.¹⁰²⁵ The Saudi constitution was necessary to clarify the rights and duties of its citizens, integrate with international society, and encourage investments from other countries and corporations. Thus, the enactment of the constitution was necessary to further develop the country.

Some have criticized the constitution of Saudi Arabia because it lacks the fundamental rights present in other Arab countries' constitutions.¹⁰²⁶ For instance, some of these constitutions declare that freedoms are inviolate and base their governance on periodic elections or plebiscites.¹⁰²⁷ However, this does not reflect the realities of these countries. They often suspend these rights, are in permanent states of emergency, conduct fraudulent or uncontested elections, and let authoritarianism spread despite these theoretical safeguards.¹⁰²⁸ Even countries with republican regimes will allow their presidents to remain in power for life, and if a constitution

¹⁰¹⁹ *Id.*

¹⁰²⁰ *Id.*

¹⁰²¹ Patricia Crone, *God's rule: government and Islam* (Columbia University Press, 2004).

¹⁰²² Ali M. Al-Mehaimeed, *The Constitutional System of Saudi Arabia: A Conspectus*, 8 *Arab Law Quarterly* 30-36 (1993).

¹⁰²³ *Id.*

¹⁰²⁴ *Id.*

¹⁰²⁵ *Id.*

¹⁰²⁶ Al-Fahad, *supra*.

¹⁰²⁷ *Id.*

¹⁰²⁸ *Id.*

becomes an impediment, it will be hurriedly and shamelessly amended.¹⁰²⁹ Hence, a constitution is futile if it is not applied in reality. Moreover, the fundamental necessities of a society may not be delivered due to unrealistic laws and constitutions.

Saudi Arabia has enacted a constitution that reflects the reality of the country's governance,^{1030 1031} in that it only states the rights that are applicable and protected.¹⁰³² For instance, because the total separation of power into executive, legislative, and judicial authorities would not function efficiently in the kingdom, Article 44 concludes by declaring the king to be "their final authority."¹⁰³³ The king also appoints and relieves judges of their offices upon the Supreme Judicial Council's recommendations.¹⁰³⁴ As Article 48 outlines, while the king has the power to enact new laws, judges are urged to only apply Shariah and those statutes consistent with it.¹⁰³⁵ As these articles reflect the reality of the kingdom, they have resulted in political stability.

The constitution focuses on rights in the private and economic spheres, leaving general rights such as the freedom of expression and press to societal customs.¹⁰³⁶ Articles 27–28 state that the country must ensure that its citizens have a decent livelihood and facilitate employment.¹⁰³⁷ Articles 30–31 declare that education and health care must be available to every citizen, presumably free of charge.¹⁰³⁸ Moreover, private homes are inviolable, protecting private

¹⁰²⁹ *Id.*

¹⁰³⁰ *Id.*

¹⁰³¹ Note: The dissertation does not discuss which way of ruling a country seems to be more efficient or fairer, but instead it only discusses the constitution of Saudi Arabia as the way it is.

¹⁰³² *Id.*

¹⁰³³ See the constitution translated in the Saudi Embassy website: available at:

<https://www.saudiembassy.net/basic-law-governance>.

¹⁰³⁴ Al-Fahad, *supra*.

¹⁰³⁵ *Id.*

¹⁰³⁶ *Id.*

¹⁰³⁷ The Saudi Constitution, article (27), *supra*.

¹⁰³⁸ The Saudi Constitution, article (30), *supra*.

communications and private property rights.¹⁰³⁹ Crucially, the constitution also seeks to protect the environment, as written in Article 32: “The State shall endeavor to preserve, protect, and improve the environment and prevent its pollution.”¹⁰⁴⁰ This article could give the country the legitimacy needed to shift to renewable energy. This legitimacy could also be derived from Islamic rules, which most of the population commit themselves to.

3.1. General Principles

The constitution of Saudi Arabia has nine chapters and 82 articles. These chapters focus on the following subjects: general principles, monarchy, features of the Saudi family, economic principles, rights and duties, the authorities of the state, financial affairs, control bodies, and general provisions.¹⁰⁴¹ ¹⁰⁴² The first chapter, “General Principles,”¹⁰⁴³ emphasizes that Islam is the main source of laws and the country itself.¹⁰⁴⁴ Therefore, Islamic general rules have clearly influenced Saudi Arabia, and thus the citizens should be able to accept environmental reforms based on Islam. However, not all laws must be based on Islamic rules. Rather, all laws, regardless of their sources, must not violate the general Islamic rules. For example, intellectual property laws have been accepted because they do not violate any general Islamic rules, even though none of these rules mention intellectual property.

3.2. Law of Governance

The second chapter, “The Law of Governance,” establishes that monarchy is the system of rule. However, an amendment later occurred regarding the selection of the new king. The

¹⁰³⁹ The Saudi Constitution, article (16), *supra*.

¹⁰⁴⁰ The Saudi Constitution, article (32), *supra*.

¹⁰⁴¹ See the constitution translated in the Saudi Embassy website: available at: <https://www.saudiembassy.net/basic-law-governance>.

¹⁰⁴² Note: The paper will cover only some chapters of the constitution that might be necessary for the scope of the dissertation.

¹⁰⁴³ The Saudi Constitution, article (1) *supra*.

¹⁰⁴⁴ *Id.*

original selection process relied on the seniority amongst the present king's living brothers,¹⁰⁴⁵ which could lead to uncertainty in the future.¹⁰⁴⁶ The amendment calls for the formation of an electoral college of princes to choose a new king.¹⁰⁴⁷ Article 5 states that the new king should be the most upright of the sons of the founding king, Abd al-Aziz Bin Abd al-Rahman al-Faysal Al Saud, and their children's children.¹⁰⁴⁸ Abd al-Aziz's grandsons are now included to form an electoral college of about 500 eligible princes.¹⁰⁴⁹ The new king must be chosen by popular vote in the family election.¹⁰⁵⁰

3.3. Economic Principles

The fourth chapter, “Economic Principles,” clarifies that while the private sector has an important role in the economy, the sector cannot wield its power to own the natural resources of the community.¹⁰⁵¹ Article 14 states that all natural resources belong to the country and the law can specify means for exploitation, protection, and development of these resources in the best interest of the state, its security, and its economy.¹⁰⁵² This approach adheres to the Maliki school’s views of resource ownership.¹⁰⁵³ Following Article 15, any concessions or licenses to exploit natural resources must be granted provisions.¹⁰⁵⁴ Hence, the constitution outlines that the benefits of natural resources must not be exclusive to private entities, which is another belief of

¹⁰⁴⁵ Rashed Aba-Namay, The Recent Constitutional Reforms in Saudi Arabia, 42 The International and Comparative Law Quarterly 295-331 (1993).

¹⁰⁴⁶ *Id.*

¹⁰⁴⁷ *Id.*

¹⁰⁴⁸ *Id.*

¹⁰⁴⁹ *Id.*

¹⁰⁵⁰ *Id.*

¹⁰⁵¹ Saudi Arabia constitution, *supra*.

¹⁰⁵² *Id.*

¹⁰⁵³ El-Malik (1993), *supra*.

¹⁰⁵⁴ Saudi Arabia constitution, *supra*.

the Maliki school.¹⁰⁵⁵ Articles 17, 18, and 19 specify that ownership, capital, and labor are the basic components of the economy and thus must be protected by the state.¹⁰⁵⁶

3.4. General rights and duties

Chapter 5 focuses on rights and duties, primarily the general rights for citizens such as the right to receive proper health care and education.¹⁰⁵⁷ One of the rights granted is the right to a clean environment,¹⁰⁵⁸ as proposed in Article 32: “The State shall work toward the preservation, protection and improvement of the environment, as well as prevent pollution.”¹⁰⁵⁹ Although the country relies heavily on fossil fuels for its income, Saudi Arabia has already begun to enact environmental reforms. For instance, Saudi Arabia was among the countries that signed the Paris Agreement,¹⁰⁶⁰ which aims to combat climate change and to accelerate and intensify the actions and investments needed for a sustainable, low-carbon future.¹⁰⁶¹ For the first time, all nations agreed to seriously combat climate change by signing this agreement.¹⁰⁶² Another major agreement addressing climate change is the Kyoto Protocol,¹⁰⁶³ and it encourages industrialized and oil-producing countries to reduce their greenhouse gases (GHG) emissions under the agreed individual targets.¹⁰⁶⁴ Given that Saudi Arabia signed this agreement as well,¹⁰⁶⁵ the country is clearly willing to reform its environmental policies and address climate change. Particularly,

¹⁰⁵⁵ El-Malik (1996), *supra*.

¹⁰⁵⁶ Saudi Arabia constitution, *supra*.

¹⁰⁵⁷ *Id.*

¹⁰⁵⁸ *Id.*

¹⁰⁵⁹ *Id.*

¹⁰⁶⁰ See the U.N report: 7. d Paris Agreement available at:

https://treaties.un.org/Pages/ViewDetails.aspx?src=TREATY&mtdsg_no=XXVII-7-d&chapter=27&clang=en

¹⁰⁶¹ See the UN report: What is the Paris Agreement?, available at: <https://unfccc.int/process-and-meetings/the-paris-agreement/what-is-the-paris-agreement>

¹⁰⁶² *Id.*

¹⁰⁶³ See the UN report: What is the Kyoto Protocol?, available at: https://unfccc.int/kyoto_protocol

¹⁰⁶⁴ *Id.*

¹⁰⁶⁵ See the UN database: Saudi Arabia, available at: <https://unfccc.int/node/61163>

Vision 2030 provides more evidence of Saudi Arabia's shift toward environmental reforms and away from fossil fuels.¹⁰⁶⁶

4. Organization of the Petroleum Exporting Countries (OPEC)

Since the discovery of oil, all nations have viewed it as crucial to their economic growth and military hegemony.¹⁰⁶⁷ Oil became a commodity of vital political and strategic importance,¹⁰⁶⁸ and governmental interference in this sector was inevitable.¹⁰⁶⁹ In the 1950s, American and British companies, led by the seven sisters conglomerate, dominated the global oil market.¹⁰⁷⁰ The seven sister companies controlled more than 90% of global crude oil production, processing, and marketing outlets.¹⁰⁷¹ The Organization of the Petroleum Exporting Countries (OPEC) was created in September 1960¹⁰⁷² to restore the control and management of this depletable natural resource to its host countries.¹⁰⁷³ OPEC led to the redistribution of oil markets between host countries and international oil companies.¹⁰⁷⁴

4.1. Existence of OPEC

Traditionally, oil-producing countries dealt individually with the oil companies operating in their territories.¹⁰⁷⁵ Oil-producing countries did not have the power to manage their oil resources nor the price of it once an oil concession had been awarded.¹⁰⁷⁶ Crucially, when

¹⁰⁶⁶ Note: The vision will be discussed in details below.

¹⁰⁶⁷ Rene G. Ortiz, *The OPEC Role Until the Year 2000*, 8 FLETCHER F. 285 (1984).

¹⁰⁶⁸ *Id.*

¹⁰⁶⁹ *Id.*

¹⁰⁷⁰ *Id.*

¹⁰⁷¹ *Id.*

¹⁰⁷² *Id.*

¹⁰⁷³ *Id.*

¹⁰⁷⁴ *Id.*

¹⁰⁷⁵ Abbas Alnasrawi, *Collective Bargaining Power in OPEC*, 7 J. World Trade L. 188 (1973).

¹⁰⁷⁶ *Id.*

international companies controlled the oil source in their host countries, they could change the price regardless of domestic interest.¹⁰⁷⁷ The host countries simply received a stipulated share of the oil profits,¹⁰⁷⁸ and this led these countries to reconsider their agreements with international oil companies, as oil production had become vital to their national economies.¹⁰⁷⁹ The importance of oil further increased as it was repeatedly used as a source of budgetary revenue and foreign exchange.¹⁰⁸⁰

In response to these pressures, five oil-producing countries made an alliance to take control of their oil resources and also the quantity and price of oil per barrel.¹⁰⁸¹ International companies had already reduced the price without considering their perspectives in 1959.¹⁰⁸² This organization has survived a decade of meddling and also many predictions that it would collapse.¹⁰⁸³ Currently, OPEC contributes to both local economies and the global economy.¹⁰⁸⁴ OPEC countries now account for about 40% of the global oil supply and over 75% of proven crude oil reserves,¹⁰⁸⁵ and their share of the supply increases whenever the demand for oil grows.¹⁰⁸⁶ While OPEC has faced many challenges, its effective organization has been crucial to its survival.¹⁰⁸⁷

4.2. Main organs of OPEC

¹⁰⁷⁷ *Id.*

¹⁰⁷⁸ *Id.*

¹⁰⁷⁹ *Id.*

¹⁰⁸⁰ *Id.*

¹⁰⁸¹ *Id.*

¹⁰⁸² Laurence Stoehr, OPEC as a Legal Entity, 3 *FORDHAM INT'L L. F.* 91 (1979).

¹⁰⁸³ *Id.*

¹⁰⁸⁴ *Id.*

¹⁰⁸⁵ Melaku Geboye Desta, OPEC Production Management Practices under WTO Law and the Antitrust Law of Non-OPEC Countries, 28 *J. ENERGY & NAT. Resources L.* 439 (2010).

¹⁰⁸⁶ *Id.*

¹⁰⁸⁷ Stoehr, *supra*.

OPEC has three major organs: the conference, the board of governors, and the secretariat.¹⁰⁸⁸ The conference is the supreme authority of the organization, and it is composed of delegations from each of the member states.¹⁰⁸⁹ At least three-quarters of OPEC's members must be represented for a conference to be held.¹⁰⁹⁰ The conference distinguishes between full and associate members in terms of voting,¹⁰⁹¹ as only full members have the right to vote. In contrast, associate members can only participate in the meetings held by the conference.¹⁰⁹² Although full members can have more than one representative, each delegation is limited to one vote.¹⁰⁹³ The main role of the conference is to create OPEC's general policies and decide on how to implement these policies,¹⁰⁹⁴ although it also has procedural duties such as managing the organization's finances.¹⁰⁹⁵ The conference generally meets twice per year, although it can meet more often if it is deemed necessary to, one example being the oil negotiations of 1971.¹⁰⁹⁶

The board of governors¹⁰⁹⁷ acts as the managerial branch of OPEC.¹⁰⁹⁸ Each member of OPEC has one governor, and each governor has one vote.¹⁰⁹⁹ The quorum of this branch is two-thirds of the governors, and a simple majority of those present is necessary to carry a motion.¹¹⁰⁰ A governor serves a term of two years, and this governor can be removed by two-thirds of the board if they act contrary to the interests of OPEC.¹¹⁰¹ The board of governors has two major

¹⁰⁸⁸ See OPEC statute available at:

https://www.opec.org/opec_web/static_files_project/media/downloads/publications/OPEC_Statute.pdf

¹⁰⁸⁹ Stoehr, *supra*.

¹⁰⁹⁰ OPEC statute, article 11 (B).

¹⁰⁹¹ OPEC statute, article 7 (E).

¹⁰⁹² OPEC statute, article 7 (E).

¹⁰⁹³ OPEC statute, article 11 (C).

¹⁰⁹⁴ OPEC statute, article 33 (B).

¹⁰⁹⁵ OPEC statute, article 33 (B).

¹⁰⁹⁶ Stoehr, *supra*

¹⁰⁹⁷ OPEC statute, article 9

¹⁰⁹⁸ Stoehr, *supra*

¹⁰⁹⁹ OPEC statute, article 17 (D).

¹¹⁰⁰ OPEC statute, article 17 (B).

¹¹⁰¹ OPEC statute, article 17 (E).

functions: managing the affairs of OPEC by implementing conference resolutions and preparing recommendations for the conference.¹¹⁰² The board also draws up OPEC's budget for each calendar year and submits it to the conference for approval.¹¹⁰³ Its procedural functions include approving the appointment of the division directors and the heads of departments upon their nominations by the member countries, with consideration for recommendations of the secretary general.¹¹⁰⁴

The secretariat¹¹⁰⁵ was not intended to be a separate entity of OPEC. It was under the control of the board of governors until 1960,¹¹⁰⁶ and it became its own entity following OPEC's significant growth and its widely recognized role in the world economy.¹¹⁰⁷ The secretary general serves a term of three years¹¹⁰⁸ and must be a national of a member state.¹¹⁰⁹ Originally, the appointment of the secretary general would rotate through all members of OPEC based on their seniority. The secretariat mainly provides information and studies to the conference.¹¹¹⁰ The secretary general is responsible for performing these duties, but they may also delegate their authority to the five departments of the secretariat.¹¹¹¹ The secretariat should be composed of international employees, and therefore they should not be biased towards any of the member states.¹¹¹²

4.3. Importance of OPEC in the oil market

¹¹⁰² OPEC statute, article 20

¹¹⁰³ OPEC statute, article 20 (4)

¹¹⁰⁴ OPEC statute, article 20 (7)

¹¹⁰⁵ OPEC statute, article 25

¹¹⁰⁶ Stoehr, supra

¹¹⁰⁷ Stoehr, supra

¹¹⁰⁸ OPEC statute, article 28

¹¹⁰⁹ OPEC statute, article 28 (B)

¹¹¹⁰ Stoehr, supra

¹¹¹¹ Id.

¹¹¹² Stoehr, supra

The importance of OPEC comes from its influence on the quantity and price of oil per barrel. Ideally, OPEC members avoid internal competition and prioritize their common interests,¹¹¹³ which allows the members to benefit from acting collectively rather than unilaterally.¹¹¹⁴ OPEC can efficiently move supply levels up or down depending on market circumstances,¹¹¹⁵ and it does so by allocating the maximum daily production quotas to its members.¹¹¹⁶

4.4. Challenges of OPEC

However, OPEC countries face serious challenges. These countries have unique political situations and histories of economic development.¹¹¹⁷ They vary in terms of economic diversification, petroleum production, production costs, and mixtures of crude oil, gas, and product exports.¹¹¹⁸ Oil revenue is also spent differently among oil-producing countries.¹¹¹⁹ Moreover, Arab producers have sometimes fought each other, and several are now involved in a major arms race and confrontation with Iran.¹¹²⁰ In addition, the members do not always agree on the price of oil or their individual quotas. When OPEC's market share of global oil production fell from 51% in 1973 to 28% in 1985,¹¹²¹ this resulted in disagreements within the organization.¹¹²² Some OPEC countries opposed price increases because they would reduce their own market shares, whereas other countries supported these increases since it would benefit

¹¹¹³ Desta, *supra*.

¹¹¹⁴ *Id.*

¹¹¹⁵ *Id.*

¹¹¹⁶ *Id.*

¹¹¹⁷ Anthony H. Cordesman, *Setting the Stage: Examining the Diversity of OPEC and Other Oil Exporters and Their Lack of Command Goals and Needs*, Center for Strategic and International Studies 3–15 (2016).

¹¹¹⁸ *Id.*

¹¹¹⁹ *Id.*

¹¹²⁰ *Id.*

¹¹²¹ Bassam Fattouh and Lavan Mahadeva, *OPEC: What Difference Has It Made?*, 5 *Annual Review of Resource Economics* 427-443 (2013).

¹¹²² *Id.*

them.¹¹²³ Furthermore, it has been argued that the formal quota system cannot effectively prevent production from rising above quotas.¹¹²⁴

4.5. Role of Saudi Arabia in OPEC

This tension between members became clear in the 1980s, when OPEC was losing its power to set the oil price.¹¹²⁵ Saudi Arabia tried to defend the market price and thus lost a significant market share.¹¹²⁶ The demand for oil in Saudi Arabia decreased from 10.2 million barrels per day in 1980 to 3.6 million barrels per day in 1985.¹¹²⁷ In response, the country adopted the netback pricing system, which provided oil companies with a guaranteed refining margin even if oil prices were to collapse.¹¹²⁸ This has benefited Saudi Arabia, but nevertheless the price war that followed led crude oil prices to collapse.¹¹²⁹ Since then, analysts have viewed Saudi Arabia as the leader of the OPEC countries, as its decisions can significantly affect the success of OPEC policies.¹¹³⁰

Griffin and Nielson have identified the three main strategies used by Saudi Arabia as a leader of OPEC: the tit-for-tat strategy, the Cournot strategy, and the swing producer.¹¹³¹ Following the tit-for-tat strategy, it punishes other members for producing above their quotas and rewards them for compliance.¹¹³² As long as Saudi Arabia earns more than Cournot profits, it will tolerate deviations from the OPEC quota. Also, it may act as a swing producer to earn

¹¹²³ *Id.*

¹¹²⁴ *Id.*

¹¹²⁵ *Id.*

¹¹²⁶ *Id.*

¹¹²⁷ *Id.*

¹¹²⁸ *Id.*

¹¹²⁹ *Id.*

¹¹³⁰ *Id.*

¹¹³¹ James Griffin and William Neilson, *The 1985-86 Oil Price Collapse And Afterwards: What Does Game Theory Add?*, 32 *Economic Inquiry* 543-561 (1994).

¹¹³² *Id.*

profits above the Cournot equilibrium level.¹¹³³ However, Saudi Arabia takes a different approach if OPEC members cheat too brazenly.¹¹³⁴ The country simply increases its output until the other countries only receive Cournot profits.¹¹³⁵ Because of these tactics, Griffin and Nielson argue that Saudi Arabia acts as a discipliner to protect OPEC organization, which ultimately benefits all of its members.¹¹³⁶

Saudi Arabia's role as a discipliner reflects an administrative issue that OPEC faces. Namely, OPEC does not have effective monitoring or punishment mechanisms.¹¹³⁷ Even if such mechanisms were to exist, OPEC does not have the formal methods and tools to punish those countries that violate the agreed-upon quotas.¹¹³⁸ Some analysts raise doubts about the lack of monitoring mechanisms, and they assert that OPEC can collude to restrict output, which would create a competitive market rather than a monopoly.¹¹³⁹ However, even if no such mechanisms are implemented, OPEC members can still be punished for violating quotas through implicit threats.¹¹⁴⁰ Stigler proposes that any price war would cause the collusion to collapse.¹¹⁴¹ On the other hand, others argue that a price war reflects the equilibrium outcome of a dynamic noncooperative game.¹¹⁴² Therefore, a price war may be a solution to many issues OPEC faces because its members.¹¹⁴³ A price war is also a credible means to communicate with other firms, which makes it strategic in nature.¹¹⁴⁴

¹¹³³ *Id.*

¹¹³⁴ Fattouh and Mahadeva, *supra*.

¹¹³⁵ *Id.*

¹¹³⁶ *Id.*

¹¹³⁷ Wilfrid Kohl, OPEC behavior, 1998--2001. 42 *The Quarterly Review of Economics and Finance* 209-233 (2002).

¹¹³⁸ *Id.*

¹¹³⁹ Fattouh and Mahadeva, *supra*.

¹¹⁴⁰ *Id.*

¹¹⁴¹ George J. Stigler, A Theory of Oligopoly, 72 *Journal of Political Economy* 44-61 (1964).

¹¹⁴² Edward Green and Robert Porter, Noncooperative Collusion under Imperfect Price Information, 52 *Econometrica: Journal of the Econometric Society* 87-100 (1984).

¹¹⁴³ Fattouh and Mahadeva, *supra*.

¹¹⁴⁴ *Id.*

Another major issue facing OPEC is the over-reliance of some of its members on oil revenue.¹¹⁴⁵ Although all Gulf region countries are currently dependent on oil revenue, some OPEC members have this revenue accounting for most of their GDPs.¹¹⁴⁶ For instance, many studies refer to Iraq, Libya, and Venezuela as failed states, and only Venezuela has failed almost solely because of its overdependence on petroleum revenues.¹¹⁴⁷ Angola, Ecuador, and Nigeria share the same issue of overdependence. Their petroleum revenues have not been used to make serious economic reforms and diversify their GDPs, leading the overall situation to grow worse.¹¹⁴⁸ Although many OPEC states must deal with political challenges such as outside intervention, this does not excuse these countries for their economic failures.¹¹⁴⁹ Rather, these failures are due to their own actions.¹¹⁵⁰ In general, the Gulf region countries have benefited from their oil revenues, as have their citizens.¹¹⁵¹ These countries have diversified to some extent, improved the balance of their economies, and created effective jobs for their citizens.¹¹⁵² This does not mean that the Gulf region countries have acted wisely with their oil revenues.¹¹⁵³ Rather, these countries, including Saudi Arabia, are experiencing problems due to their reliance on oil, and their economies are not sufficiently diverse.¹¹⁵⁴ Nevertheless, Saudi Arabia still has the time and the resources to make significant economic reforms.¹¹⁵⁵

OPEC remains active despite its challenges and failings. The price of oil has decreased despite efforts from OPEC on many occasions. For instance, the oil price reached \$20 per barrel

¹¹⁴⁵ Cordesman, supra.

¹¹⁴⁶ *Id.*

¹¹⁴⁷ *Id.*

¹¹⁴⁸ *Id.*

¹¹⁴⁹ *Id.*

¹¹⁵⁰ *Id.*

¹¹⁵¹ *Id.*

¹¹⁵² *Id.*

¹¹⁵³ *Id.*

¹¹⁵⁴ *Id.*

¹¹⁵⁵ Cordesman, supra.

in 1997 and decreased to \$10 per barrel in 1998.¹¹⁵⁶ Of course, a decrease in the oil price might be a result of factors other than OPEC's interference. For instance, the oil price fell below \$30 in 2020 because the Covid-19 pandemic reduced the demand for oil. Regardless, OPEC has managed to respond effectively during this pandemic, and it agreed to decrease the oil supply, which prevented the oil price from collapsing. In fact, OPEC countries even managed to make agreements with non-OPEC members to manage oil prices, such as Russia. This reflects the ability of OPEC to form beneficial agreements among both its own members and also other countries. As OPEC seeks to improve cooperation between its members, its goal is similar to that of NATO, which also has many conflicts between its members. Currently, two members of NATO, Turkey and Greece, are facing serious issues in the Mediterranean Sea because of the gas discovered there. However, NATO, like OPEC, survives despite such internal conflicts.

5. Vision 2030

5.1. Overview and the non-renewable energy sector¹¹⁵⁷

Because Vision 2030 is designed to solve specific challenges, it is important to address the nature of Saudi Arabia and its subsequent economic development. It is an arid country with low rainfall and limited water resources.¹¹⁵⁸ The size of the kingdom is approximately 2.25 million square kilometers,¹¹⁵⁹ and this large region includes lava flows, plains, mountains, and

¹¹⁵⁶ Fattouh and Mahadeva, *supra*.

¹¹⁵⁷ The paper will provide a general overview and explain what the 2030 vision is. In the second part of this section, the paper will focus heavily and discuss in depth the role of the 2030 vision in supporting and promoting renewable energy.

¹¹⁵⁸ Look at the United Nations Framework Convention on Climate Change report: The First Biennial Update Report (BUR1) Kingdom of Saudi Arabia. available at https://unfccc.int/sites/default/files/resource/18734625_Saudi%20Arabia-BUR1-1-BUR1-Kingdom%20of%20Saudi%20Arabia.pdf

¹¹⁵⁹ *Id.*

deserts.¹¹⁶⁰ The kingdom does not have any rivers, and the surface water is limited to rainfall runoff that flows through the valleys.¹¹⁶¹ While there is groundwater in Saudi Arabia, it is not abundant. Sand covers most of the kingdom, and the three major bodies of sand are the Great Nafud in the north, the Empty Quarter in the south, and Ad-Dahna, a crescent-shaped body connecting the Nafud and Rub Al-Khali deserts.¹¹⁶²

Saudi Arabia has the second-largest proven oil reserves in the world, which is about 16% of the world's total.¹¹⁶³ According to OPEC, the oil and gas sector of Saudi Arabia accounts for roughly 50% of its GDP and about 70% of its export earnings.¹¹⁶⁴ ¹¹⁶⁵ The oil revenue enabled Saudi Arabia to invest in infrastructure, health care, and education. One estimation suggests that the country has put more than \$450 billion into infrastructure alone.¹¹⁶⁶ Health care and education are also free for all citizens. The prices of electricity and housing are subsidized as a result of the oil revenue. Moreover, many Saudi students can study abroad at well-known universities for free. The benefits of the oil revenue are clear and have improved the lives of Saudi citizens.

5.1.1. Consequences of overdependence on oil in Saudi Arabia

However, an overdependence on oil has made the economy vulnerable. Saudi Arabia was significantly affected when oil and gas prices plummeted in 2014.¹¹⁶⁷ In other words, the country has become a rentier state.¹¹⁶⁸ The U.S. Energy Information Administration estimates that the oil

¹¹⁶⁰ Id.

¹¹⁶¹ Id.

¹¹⁶² Id.

¹¹⁶³ Hussein, *supra*.

¹¹⁶⁴ Look at OPEC report at: https://www.opec.org/opec_web/en/about_us/169.htm

¹¹⁶⁵ Hussein, *supra*.

¹¹⁶⁶ Id.

¹¹⁶⁷ Id.

¹¹⁶⁸ Joseph Kéchichian, *The Quest for Consolidation: Saudi Arabia in 2030*, Asian Institute for Policy Studies 42-78 (2019).

export revenue decreased from \$301 billion to \$133 billion between 2014 and 2016.¹¹⁶⁹ Oil price fluctuations put pressure on the GDP of Saudi Arabia.¹¹⁷⁰ The oil price has increased from \$10 in 1985 to nearly \$150 per barrel in 2008 and then remained between \$60–80 from 2017–2018.¹¹⁷¹ To stabilize the country, Saudi Arabia's Crown Prince Mohammed bin Salman wants to wean the kingdom off what he calls its dangerous addiction to oil. As a result, Vision 2030 has been adopted to make the economic shift that he has envisioned.

5.1.2. Promises of Vision 2030

Vision 2030 promotes radical changes to the Saudi economy. If realized, Vision 2030 will enable the country to double its GDP, create more than 6 million jobs by 2030, and increase Saudi household income by 60%.¹¹⁷² Crucially, this transformation would rid Saudi Arabia of its dependency on oil.¹¹⁷³ Non-oil revenue is estimated to increase from 10% of total government revenue to 70% by 2030.¹¹⁷⁴ This will alter the dominant role of the public sector in society and increase private sector wages. Although these wages are currently low, they are expected to increase from 19% to 58% of the total household income.¹¹⁷⁵

This significant transformation requires the country to move from its current government-led economic model to a more market-based approach.¹¹⁷⁶ Such an approach will enable more Saudi men and women to participate in the workforce, which is important to achieving a higher household income.¹¹⁷⁷ The private sector will be restricted during the establishment of the new

¹¹⁶⁹ Hussein, supra.

¹¹⁷⁰ Kéchichian, supra.

¹¹⁷¹ Id.

¹¹⁷² the Saudi 2030 vision, supra.

¹¹⁷³ Id.

¹¹⁷⁴ Id.

¹¹⁷⁵ Id.

¹¹⁷⁶ Id.

¹¹⁷⁷ Id.

market-based approach.¹¹⁷⁸ To compensate for this, the government will provide a more competitive environment for businesses, and the individual Saudi citizen will take on more personal accountability.¹¹⁷⁹ A competitive environment is important to achieve rapid growth in productivity, as it enables competition, trade, and investment.¹¹⁸⁰ Owing to the new market approach, the government could seek out new revenue sources, possibly by adding new taxes and raising domestic energy prices, to ensure fiscal sustainability.¹¹⁸¹ Vision 2030 highlights that while the transition will not be smooth for the Saudi people, it is necessary to improve the country's stability.¹¹⁸²

Saudi Arabia has intrinsic economic potential far beyond oil,¹¹⁸³ and it is notable that the private non-oil sector, although small in Saudi Arabia, still has the potential to drive much of the predicted growth.¹¹⁸⁴ Vision 2030 demonstrated that the growth of the private non-oil sector outperformed the economy as a whole, albeit while starting from a low base.¹¹⁸⁵ It grew by 10% annually from 2003–2013, while the GDP of the government grew by 6% annually.¹¹⁸⁶ Moreover, the private sector seems to be more productive annually than the rest of the economy, with an average rate of 2.5% per year.¹¹⁸⁷

5.1.3. Mining and metals sector

To achieve its goals, Vision 2030 estimates that the country must invest \$4 trillion in the following eight sectors:¹¹⁸⁸ mining and metals, petrochemicals, manufacturing, retail and

¹¹⁷⁸ *Id.*

¹¹⁷⁹ *Id.*

¹¹⁸⁰ *Id.*

¹¹⁸¹ *Id.*

¹¹⁸² *Id.*

¹¹⁸³ *Id.*

¹¹⁸⁴ *Id.*

¹¹⁸⁵ *Id.*

¹¹⁸⁶ *Id.*

¹¹⁸⁷ *Id.*

¹¹⁸⁸ *Id.*

wholesale trade, tourism and hospitality, health care, finance, and construction.¹¹⁸⁹ These sectors have the potential to generate more than 60% of Vision 2030's total growth.¹¹⁹⁰ The first promising sector is mining and metals. Most metals are located in the west of the country.¹¹⁹¹ These metals include major phosphate resources, gold, zinc, bauxite and high-quality silica, gypsum, limestone, kaolin, and magnesite.¹¹⁹² These minerals can support both additional resource sectors and manufacturing sectors. Currently, the mining and metals sector is underdeveloped and contributes to less than 3% of the GDP.¹¹⁹³ Vision 2030 estimates that this sector will increase to about 10% of the GDP, creating 500,000 new jobs for Saudi nationals.¹¹⁹⁴ Vision 2030 aims to develop this sector by investing heavily in exploration and creating a competitive ecosystem that allows for both public- and private-sector companies to thrive.¹¹⁹⁵

5.1.4. Petrochemicals sector

The second promising sector is petrochemicals.¹¹⁹⁶ The sector already accounts for two-thirds of Saudi Arabia's non-oil exports and is also competitive in international markets.¹¹⁹⁷ The most famous Saudi company in this sector is the Saudi Basic Industries Corporation (SABIC), of which 70% is owned by the government. Currently, the company is one of the top five global chemicals companies.¹¹⁹⁸ Vision 2030 claims that reducing inefficiencies, further integrating its oil refining and petrochemical sectors, and investing in innovation to make higher-margin products will provide the economy with more than \$30 billion and create thousands of jobs.¹¹⁹⁹

¹¹⁸⁹ Id.

¹¹⁹⁰ Id.

¹¹⁹¹ Id.

¹¹⁹² Id.

¹¹⁹³ Id.

¹¹⁹⁴ Id.

¹¹⁹⁵ Id.

¹¹⁹⁶ Id.

¹¹⁹⁷ Id.

¹¹⁹⁸ Id.

¹¹⁹⁹ Id.

On top of that, the petrochemical sector has already received billions in investments from foreign companies, including Royal Dutch Shell and China National Petroleum Corporation.¹²⁰⁰

Nevertheless, Vision 2030 claims the sector has the potential to grow even more.¹²⁰¹

5.1.5. Manufacturing sector

The third promising sector is manufacturing.¹²⁰² Saudi Arabia is a large market for many manufactured goods, such as automobiles and mechanical machinery. Since most of the countries' needs are supplied from abroad, there is an opportunity to build a strong domestic manufacturing sector. By developing this sector, Vision 2030 proposes that the country will be able to satisfy its local demand as well as potentially some regional demand. The sector requires, according to Vision 2030, a skilled and more productive workforce, stronger legal and investment protection, and the removal of obstacles that hinder business, including high import duties, lengthy customs and visa procedures, and gaps in local supply chains.¹²⁰³

5.1.6. Retail and wholesale trade sector

The fourth promising sector is retail and wholesale trade.¹²⁰⁴ Because online retail is expected to replace traditional retail, many Saudi citizens are likely to participate in this sector.¹²⁰⁵ The report predicts that the retail sector will employ approximately 800,000 citizens over the next 15 years and triple its value.¹²⁰⁶ The number of Saudi people working in the retail sector doubled between 2010 and 2014.¹²⁰⁷ Saudi women in particular have found employment

¹²⁰⁰ *Id.*

¹²⁰¹ *Id.*

¹²⁰² *Id.*

¹²⁰³ *Id.*

¹²⁰⁴ *Id.*

¹²⁰⁵ *Id.*

¹²⁰⁶ *Id.*

¹²⁰⁷ *Id.*

in this sector, rising from 10,000 in 2010 to 120,000 in 2014.¹²⁰⁸ The government heavily supports Saudi women in this sector, especially in lingerie and cosmetics, to reduce their unemployment rate.¹²⁰⁹ Following Vision 2030, many new practices must be adopted to grow the retail sector, such as adapting modern retail formats, migrating rapidly online, and adopting best practices in merchandising, including promoting supply-chain efficiencies such as by using more automation in warehouses.¹²¹⁰

5.1.7. Tourism sector

The fifth sector is tourism and hospitality.¹²¹¹ Saudi Arabia attracts 13 million Muslim visitors annually to visit the holy sites of Mecca and Medina.¹²¹² The country also attracts more than two million during the annual Hajj pilgrimage period.¹²¹³ However, many Saudi people prefer to travel outside the country during their own holidays, which caused the tourism industry to decrease by 31% between 2004 and 2012. The country bolstered this sector in 2019 by making the visitor visa to Saudi Arabia easier and faster to obtain than before. Vision 2030 recommends investing in tourism as the country is large and varied, including locales such as the long Red Sea coastline, a wealth of archaeological treasures, and areas of natural beauty. Furthermore, religious tourism could also be further developed and cater to tens of millions more pilgrims each year outside the peak Hajj season.¹²¹⁴ The development of tourism must account for both religion and leisure, and this will require higher-quality facilities, better safety and service, and a

¹²⁰⁸ Id.

¹²⁰⁹ Id.

¹²¹⁰ Id.

¹²¹¹ Id.

¹²¹² Id.

¹²¹³ Id.

¹²¹⁴ Id.

greater openness to foreign visitors.¹²¹⁵ Vision 2030 expects this sector to provide 1.3 million jobs and increase its value more than fivefold.¹²¹⁶

5.1.8. Health care sector

The sixth sector is health care. This sector has benefited from the high public spending during the oil boom.¹²¹⁷ The country's many public hospitals provide all citizens with free health care, and it must continue investing heavily in health care, as a large percentage of the population will be over the age of 65 by 2030.¹²¹⁸ Following Vision 2030, the private sector will be allowed to participate in suboptimal productivity and financing.¹²¹⁹ Currently, there are not enough Saudi citizens employed in the medical sector.¹²²⁰ It is estimated that just one in three health-care professionals is a Saudi national, and there are not enough health-care graduates to replace the professionals who retire or leave their jobs, let alone fill additional posts.¹²²¹ As a consequence, this sector needs further investment to provide more health-care professions, colleges for doctors and nurses, and appropriately equipped teaching hospitals.¹²²²

5.1.9. Finance and construction sectors

The last two sectors are finance and construction.¹²²³ Finance is an essential sector that promotes economic growth in the private sector and can also contribute to the economy if it is substantially expanded. Saudi Arabia can improve this sector by increasing lending to small- and medium-sized businesses and offering more investment products.¹²²⁴ The construction sector has

¹²¹⁵ *Id.*

¹²¹⁶ *Id.*

¹²¹⁷ *Id.*

¹²¹⁸ *Id.*

¹²¹⁹ *Id.*

¹²²⁰ *Id.*

¹²²¹ *Id.*

¹²²² *Id.*

¹²²³ *Id.*

¹²²⁴ *Id.*

been developed as the country has improved its infrastructure.¹²²⁵ For over 15 years, the private sector has contributed to construction, providing many opportunities for jobs and investments.¹²²⁶ Unfortunately, the sector is inefficient, insufficiently regulated, and, in some circumstances, dangerous. Thus, the construction sector must improve efficiency, adopt modern techniques, and increase operational management to deliver projects on time and on budget.¹²²⁷ This sector may also offer new jobs to citizens, as more than nine in ten workers are foreign laborers.¹²²⁸

5.1.10. Legitimate steps in moving beyond fossil fuels

Vision 2030 demonstrates that Saudi Arabia has taken legitimate steps to move beyond fossil fuels. The country has invested more than \$4 trillion in non-oil sectors, aiming to diversify its GDP. The country will fund this investment mainly by selling 5% of Saudi Aramco, a state-owned company, to investors and by offering \$100 billion in stock in an initial public offering (IPO) to establish a company value of \$2 trillion.¹²²⁹ In addition, the country has already made notable progress in constructing commercial and economic cities, such as the King Abdullah Financial District and Prince Abdulaziz bin Mousaed Economic City.¹²³⁰ If these cities are supported by a clear and efficient legal system, they will attract investors.

While it is clear that Vision 2030 will be an expensive endeavor, calculating the exact cost is difficult, if not impossible. For example, Saudi Arabia must invest heavily in infrastructure to make serious changes, and Vision 2030 does not fully explore the scale of this

¹²²⁵ *Id.*

¹²²⁶ *Id.*

¹²²⁷ *Id.*

¹²²⁸ *Id.*

¹²²⁹ Hussein, *supra*.

¹²³⁰ the Saudi 2030 vision, *supra*.

investment.¹²³¹ The shift toward renewable energy requires an alternative infrastructure, which also requires funding.¹²³² To achieve the Vision 2030 goals, Saudi Arabia must adapt all existing solid fuels infrastructure to transfer to clean energy. Furthermore, to attract investors, there must be a strong infrastructure that enables these investors to produce wealth. Another issue that Vision 2030 does not adequately explore is the role of politics in the economy. The report stated that it did not consider any political costs since they would be impossible to predict. In a region with many conflicts, political costs can be very high. For instance, Saudi Arabia has spent billions of dollars on weapons and aircrafts. This spending increased when the United States became less involved in the Middle East than before. Thus, these countries must rely on themselves. The spending is unlikely to decrease, as there are no indicators that the region will soon go through a peace period similar to that of Western Europe.

Nevertheless, Saudi Arabia continues to pursue its goals, as a stalled economic transformation could be devastating.¹²³³ The report estimates that for each year of delay, the government will incur an additional cost of 190 billion Saudi riyal (SAR) or \$50 billion by 2030, resulting from more expensive operations and lower oil revenues.¹²³⁴ Therefore, without significant transformation, the country may accumulate a net debt of roughly 140% of its GDP by 2030 and could still be running large fiscal deficits.¹²³⁵ This deficit assumes that the public expenditure is frozen at its current levels and also that public spending decreases.¹²³⁶ In other words, the deficit could be more than 140% of the GDP.

¹²³¹ *Id.*

¹²³² the Saudi's Renewable energy plan 2030, *supra*.

¹²³³ the Saudi 2030 vision, *supra*.

¹²³⁴ *Id.*

¹²³⁵ *Id.*

¹²³⁶ *Id.*

Notably, because the country does not have debts, Saudi Arabia has advantages when tapping capital markets.¹²³⁷ The country has many trillions in both financial and non-financial assets, including holdings in listed companies worth one-third of the total value of the national stock exchange, about 50,000 square kilometers of land, and vast oil reserves.¹²³⁸ In fact, the country will likely attract more capital investment due to its economic reforms. Before the Vision 2030 measures, the country attracted \$1.6 trillion in investment between 2003 and 2013.¹²³⁹ After Vision 2030 and its associated reforms have been implemented, a fast-growing private sector including international investors is likely to drive investment growth.¹²⁴⁰ To bolster development, the country might target international private sectors with debt capital markets and bonds specifically to finance major projects in areas like infrastructure, mining, and utilities.¹²⁴¹ The country can also encourage Saudi citizens to invest domestically. In short, by taking advantage of its present financial stability and lack of debt, Saudi Arabia can finance its domestic projects largely by encouraging investment.

Some critics have noticed a contradiction between the Vision 2030 goals and the implementation of these goals. For instance, because Vision 2030 seeks to reduce public spending, this may harm small and medium businesses and lead to shrinkage. Thus, Vision 2030 may increase unemployment, which is against its own goals of doubling the current GDP and decreasing unemployment. Moreover, the financial burdens of some Vision 2030 projects are being placed on the citizens and not the government. Many taxes were implemented after establishing the Vision 2030 goals that will reduce the household incomes of the citizens and

¹²³⁷ *Id.*

¹²³⁸ *Id.*

¹²³⁹ *Id.*

¹²⁴⁰ *Id.*

¹²⁴¹ *Id.*

decrease their entertainment spending. Contradictorily, Vision 2030 aims to increase the entertainment sector.

These arguments seem to assume that Saudi Arabia already has the cash to finance its Vision 2030 projects. However, Vision 2030 outlines the method that the government will use to finance these projects, such as selling shares of Saudi Aramco.¹²⁴² Because Saudi Arabia relies almost totally on fossil fuels for its GDP, it lacks a diverse income while the population grows continuously. Moreover, Vision 2030 was established after the oil crisis in 2014, which created serious issues in the Saudi economy and impacted its Vision 2030 projects.

From 2016 to 2030, Saudi Arabia will be in a transitional phase, which is critical and challenging for both the government and the citizens. This phase is the cost of shifting to a sustainable economy that relies on many income sources and supports an incentive-based market system. During the transitional phase, features such as salaries and entertainment opportunities will be limited. However, after achieving the Vision 2030 goals, the Saudi GDP will double, leading to decreased unemployment, increased salaries, and increased entertainment spending.

Some might argue that the investments of the Saudi Public Investment Fund (PIF) do not add value to the local market. Significantly, Vision 2030 relies on the investments of the PIF.¹²⁴³ Yet, the fund seems disinterested in investing in Saudi companies. It can be argued that if a Saudi company provides the same services as a foreign company that the PIF invests in, the PIF should then invest in the local company because Vision 2030 aims to strengthen the local private sector.¹²⁴⁴ In other words, investing in foreign companies does not seem to support the private

¹²⁴² The Saudi Vision 2030, supra.

¹²⁴³ *Id.*

¹²⁴⁴ *Id.*

sector in Saudi Arabia. Following this logic, the PIF should instead invest in local companies to increase their value in the Saudi economy and also increase employment.

However, this argument does not recognize the main goal of Vision 2030, which is to achieve a productive, sustainable, and diverse economy. To achieve this goal, the government must diversify its income sources and support the Saudi private sector. Foreign income sources usually come from exporting goods and services, investing in foreign countries, and attracting foreign companies to invest in domestic companies and sectors. In this context, the PIF has specific goals and thus adapts its investments.

The PIF seems to have three main goals: increase profit, increase the foreign cashflow to the country, and decrease the domestic cashflow outside the country.¹²⁴⁵ When making an investment, the PIF considers these three criteria, and the result can be an investment in foreign companies rather than local companies. For instance, the PIF invested in Uber, a foreign company, but did not invest in Kareem, a local company that provides the same service. In applying the three criteria, the PIF clearly determined that Uber is more profitable and represents a foreign cashflow into the country. In other words, the Saudi citizen who pays Kareem does not move cash outside the country, whereas the Saudi citizen who pays Uber moves the cash abroad. Because these three criteria enable the PIF to make wise investments, the country can use other public funds to support local companies like Kareem.

Notably, the PIF's investments are not an act of charity. Rather, they aim to diversify the Saudi economy and greatly alter its macro economy. It is thus a mistake to criticize the PIF's investment strategies without acknowledging the criteria and priorities that the fund uses to determine its investments. Furthermore, it is mistaken to demand that the government should

¹²⁴⁵ Look at the official PIF official page: <https://www.pif.gov.sa/en/VRP/PIFStrategy2021-2025-EN.pdf>

both shift toward a productive economy and provide the same support that came from its rental economy. A productive economy does not only entail supporting local production and exports. Rather, it also involves obtaining more foreign cash than is spent on foreign endeavors. Summarily, being productive means exporting more goods and services while reducing the domestic cashflow outside the country. Hence, any investment that does not increase the foreign cashflow to Saudi Arabia or reduce the domestic cashflow to foreign sources is pointless, given that it does not support Vision 2030.

5.2. Renewable energy sector

Saudi Arabia had taken steps toward renewable energy before the implementation of Vision 2030. In 2012, King Abdullah City for Atomic and Renewable Energy (KACARE) presented its plan for the country to develop 54 GW of renewables by 2032.¹²⁴⁶ The white paper aimed to improve the demand for clean energy and create local jobs,¹²⁴⁷ and it contains three tendering rounds in its framework: an introductory round of 500–800 MW, a first round of 2000–3000 MW, and a second round of 3000–4000 MW.¹²⁴⁸ The main actor in the power sector is the Saudi Electricity Company (SEC).¹²⁴⁹ The plan also prioritizes solar energy and seeks to provide 17.35 GW from only solar energy.¹²⁵⁰

Although this plan is ambitious, it does not address the main issue that the country faces, which is its overdependence on oil. While the plan acknowledges that the future demand for renewable energy will be greater than that for fossil fuels, it does not consider how this will

¹²⁴⁶ Look at the Defense Industry Initiative organization report: Regulatory Overview "Saudi Arabia". Available at: <https://dii-desertenergy.org/wp-content/uploads/2017/02/Regulatory-Overview-Saudi-Arabia.pdf>

¹²⁴⁷ *Id.*

¹²⁴⁸ *Id.*

¹²⁴⁹ *Id.*

¹²⁵⁰ the Saudi's Renewable energy plan 2030, *supra*.

impact the economy, which currently relies on oil revenue. The plan seems to be effective only in the short term, and it does not account for future energy demands and societal welfare. In contrast, Vision 2030, created by the esteemed McKinsey & Company,¹²⁵¹ focuses on changing the economic system of the country as a whole. Therefore, because Saudi Arabia has adopted Vision 2030's goals, the country is clearly invested in making a long-term shift toward a sustainable economy.

5.2.1. Renewable energy goals of Vision 2030

One of Vision 2030's main goals is to use more renewable energy to generate electricity instead of relying mostly on fossil fuels.¹²⁵² Following the report, Saudi Arabia aims to deploy 58.7 GW of renewable energy to reduce the proportion of oil used to generate electricity¹²⁵³ and to greatly increase the share of renewable energy to 30% of the kingdom's total generation capacity.¹²⁵⁴ This move is influenced both by global efforts to address the climate change crisis¹²⁵⁵ and the likelihood of many countries reducing their dependency on fossil fuels, leading to decreased demand of fossil fuels and thus decreased oil prices.¹²⁵⁶ Thus, Saudi Arabia's investment in renewable energy technology is one way to address all of these challenges.¹²⁵⁷

¹²⁵¹ McKinsey & Company is a United States-based management consulting firm, which advises on strategic management to corporations, governments, and other organizations.

¹²⁵² Blazquez, Hunt and Manzano, supra.

¹²⁵³ Id.

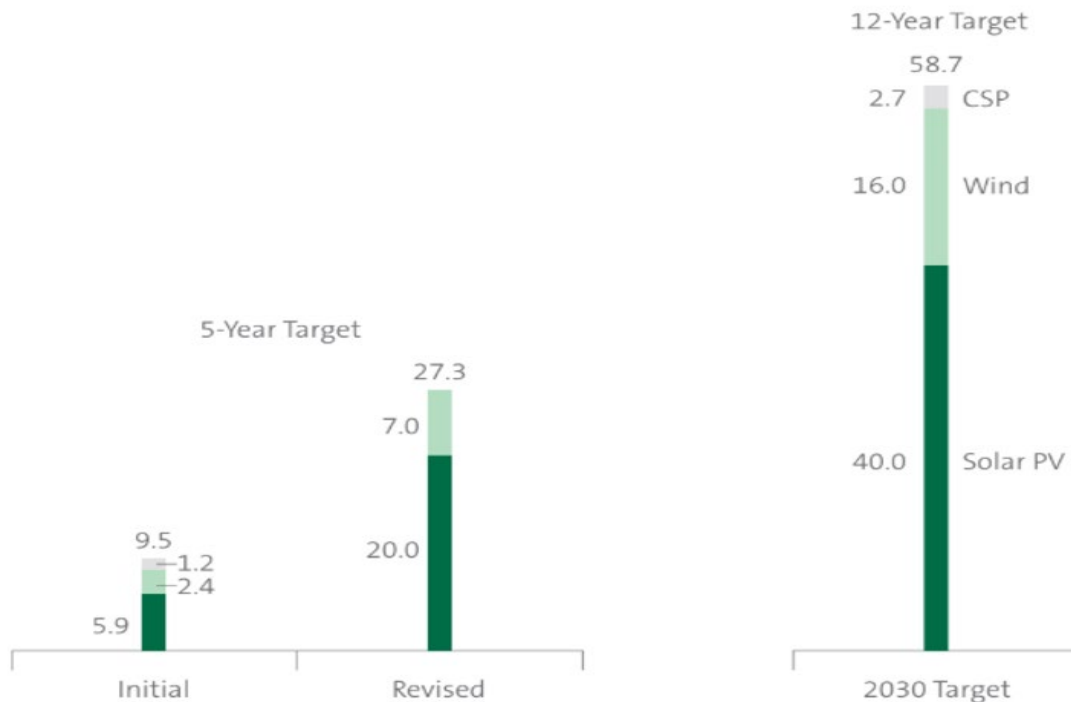
¹²⁵⁴ the Saudi's Renewable energy plan 2030, supra.

¹²⁵⁵ Blazquez, Hunt and Manzano, supra.

¹²⁵⁶ Id.

¹²⁵⁷ Id.

PLANNED CAPACITY (GW)



Source: The Saudi's renewable energy plan 2030 vision

The Saudi Ministry of Energy, Industry, and Mineral Resources (MEIM) plays a major role in this shift from fossil fuels to renewable energy.¹²⁵⁸ MEIM cooperates with foreign entities that have more expertise than itself,¹²⁵⁹ such as the U.S. Department of Energy's Office of International Affairs.¹²⁶⁰ These entities meet annually to address their mutual interests, review areas of cooperation, and identify new areas for collaboration and research.¹²⁶¹ These entities

¹²⁵⁸ Look at the U.S Department of energy data: U.S.-Saudi Arabia Energy Cooperation. Available at: <https://www.energy.gov/ia/international-affairs-initiatives/us-saudi-arabia-energy-cooperation>

¹²⁵⁹ Id.

¹²⁶⁰ Id.

¹²⁶¹ Id.

also exchange information on electricity development plans and potential nuclear power developments.¹²⁶² In addition, MEIM cooperates with other entities that prioritize CO₂ reduction and research in new supercritical CO₂ technologies.¹²⁶³

5.2.2. Exploitation of solar energy in Saudi Arabia

Because it can exploit solar and wind energy more than other countries, Saudi Arabia is well-suited to renewable energy generation. In particular, it has the greatest potential for renewable energy in the Middle East and North Africa (MENA) region,¹²⁶⁴ as the country lies in the middle of the “sun belt.”¹²⁶⁵ Globally, Saudi Arabia has the sixth-highest potential for solar energy production.¹²⁶⁶ The country averages 8.9 h/day of sunshine and 5,600 Wh/m² of horizontal solar radiation.¹²⁶⁷ The solar irradiation of Saudi Arabia is 250 W/m², which is above the average irradiation of high potential solar areas of 100–200 W/m².¹²⁶⁸ The country also has the 13th-highest potential for onshore wind energy production.¹²⁶⁹ The annual average onshore wind speeds is roughly 6.0–8.0 m/s. In certain locations, the onshore wind speeds average 7+ m/s, which is well above the standard speed for economic viability.¹²⁷⁰

¹²⁶² *Id.*

¹²⁶³ *Id.*

¹²⁶⁴ the Saudi 2030 vision, *supra*.

¹²⁶⁵ the Saudi’s Renewable energy plan 2030, *supra*.

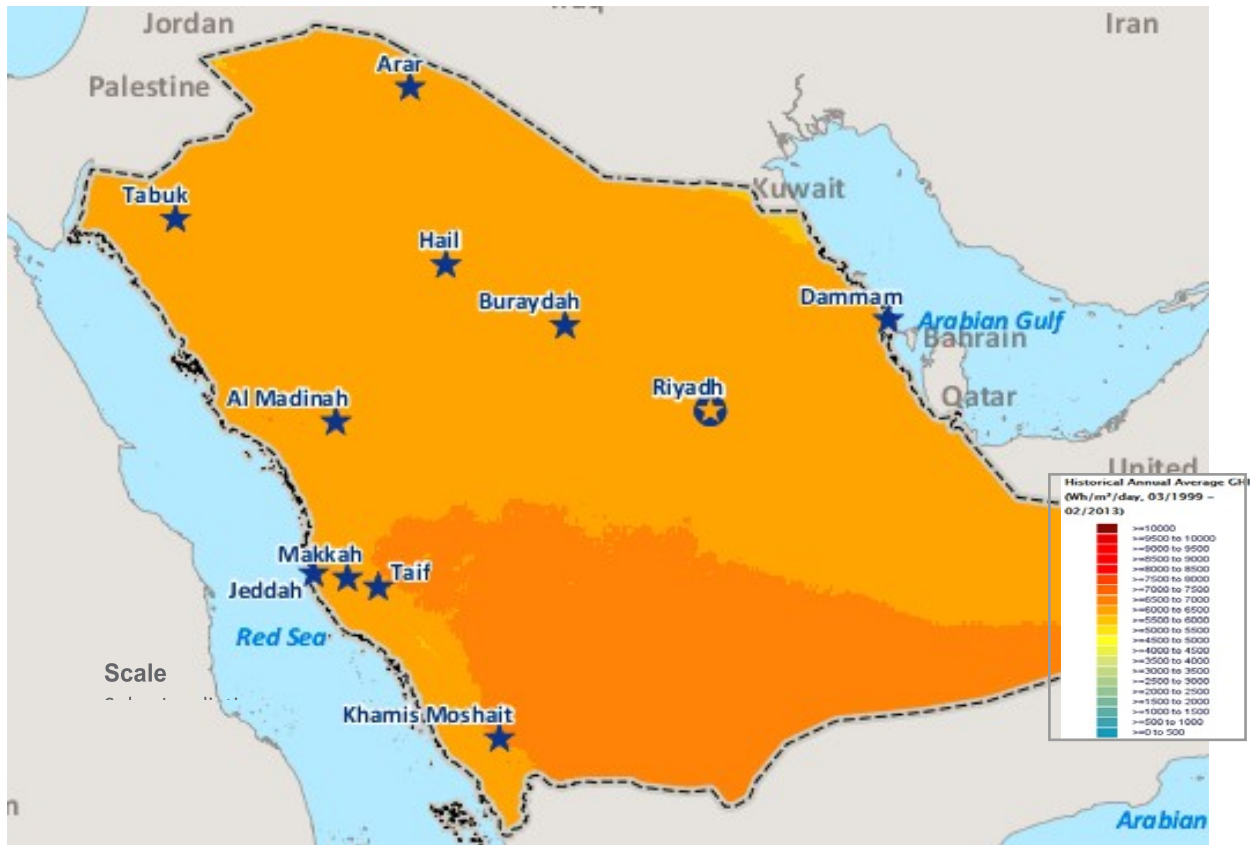
¹²⁶⁶ *Id.*

¹²⁶⁷ *Id.*

¹²⁶⁸ *Id.*

¹²⁶⁹ *Id.*

¹²⁷⁰ *Id.*



The Saudi's Renewable Energy Plan 2030, supra

To take full advantage of its strengths, Saudi Arabia focuses more heavily on solar power than wind power. Most of the countries' regions are excellent places for solar cells, and the country also has large unused areas. Saudi Arabia plans to harness solar energy, namely with photovoltaics (PV), to generate 40 GW from its total target of 58.7 GW.¹²⁷¹ In addition, Saudi Arabia seeks to localize a significant portion of the renewable energy value chain in the Saudi economy, including research and development (R&D) as well as manufacturing.¹²⁷² The country has also set a minimum localization requirement for renewable energy technology, which was

¹²⁷¹ Id.

¹²⁷² Id.

30% in 2017.¹²⁷³ The percentage is expected to exceed 50% going forward. King Abdulaziz City for Science and Technology (KACST) is responsible for increasing the localization of solar technologies.¹²⁷⁴ KACST is both the Saudi Arabian national science agency and its national laboratories.¹²⁷⁵ As a science agency, it creates science and technology policies, collects data, funds external research, and offers services such as the patent office.¹²⁷⁶

5.2.3. Solar energy projects in Saudi Arabia

Since the creation of Vision 2030, the country has supported many solar energy projects. The Renewable Energy Project Development Office (REPDO) has shortlisted the companies and consortia that will develop a solar project in the Al-Faisaliah region, with some proposing tariffs below the \$0.02/kWh threshold.¹²⁷⁷ The Faisaliah project is one of the largest new solar projects, and it is expected to produce 600 MW of the planned capacity.¹²⁷⁸ The project will be contracted by either a partnership led by the firm Masdar, which has its headquarters in the United Arab Emirates, or a consortium led by ACWA Power, a Saudi player.¹²⁷⁹ REPDO is expected to use the “best and final offer” approach to select the winner in 2020.¹²⁸⁰ The winner of this bid will be rewarded with a 25-year power purchase agreement (PPA) contract featuring the Saudi Power Procurement Company (SPPC) as the offtaker.¹²⁸¹ In return, the winning company must comply

¹²⁷³ Id.

¹²⁷⁴ Look at the Saudi official governmental website at: <https://www.kacst.edu.sa/>

¹²⁷⁵ Look at the International Astronautical Federation (IAF) database: KING ABDULAZIZ CITY FOR SCIENCE & TECHNOLOGY (KACST). Available at: [https://www.iafastro.org/membership/all-members/king-abdulaziz-city-for-science-and-technology-\(kacst\).html](https://www.iafastro.org/membership/all-members/king-abdulaziz-city-for-science-and-technology-(kacst).html)

¹²⁷⁶ the International Astronautical Federation, *supra*.

¹²⁷⁷ There is no official source for the details of this project; nevertheless, the project was written in PV tech.org (which covers news and articles on the solar PV supply chain internationally). The source is available at: <https://www.pv-tech.org/news/saudi-arabia-reignites-plans-for-integrated-solar-manufacturing>

¹²⁷⁸ Id.

¹²⁷⁹ Id.

¹²⁸⁰ Id.

¹²⁸¹ Id.

with the minimum 17% share of local content specified by Saudi law.¹²⁸² Solar bids of \$0.0162/kWh are now being touted in Saudi Arabia, and these mirror the tariffs of \$0.016953/kWh achieved last October by a 900-MW project in Dubai.¹²⁸³ Evidently, Middle Eastern countries have become more attractive for investors in the clean energy market.¹²⁸⁴

Another significant solar power project is the Sakaka project, which was completed in 2019 by ACWA Power.¹²⁸⁵ The project sells power at \$0.0236/kWh,¹²⁸⁶ and the company has successfully connected it to the national electricity grid.¹²⁸⁷ To support Vision 2030, King Salman Renewable Energy Initiative spent \$319 million to fund the project.¹²⁸⁸ The Sakaka project's 300 MW capacity provides energy for more than 45,000 households in the Al-Jouf region and offsets approximately 500 tons of CO₂ annually.¹²⁸⁹ The project demonstrates the country's commitment to clean energy, which will support economic diversification, develop human capital and elevate national competencies.¹²⁹⁰ The project had a 100% employment rate during its first year of operation and contracted 30% local content during construction.¹²⁹¹ The project is one of the first to be integrated with national grid.¹²⁹²

¹²⁸² Id.

¹²⁸³ Id.

¹²⁸⁴ Id.

¹²⁸⁵ There is no official source for the details of this project; nevertheless, the project was written in World-energy.org (which is one of the largest energy portal websites in the world). The source is available at:

<https://www.world-energy.org/article/4362.html>

¹²⁸⁶ Id.

¹²⁸⁷ Id.

¹²⁸⁸ Id.

¹²⁸⁹ Id.

¹²⁹⁰ Id.

¹²⁹¹ Id.

¹²⁹² Id.

Moreover, Saudi Arabia has cooperated with Japan to finance a solar project in the Rabigh region.¹²⁹³ Japan has programs to provide other countries with leading low-carbon or decarbonizing technologies and promote the development their infrastructure.¹²⁹⁴ The Rabigh project is expected to generate 400 MW,¹²⁹⁵ and it is an important step to increase the generation capacity of renewable energy to 58.7 GW.¹²⁹⁶ The project is expected to offset 477,129 tons of CO₂ annually.¹²⁹⁷

Furthermore, REPDO recently announced that the Dumat Al-Jandal wind energy project will be granted to the French electricity company Energies Nouvelles (EDF), with the well-known Abu Dhabi Future Energy Company as a “source.”¹²⁹⁸ This project is the first wind project in the kingdom and the second bid submitted by the Saudi Ministry of Energy within the framework of the King Salman Renewable Energy Initiative.¹²⁹⁹ The project is expected to provide electricity at \$0.0213/kWh, and this tariff will set a new record for a project of this type in Europe, the Middle East, and Africa.¹³⁰⁰ At a cost of \$500 million, the project will generate energy for 70,000 households and create 1,000 job opportunities during the construction and operation phases.¹³⁰¹ Its expected average annual production is approximately 1.4 TW.¹³⁰² This

¹²⁹³ Look at the official site of Japan's Ministry of the Environment: Preliminary Selection Result for Financing Programme for JCM Model Projects in FY2020 (1st Selection) (2020). Available at: <http://www.env.go.jp/en/headline/2467.html>

¹²⁹⁴ Id.

¹²⁹⁵ Id.

¹²⁹⁶ Id.

¹²⁹⁷ Id.

¹²⁹⁸ Look at the governmental Saudi Press Agency: Iqtisadi / Kingdom awards its first wind energy project (2019). Available at: <https://www.spa.gov.sa/1873118>

¹²⁹⁹ Id.

¹³⁰⁰ Id.

¹³⁰¹ Id.

¹³⁰² Id.

wind project is important for the country to diversify its energy sources, placing renewable energy generation technologies at the forefront.¹³⁰³

Many solar and wind energy projects are planned to be completed before 2030, and the Sakaka (300 MW) and Dumat Al Jandal (400 MW) projects are currently tendered. There are many other projects in pre-development, including Qurrayat (200 MW), Alfaisalia (600 MW), Saad (300 MW), Wadi Adwawser (70 MW), Yanbu (850 MW), Madinah (50 MW), Rabigh (300 MW), Alras (300 MW), Qurrayat (40 MW), Rafha (45 MW), Jeddah (45 MW), and Mahad Dahab (20 MW).¹³⁰⁴ REPDO has issued a request for qualifications (RFQ) for round three of the kingdom's long-term National Renewable Energy Program (NREP), which comprises of four solar projects that will generate 1200 MW.¹³⁰⁵ ¹³⁰⁶ This third round will be divided into two categories: A and B.¹³⁰⁷ The first category targets small projects such as the Layla 80-MW and Wadi Al Dawaser 120-MW solar PV projects.¹³⁰⁸ The second category targets large projects such as the Saad 300-MW and Ar Rass 700-MW solar PV projects. All projects within both categories must satisfy the minimum local content requirement for solar technology, which is 17%. Ideally, doing so will add value to the national economy.¹³⁰⁹ In short, NREP promotes renewable energy use while also applying the Saudi's Nationally Determined Contribution (NDC) to avoid carbon and other GHG emissions.¹³¹⁰

¹³⁰³ Id.

¹³⁰⁴ the Saudi's Renewable energy plan 2030, supra.

¹³⁰⁵ Note: Round 1 and 2 has already been launched before 2018

¹³⁰⁶ Look at the governmental Saudi Press Agency: Saudi Arabia Launches Round Three of National Renewable Energy Program (2020) Available at: <https://www.spa.gov.sa/viewfullstory.php?lang=en&newsid=2020780>

















¹³⁰⁷ Id.

¹³⁰⁸ Id.

¹³⁰⁹ Id.

¹³¹⁰ Id.

REPDO TENDERING PLAN (MW)

TENDERED		PRE-DEVELOPED					
Sakaka  300	Dumat Al Jandal  400	Qurrayat  200	Alfaisalia  600	Saad  300	Wadi Adwawser  70	Yanbu  850	2019 Total 2,225 
		Madinah  50	Rabigh  300	Alras  300	Qurrayat  40		850 
		Rafha  45	Jeddah  45				
			Mahad Dahab مهد الذهب  20				3,075



Source: REPDO, Overview of Saudi Arabia's Renewable Energy Program (Jan 2019), Team analysis

5.2.4. Renewable Resource Monitoring and Mapping program

Saudi Arabia also aims to create a database that will provide detailed information related to renewable energy.¹³¹¹ The Renewable Resource Monitoring and Mapping (RRMM) program

¹³¹¹ the Saudi's Renewable energy plan 2030, *supra*.

focuses on monitoring and mapping renewable energy resources in Saudi Arabia.¹³¹² This program will cover the operation, calibration, and maintenance of renewables.¹³¹³ RRMM will also be an online portal that provides updated information on renewable energy resources in the country,¹³¹⁴ primarily solar, wind, geothermal, and waste-to-energy resources.¹³¹⁵ The program will be useful for power project developers and financiers, researchers, academics, government entities, and industries.¹³¹⁶

To achieve its renewable energy goals, Saudi Arabia must be attractive to foreign investors, and the country currently offers them many incentives. The country makes customs duty exemptions for primary raw materials, manufacturing equipment, and spare parts.¹³¹⁷ The country also provides up to 75% of project financing using soft loans from the Saudi Industrial Development Fund (SIDF).¹³¹⁸ Moreover, Saudi Arabia provides land incentives for leases, starting from \$ 0.26/m².¹³¹⁹ Furthermore, the country supports the nationalization of jobs, as the Human Resource Development Fund (HRDF) covers the monthly salaries of Saudi national employees by up to 15% for men and 20% for women.¹³²⁰ In addition, the country covers 100% of foreign direct ownership, and there are no restrictions on the repatriation of capital.¹³²¹

¹³¹² Id.

¹³¹³ Id.

¹³¹⁴ Id.

¹³¹⁵ Id.

¹³¹⁶ Id.

¹³¹⁷ Id.

¹³¹⁸ Id.

¹³¹⁹ Id.

¹³²⁰ Id.

¹³²¹ Id.

5.2.5. Challenges of the renewable energy sector in Saudi Arabia

However, the country faces many difficulties in attracting investors.¹³²² For instance, the country is still in the process of establishing a legal framework that supports its power supply, ranging from renewable sources to grid connections.^{1323 1324} Plus, the entities that plan to achieve the renewable energy goals of Vision 2030 are nascent and still must partner with other entities.¹³²⁵ The R&D in the region is also still limited. Although KACARE has established its own R&D department, the results have not yet materialized.¹³²⁶ The most important challenge that the country faces is subsidizing its conventional power sources.¹³²⁷ These subsidies are considered to be high and thus act as an obstacle to the private sector's development of renewable energy sources.¹³²⁸ The electricity tariff system makes power in the kingdom among the cheapest in the world, and it would be difficult to compete with in the private sector.¹³²⁹ The largest source of electrical power is the SEC, although Saline Water Conversion Corporation (SWCC) and Saudi Aramco also own and develop their own conventional power stations.¹³³⁰

5.2.6. Possible solutions from Vision 2030

Nevertheless, these challenges are being solved in accordance with Vision 2030. Currently, a conflict of international laws is impossible in Saudi Arabian affairs, as the parties

¹³²² Note: the issues and challenges that faces Saudi Arabia regarding shifting from fossil fuels to other sources will be discussed in depth in Chapter 5.

¹³²³ PricewaterhouseCoopers (PwC) Developing renewable energy projects A guide to achieving success in the Middle East. Available at: <https://www.pwc.com/m1/en/publications/documents/evsheds-pwc-developing-renewable-energy-projects.pdf?platform=hootsuite>

¹³²⁴ Note: PwC is a multinational professional services network headquartered in London, United Kingdom. PwC is the second largest professional services company in the world.

¹³²⁵ Id.

¹³²⁶ Id.

¹³²⁷ Id.

¹³²⁸ Id.

¹³²⁹ Id.

¹³³⁰ Id.

have the right to choose the applicable law, provided that one of the parties is not Saudi.¹³³¹ This could attract more investors, partially as the country continues to develop a comprehensive detailed legal framework, especially for business. In Saudi Arabia, the principles applied to contracts are not codified,¹³³² meaning that one standardized rule applies to all types of contracts.¹³³³ Thus, the Saudi court would assume its jurisdiction to apply Saudi law regardless of the parties intentions.¹³³⁴ This, however, is not always applied for “the foreign law clause,” as courts generally respect this clause.¹³³⁵ Consequently, parties must be cautious when making their agreements because of the substantial freedom of contract that is afforded under Saudi law.¹³³⁶ While local counsel may use their own legal knowledge of similar cases or similar previous circumstances,¹³³⁷ Saudi courts do not apply the precedent system, which means that the court can make decisions based on the judge’s discretion rather than on how previous cases were decided.¹³³⁸

Saudi Arabia has also used strategic memberships, treaties, and agreements to raise its reputation among foreign investors. Saudi Arabia takes part in the International Centre for Settlement of Investment Disputes (ICSID) Convention and the Convention on the Recognition and Enforcement of Foreign Arbitral Awards, otherwise known as the New York Convention.¹³³⁹ Saudi Arabia’s treaties give investors many dispute resolution options with required “cooling off” periods for negotiations, which takes place between the initial notice of a dispute and the

¹³³¹ *Id.*

¹³³² *Id.*

¹³³³ *Id.*

¹³³⁴ *Id.*

¹³³⁵ *Id.*

¹³³⁶ *Id.*

¹³³⁷ *Id.*

¹³³⁸ *Id.*

¹³³⁹ *Id.*

commencement of arbitration.¹³⁴⁰ Many of these treaties grant foreign investors from certain countries the right to select between local courts or international arbitration in the event of a dispute.¹³⁴¹ In fact, most treaties ensure that the investor would face most favorable treatment, be provided with security, and be protected from expropriation.¹³⁴² This, however, does not mean that an investor could ignore local requirements, such as giving priority to Saudi citizens in employment or complying with the minimum requirement of 17% local content.¹³⁴³ Instead, the investor would be granted the protection approved by treaties while also being responsible for satisfying the local requirements for conducting business in Saudi Arabia. Crucially, the country's clean energy market has become more attractive to investors.¹³⁴⁴ The kingdom hosts major independent water and power producers (IWPPs) and independent power producers (IPPs), delivered under long-term PPAs.¹³⁴⁵ These agreements have attracted many investors to invest billions in the country and have proven to be bankable.¹³⁴⁶ To bring in even more investors, the government will lower its energy subsidies, and this will allow the energy market to become more competitive.¹³⁴⁷

Although it still lacks comprehensive legislation that properly addresses the new emerging market, the country is actively restructuring several sectors related to policy and legislation so that they will better serve the power sector, as outlined in the Vision 2030 report.¹³⁴⁸ Currently, the key legislations are as follows: the Foreign Investment Regulation,

¹³⁴⁰ *Id.*

¹³⁴¹ *Id.*

¹³⁴² *Id.*

¹³⁴³ *Id.*

¹³⁴⁴ *Id.*

¹³⁴⁵ *Id.*

¹³⁴⁶ *Id.*

¹³⁴⁷ *Id.*

¹³⁴⁸ Naryman Al Kassimi & Dana Halwani, Saudi Arabia, 37 INT'L FIN. L. REV. 106 (2018).

Royal Decree M/1 (10 April, 2000); Electricity Regulation, Royal Decree M/56 (22 November, 2005); Electricity Regulation Implementing Rules, issued pursuant to Electricity and Co-generation Regulatory Authority Board Resolution 3/11/27 (13 May, 2006); and the General Environmental Regulation, Royal Decree M/34 (15 October, 2001).¹³⁴⁹ To aid the energy sector, the government leases land at low rates and offers free loans to companies that meet the requirements of the Saudi Industrial Development Fund (SIDF).¹³⁵⁰ There are ongoing discussions to update and reform many existing laws, including regulations for bankruptcy, commercial mortgages, and privatization.¹³⁵¹ Hence, Saudi Arabia is currently taking serious steps to reform its legal system.

5.2.7. Corporate average fuel economy standards

Saudi Arabia is also pursuing new ways to improve local renewable energy use among its citizens, and it has implemented many programs and standards to promote clean energy. For example, the Corporate Average Fuel Economy (CAFE) standards now cover light-duty vehicles¹³⁵² and aim to improve the overall fuel economy by an average of 4% annually.¹³⁵³ In addition, the standards also intend to improve the fuel economy for light-duty vehicles from its current level of 12 km/l to 19 km/l by 2025.¹³⁵⁴ Fuel economy is measured according to the U.S. Environmental Protection Agency's (EPA) testing procedures, which are the EPA Federal Test FTP-75 for city driving and HWFET for highway driving.¹³⁵⁵ Following the Saudi Standards,

¹³⁴⁹ Id.

¹³⁵⁰ Id.

¹³⁵¹ Id.

¹³⁵² Look at the International Energy Agency database: Saudi Arabia Corporate Average Fuel Economy (CAFE) standards (2019). Available at: <https://www.iea.org/policies/8395-saudi-arabia-corporate-average-fuel-economy-cafe-standards>

¹³⁵³ Id.

¹³⁵⁴ Id.

¹³⁵⁵ Id.

Metrology, and Quality Organization (SASO), the combined fuel economy is calculated as follows: combined fuel economy = $1/[(0.55/\text{city fuel economy}) + (0.45/\text{highway fuel economy})]$.¹³⁵⁶ In addition, manufacturers can now use the New European Driving Cycle (NEDC) testing procedures.¹³⁵⁷

5.2.8. Minimum energy performance standards

Moreover, the country has also adopted the Minimum Energy Performance Standards (MEPS).¹³⁵⁸ These standards cover electrically operated air conditioners, condensing units, chillers, absorption chillers, and electrically operated variable-refrigerant-flow (VRF) air conditioner systems and close control air conditioners as well as condensing units serving computer rooms.¹³⁵⁹ These standards apply to all air conditioners designed to operate in AC single-phase circuits of 220 V or 230 V, with dual voltage or voltage ranges including these values, or that use three-phase circuits of 380 V or 400 V with a frequency of 60 Hz.¹³⁶⁰ The standards outline the exact testing standards that these products must comply with (e.g., CC ≤ 65,000: EER 11.2; 65,000 < CC ≤ 135,000: EER 11.2; 135,000 < CC ≤ 240,000: EER 11; 24,000 < CC ≤ 760,000: EER 10.0).¹³⁶¹ The regulations also set minimum energy performance standards (MEPS) for computer and data processing room air conditioners.¹³⁶² Air conditioners with capacities exceeding 65,000 Btu/h are covered by the large AC standard (SASO 2874/2016).¹³⁶³

¹³⁵⁶ Id.

¹³⁵⁷ Id.

¹³⁵⁸ Look at the International Energy Agency database: SASO 2874/2016: Large capacity air conditioners - performance requirement and methods of testing (2020). Available at: <https://www.iea.org/policies/2430-saso-28742016-large-capacity-air-conditioners-performance-requirement-and-methods-of-testing>

¹³⁵⁹ Id.

¹³⁶⁰ Id.

¹³⁶¹ Id.

¹³⁶² Id.

¹³⁶³ Id.

5.2.9. National Renewable Energy Program

Furthermore, REPDO implemented the National Renewable Energy Program (NREP)¹³⁶⁴ to support all RE-related initiatives in the kingdom by reviewing legal and regulatory frameworks.¹³⁶⁵ In the long term, the program aims to localize R&D, manufacturing, and other sections of the renewable energy value chain.¹³⁶⁶ It also promotes the renewable energy industry by encouraging both private and public sectors to make partnerships and allowing the private sector to invest in renewable energy.¹³⁶⁷ Ideally, more renewable energy components will be manufactured locally by increasing projects' local content targets.¹³⁶⁸ Currently, the country has localized solar and wind components by 17–19%, according to the Local Content and Government Procurement Authority (LCGPA). This is expected to increase to 33–35% by 2025.¹³⁶⁹ By 2028, the country wants to achieve 40–45% localization of renewable energy components for solar and wind power and prioritize exporting renewable energy supply chains.¹³⁷⁰

NREP is governed by MEIM,¹³⁷¹ and MEIM's control over the program consolidates the efforts of various stakeholders across the kingdom, including SEC, KACARE, and the Electricity and Co-Generation Regulatory Authority (ECRA).¹³⁷² All projects covered by NREP are procured in a fair, open, and transparent manner via a purpose-built e-procurement portal.¹³⁷³

¹³⁶⁴ Id.

¹³⁶⁵ Id.

¹³⁶⁶ Id.

¹³⁶⁷ Id.

¹³⁶⁸ Id.

¹³⁶⁹ Id.

¹³⁷⁰ Id.

¹³⁷¹ Look at the U.S. Department of Commerce database: Saudi Arabia Country Commercial Guide (2020). Available at: <https://www.export.gov/apex/article2?id=Saudi-Arabia-Power>

¹³⁷² Id.

¹³⁷³ Id.

Hence, the procurement process is open to public examination.¹³⁷⁴ The evaluation of the bids is done using an independent selection panel.¹³⁷⁵ The award contract is given to the company that meets the minimum localization content requirement for that tender and also offers the lowest levelized electricity cost.¹³⁷⁶ Doing so provides many jobs for local citizens and drives growth in the kingdom's non-oil economy, as it incentivizes companies to manufacture goods and provide services locally.¹³⁷⁷

5.2.10. Saudi Energy Efficiency Program

Saudi Arabia has also participated in workshops on how to reduce the negative local impact of fossil fuels, such as “Enhancing Vehicles Energy Efficiency in Saudi Arabia.”¹³⁷⁸ This is because the country has witnessed unprecedented energy consumption growth as a result of its economic development, population growth, and industrialization.¹³⁷⁹ Its energy consumption could reach up to 8 MMbdoe in 2030.¹³⁸⁰ As a result, the country participated in the G20 Transport Task Group workshop to gain international experience in active demand-side management.¹³⁸¹ Following the workshop, the Saudi Energy Efficiency Program (SEEP) mobilized more than 150 professionals from more than 30 governmental entities and state-owned enterprises.¹³⁸² The main focus of SEEP is to address the consumption of three major sectors: industry, buildings, and transportation.¹³⁸³ These sectors represent more than 90% of all energy

¹³⁷⁴ Id.

¹³⁷⁵ Id.

¹³⁷⁶ Id.

¹³⁷⁷ Id.

¹³⁷⁸ Look at the Saudi Energy Efficiency Center report: Enhancing Vehicles Energy Efficiency in Saudi Arabia (2018).

Available at:

https://theicct.org/sites/default/files/KSA_AIROge_Enhancing%20Vehicles%20Energy%20Efficiency%20in%20Saudi%20Arabia.pdf

¹³⁷⁹ Id.

¹³⁸⁰ Id.

¹³⁸¹ Id.

¹³⁸² Id.

¹³⁸³ Id.

consumption in the kingdom,¹³⁸⁴ and this consumption previously grew by 5% each year.¹³⁸⁵

Thus, the main goal of SEEP is to decrease the growth rate to ~4% each year. Saudi Arabia can also achieve 5–9% in fuel savings through aerodynamic improvements.¹³⁸⁶

5.2.11. Intended nationally determined contributions

In addition, Saudi Arabia has participated in many plans and initiatives to limit the negative impact of fossil fuels,¹³⁸⁷ such as by defining its Intended Nationally Determined Contributions (INDCs).¹³⁸⁸ These INDCs include adaptations to address climate change, economic diversification, energy efficiency, renewable energy, carbon capture, utilization, and storage as well as methane recovery and flare minimization.¹³⁸⁹ Other initiatives cover areas such as integrated coastal zone management, early warning systems, and integrated water management.¹³⁹⁰ The country has also developed more efficient energy technologies, renewable energy sources (RES), especially solar energy sources, and rational use of energy (RUE).¹³⁹¹

Despite these actions, the price of electricity in Saudi Arabia is still far below world market levels: \$1.25/MMBtu for natural gas, \$4.4 per barrel for heavy fuel oil, \$11.7 per barrel for diesel, and \$5.94 per barrel for crude oil.¹³⁹² The low price of electricity in Saudi Arabia might not be sustainable because the energy demand increases annually, and thus subsidizing energy becomes more difficult. Energy consumption increased by 6.2% annually from 2006–2016.¹³⁹³ The country increased its tariffs due to the slowdown of the economy as well as to

¹³⁸⁴ Id.

¹³⁸⁵ Id.

¹³⁸⁶ Id.

¹³⁸⁷ United Nations Framework Convention on Climate Change report, supra.

¹³⁸⁸ Id.

¹³⁸⁹ Id.

¹³⁹⁰ Id.

¹³⁹¹ Id.

¹³⁹² Look at the Qamar Energy's (Consulting Organization from UAE) report available at: http://npolicy.org/Articles/March%202018%20Drafts/Mills_Saudi_Arabia_Feb18.pdf

¹³⁹³ Id.

pursue its Vision 2030 goals.¹³⁹⁴ As a result, the demand for energy decreased to 0.7% in 2016. Without efficiency measures by the government, the demand for energy would grow to be 4–5% annually.¹³⁹⁵

5.2.12. Inefficiency of the energy market in Saudi Arabia

Currently, energy use in Saudi Arabia is highly inefficient by global standards.¹³⁹⁶ As of 2013, Saudi Arabia ranked 13th globally at 6.7 tonnes of oil-equivalent (toe) per capita, which placed it slightly behind the U.S. (7 toe/capita) but well ahead of the EU (3.2 toe/capita) and the world average (1.9 toe/capita).¹³⁹⁷ Most countries have decreased energy intensity while Saudi Arabia has increased energy intensity, reaching 137 toe per \$1000 of GDP in 2011 and staying ahead of the 95 toe per \$1000 of GDP in the EU.¹³⁹⁸ Consequently, Saudi Arabia established the Saudi Energy Efficiency Center to bolster its energy efficiency.¹³⁹⁹ The center focuses heavily on industry, buildings, and transport, primarily by means of benchmarking and implementing standards.¹⁴⁰⁰ The main goal of the center is to increase energy efficiency by 30% by 2030.¹⁴⁰¹ A study conducted by the King Abdullah Petroleum Studies and Research Center (KAPSARC) suggests that the country could save 3.7–22.9 GW of peak electricity capacity after applying a building retrofit program.¹⁴⁰² Despite these many efforts to develop energy efficiency, the energy use in the country still, for now, inefficient.¹⁴⁰³

¹³⁹⁴ *Id.*

¹³⁹⁵ *Id.*

¹³⁹⁶ *Id.*

¹³⁹⁷ *Id.*

¹³⁹⁸ *Id.*

¹³⁹⁹ *Id.*

¹⁴⁰⁰ *Id.*

¹⁴⁰¹ *Id.*

¹⁴⁰² *Id.*

¹⁴⁰³ *Id.*

In particular, the country is still relying on fossil fuels to generate 60% of its electricity generation feed stock requirements.¹⁴⁰⁴ As a result, the country aims to upgrade its entire power generation, distribution, and transmission sector.¹⁴⁰⁵ The country has an outdated transmission and distribution (D&T) infrastructure,¹⁴⁰⁶ and segments of the current grid are outdated and inefficient.¹⁴⁰⁷ Estimations show that Saudi Arabia must increase its power generation capacity from 82 GW in 2018 to 160 GW in 2040.¹⁴⁰⁸ To achieve this, the country must invest about \$5 billion in generation and \$4 billion in distribution each year.¹⁴⁰⁹ This investment may burden country, as it also seeks to privatize the newly power-generation companies.¹⁴¹⁰ These companies will likely need substantial investment to increase efficiency, meet environmental standards, and replace aging power plants.¹⁴¹¹

To address ongoing efficiency issues, Saudi Arabia has several plans to repair and expand its infrastructure. Saudi Arabia will replace its old substations, transformers, and other infrastructure to reduce energy wastage.¹⁴¹² MEIM expects these improvements to take place between 2020 and 2025, with operations continuing to 2030.¹⁴¹³ Moreover, Saudi Arabia also plans to go beyond reforming its own infrastructure, as it plans to link the central and western regions and invest \$4 billion in distribution projects annually.¹⁴¹⁴ Recently, Saudi Arabia led the Gulf Cooperation Council project to link the grids of its member states.¹⁴¹⁵ This project would

¹⁴⁰⁴ the U.S. Department of Commerce database: Saudi Arabia Country Commercial Guide, *supra*.

¹⁴⁰⁵ *Id.*

¹⁴⁰⁶ *Id.*

¹⁴⁰⁷ *Id.*

¹⁴⁰⁸ *Id.*

¹⁴⁰⁹ *Id.*

¹⁴¹⁰ *Id.*

¹⁴¹¹ *Id.*

¹⁴¹² *Id.*

¹⁴¹³ *Id.*

¹⁴¹⁴ *Id.*

¹⁴¹⁵ *Id.*

open the door for the region to international power trading.¹⁴¹⁶ Saudi Arabia also endeavors to build a 3 GW link with Egypt at a cost of \$1.6 billion.¹⁴¹⁷ This would increase the efficiency of each country's grid due to their dissimilar peak load times.¹⁴¹⁸

The country has also prepared to invest billions in installing smart meter technology.¹⁴¹⁹ The SEC has funded many projects to replace all old meters in the country by 2025.¹⁴²⁰ These new meters would allow Saudi Arabia to manage its use of energy more efficiently by communicating energy consumption instantly via the Internet.¹⁴²¹ These meters will also facilitate the future integration of clean energy, which has a more erratic output than that of traditional hydrocarbon plants.¹⁴²²

In general, the world now views renewable energy as a viable future alternative energy that does not harm the environment.¹⁴²³ ECRA has always expressed the importance of renewable energy, and it has thus worked toward preparing a national policy to realize Vision 2030.¹⁴²⁴ Saudi Arabia now seeks to diversify its energy sources, encourage competition in renewable energy fields, support local technical development by nationalizing the manufacturing of certain renewable energy equipment parts, utilize its potential economy of scale to reduce renewable energy costs, and create stable and inviting investment opportunities for renewable energy.¹⁴²⁵ Additionally, Saudi Arabia has attempted to benefit from the knowledge of Spain,

¹⁴¹⁶ *Id.*

¹⁴¹⁷ *Id.*

¹⁴¹⁸ *Id.*

¹⁴¹⁹ *Id.*

¹⁴²⁰ *Id.*

¹⁴²¹ *Id.*

¹⁴²² *Id.*

¹⁴²³ the Saudi Electricity & Cogeneration Regulatory Authority: The Development of National Renewable Energy Policy for Saudi Arabia, *supra*.

¹⁴²⁴ *Id.*

¹⁴²⁵ *Id.*

Germany, and North America in renewable energy generation.¹⁴²⁶ Other countries have shared their experiences, the obstacles they faced in developing renewable energy, and how they overcame these obstacles.¹⁴²⁷ Overall, Saudi Arabia has taken a varied approach to successfully shift toward clean energy.

Conclusion

This chapter focused on environmental reforms and renewable energy generation in Saudi Arabia, providing both the context for new projects and exploring how they will be applied in reality. The first part summarized the environmental norms under Islam as a religion. The main sources of Islam clearly direct people to protect the environment. In fact, Islamic rules state that people are obligated to protect the environment even if there is no obvious reason for doing so. Based on the teachings and principles of Islam, one should have a strong sense of morality and value the purity of the Earth. Thus, any environmental reforms could receive significant support from the citizens of Saudi Arabia, as Islam encourages such reforms. The second part provided an overview of the debate on the ownership of energy under Islamic law and examined the extent to which it has influenced modern energy laws. The third part shed light on the constitution of Saudi Arabia, which states that the country has a duty to provide a clean environment to its citizens. Therefore, any environmental reforms adopted by the country are constitutionally protected. The fourth part explored the OPEC statute as a means to protect the interests of oil-producing countries. It concluded that relying only on fossil fuels will not lead to a sustainable economy. The fifth part focused on the goals of Vision 2030 and how the country will prioritize its non-oil sectors, particularly those related to renewable energy.

¹⁴²⁶ *Id.*

¹⁴²⁷ *Id.*

Saudi Arabia has taken serious steps to shift from fossil fuels to renewable energy and other non-oil sectors. The kingdom has acknowledged the danger of relying mostly on fossil fuels as the main source of its GDP, due to volatility of the oil price. In fact, the oil price is predicted to decrease even further as gas extraction and renewable energy projects increase in popularity worldwide. Thus, Saudi Arabia has pursued the goals of Vision 2030 to diversify its economy. Most importantly, Saudi Arabia aims to deploy 58.7 GW of renewable energy by 2030, which would make up 30% of the kingdom's total generation capacity and reduce the proportion of oil. As a result, the country is implementing dozens of solar energy projects and also pursuing wind energy projects. It can be argued that Saudi Arabia has strongly committed to developing its non-oil sectors and foregoing its reliance on fossil fuels.

Chapter 5 The Norwegian Model

Introduction

Norway is considered to be a leading country in renewable electricity production, as it produces almost 98% of its electricity from renewable resources.¹⁴²⁸ This reliance stems from Norway's topographic advantages, namely its abundant steep valleys and rivers. The use of hydropower began in the late 19th century, before the discovery of oil, and the generation of electricity from hydropower boosted the industrialization process in Norway.¹⁴²⁹

In the 1970s, Norway discovered oil in the North Sea, and this significantly improved its GDP.¹⁴³⁰ The country became the third largest exporter of oil and one of the wealthiest countries in the world.¹⁴³¹ This both increased the welfare of the citizens of Norway and its aid to other countries.¹⁴³² Unlike most oil-producing countries, Norway does not rely heavily on oil revenues to fund its government spending. Rather, the government recognized the danger of its overreliance on oil and aimed to invest its oil and gas revenues instead of spending them.¹⁴³³ Thus, it created the Norwegian sovereign fund by passing the Government Pension Fund Act in 1990.¹⁴³⁴ The main goal of the Government Pension Fund Global (GPFGL) is to use oil revenues

¹⁴²⁸ Look at the article written in the official Norwegian government's site: Renewable energy production in Norway (2016): available at: <https://www.regjeringen.no/en/topics/energy/renewable-energy/renewable-energy-production-in-norway/id2343462/>

¹⁴²⁹ Inger Auestad, Yngve Nilsen and Knut Rydgren, Environmental Restoration in Hydropower Development—Lessons from Norway, 10 Sustainability 3358 (2018).

¹⁴³⁰ Asoka Bandarage, The Norwegian Model: Political Economy of NGO Peacemaking, 17 BROWN J. WORLD AFF. 221 (2011).

¹⁴³¹ Id.

¹⁴³² Id.

¹⁴³³ The Government Pension Fund Act: available at: <https://lovdata.no/dokument/NL/lov/2005-12-21-123?q=lov+om+statens+pensjonsfond>.

¹⁴³⁴ Id.

without affecting the general income flow to the government, thereby buffering the impact of volatile oil revenues on government spending.¹⁴³⁵

However, Norway's growing population has increased the domestic demand for electricity,¹⁴³⁶ and hydropower seems to be unable to fully satisfy the new demand due to the limited locations in which dams can be built. The wind sector is promising in Norway, and the country has the potential to generate a significant amount of electricity due to its geographic advantages.¹⁴³⁷ Yet, Norway has decided to satisfy the new electricity demand with gas.¹⁴³⁸ Therefore, Norway lacks wind energy production, despite the high potential for it, and remains far behind other European countries concerning its wind energy usage.¹⁴³⁹

The rest of this chapter will proceed as follows. The first part will discuss Norway's economic system and the extent to which it differs from other European economic systems, and it will also explain the state's role in the economy and how the market system and the government cooperate. The second part will shed light on the Norwegian sovereign fund, which invests oil revenues instead of using them to fund government spending. The third part will focus on Norway's renewable energy laws and policies and describe how Norway encourages renewable energy use.

¹⁴³⁵ Anita M. Halvorssen & Cody D. Eldredge, Investing in Sustainability: Ethics Guidelines and the Norwegian Sovereign Wealth Fund, 42 DENV. J. INT'L L. & POL'Y 389 (2014).

¹⁴³⁶ Espen Moe and Paul Midford, The Political Economy of Renewable Energy and Energy Security 276-317 (1st ed, 2014).

¹⁴³⁷ Id.

¹⁴³⁸ Bernt Blindheim, Implementation of wind power in the Norwegian market; the reason why some of the best wind resources in Europe were not utilised by 2010, 58 Energy Policy 337-346 (2013).

¹⁴³⁹ Moe and Midford, supra.

1. Economic system of Norway

Norway is the new country that emerged after a conflict with Sweden in 1905,¹⁴⁴⁰ and it is small compared to other European countries, with a population of approximately 4.5 million people.¹⁴⁴¹ The discovery of offshore oil in 1970 significantly changed Norway's economy, and it became the third-largest exporter of oil and one of the world's wealthiest and most politically engaged countries.¹⁴⁴² According to the United Nations (UN) ranking, Norway has the second-highest gross domestic product (GDP) per capita in the world, surpassed only by Luxembourg.¹⁴⁴³ Because of its wealth, country has both increased the welfare of its citizens and provided aid to other countries. For instance, the country's net official development aid was 4.086 billion dollars in 2009.¹⁴⁴⁴ This represents 1.06% of Norway's gross national income (GNI), making Norway second only to Sweden in terms of development aid when viewed as a percentage of GNI.¹⁴⁴⁵ This shows that after the discovery of oil in the 1970s, Norway has flourished to the extent that it can provide aid to other countries.

1.1. Democratic welfare-capitalist system (the Nordic model)

Norway and other Nordic countries have adopted a democratic welfare-capitalist system.¹⁴⁴⁶ This system specifies that the state is the primary entity responsible for its citizens' welfare and represents the will of its citizens. In his well-known analysis of welfare capitalism, Esping-Andersen distinguished between three types of welfare states: social democratic,

¹⁴⁴⁰ Bandarage, supra.

¹⁴⁴¹ *Id.*

¹⁴⁴² *Id.*

¹⁴⁴³ *Id.*

¹⁴⁴⁴ *Id.*

¹⁴⁴⁵ *Id.*

¹⁴⁴⁶ Trygve Gulbrandsen, Continued Elite Support for the Norwegian Version of the Nordic Model?, 43 *Leibniz Institute for the Social Sciences* 113-140 (2018).

conservative, and liberal.¹⁴⁴⁷ In his analysis, Norway is seen as a set of “coordinated market economies” instead of “liberal market economies.”¹⁴⁴⁸ There are no exact features of the Nordic economy model, as each Nordic country has its own unique economic and social system.¹⁴⁴⁹ Nevertheless, each Nordic country agrees that it should adopt institutions and policies that support the welfare of its citizens.¹⁴⁵⁰

Many researchers have characterized the Nordic model by the primary responsibility that the government has for the citizens’ welfare and well-being.¹⁴⁵¹ This means that the government must provide universal social rights for the entire population or at least most people.¹⁴⁵² The Nordic model differs from the neo-liberal capitalism model applied in the U.S. and other Anglo-Saxon countries, which is inspired by Adam Smith. In his famous book *The Wealth of Nations*, Smith argued the following: “Every individual ... neither intends to promote the public interest, nor knows how much he is promoting it ... he intends only his own security; and by directing that industry in such a manner as its produce may be of the greatest value, he intends only his own gain, and he is in this, as in many other cases, led by an invisible hand to promote an end which was no part of his intention.”¹⁴⁵³ This means that the country must limit its interference with the market because the market functions appropriately to benefit society. The Nordic model clearly contradicts the neo-liberal capitalism model, as the former relies on the state for the welfare of the citizens, while the latter depends on private entities to achieve the same goal.

¹⁴⁴⁷ Gosta Esping-Andersen, *The three worlds of welfare capitalism* (Princeton University Press, 1990).

¹⁴⁴⁸ *Id.*

¹⁴⁴⁹ Gulbrandsen, *supra*.

¹⁴⁵⁰ Niels Finn Christiansen, *The Nordic model of welfare: a historical reappraisal* (Museum Tusulanum Press, 2006).

¹⁴⁵¹ Erling Barth, Karl O. Moene and Fredrik Willumsen, Reprint of "The Scandinavian model—An interpretation", *127 Journal of Public Economics* 17-29 (2015).

¹⁴⁵² *Id.*

¹⁴⁵³ Adam Smith, *The Wealth of Nations* 1-524 (1st ed, 1776).

The basis of the Nordic model was introduced in the 19th century.¹⁴⁵⁴ In the aftermath of the 1848 revolutions led by Marcus Thrane, Norwegian workers began to organize themselves against their employers.¹⁴⁵⁵ The first union was established in 1899 at the plant's level, and it became nationwide with the creation of the Workers' National Trade Union.¹⁴⁵⁶ This union is known today as the LO, which is the largest labor federation in Norway.¹⁴⁵⁷ The union has 900,000 members out of a total population of roughly five million.¹⁴⁵⁸ Notably, Norway passed its first accident insurance law for factory workers in 1894.¹⁴⁵⁹ This law was the government's first step to protect its citizens from private enterprises. In 1909, Norway passed the first health insurance act that implied all workers with an income under a specified level must have mandatory insurance.¹⁴⁶⁰ These laws protected the population's equality in response to growing concerns about the extent and consequences of poverty in Norway.¹⁴⁶¹ After World War II, the government enacted the National Insurance Act to address issues such as universal family allowance, continued wages during sick leave, health insurance, unemployment benefits, and old-age pensions.¹⁴⁶²

The Norwegian economic model was approved and accepted by all political parties.¹⁴⁶³ They agreed to provide whatever is necessary to achieve the welfare of the citizens. For instance, the country has adopted a public educational system for all citizens.¹⁴⁶⁴ Many Norwegian civil servants have argued that the country should be based on the rule of law and also function as a

¹⁴⁵⁴ Gulbrandsen, supra.

¹⁴⁵⁵ Gunnar Aakvaag, Institutional Change in the Public Sphere 71-96 (1st ed, 2017).

¹⁴⁵⁶ *Id.*

¹⁴⁵⁷ *Id.*

¹⁴⁵⁸ *Id.*

¹⁴⁵⁹ Gulbrandsen, supra.

¹⁴⁶⁰ *Id.*

¹⁴⁶¹ *Id.*

¹⁴⁶² *Id.*

¹⁴⁶³ Barth, Moene and Willumsen, supra.

¹⁴⁶⁴ *Id.*

“Kulturstaat.”¹⁴⁶⁵ Hence, the country should play a moral and social role to protect its citizens, especially the weak.¹⁴⁶⁶ For instance, during recessions, the country is obligated to prevent unemployment among young people.¹⁴⁶⁷ For this purpose, Norway has increased the number of students in higher education institutions to reduce youth unemployment.¹⁴⁶⁸ Important institutional and structural conditions have facilitated the Norwegian model,¹⁴⁶⁹ such as the 1814 Constitution, which established individual rights and thus laid the foundation of the ensuing political mobilization of broad segments of the Norwegian population.¹⁴⁷⁰

The citizens of Norway seem to resist the idea of an unregulated market adopted by the European Union (EU).¹⁴⁷¹ This resistance can be seen in the voting results for its potential EU membership. Norway is not part of the EU, and it has a different economic system than EU countries. The People’s Movement worked against Norwegian membership in the European Community (EC) and informed the citizens about their main issues.¹⁴⁷² The movement criticized the Treaty of Rome and argued that this treaty would remove politicians’ economic control, leaving the citizens at the mercy of a private entity.¹⁴⁷³ This would lead to social injustice in the long term.¹⁴⁷⁴ Such inequality goes against the government’s main goal, which is to support the welfare state and democratization.¹⁴⁷⁵

¹⁴⁶⁵ Gulbrandsen, *supra*.

¹⁴⁶⁶ Daron Acemoglu, James A. Robinson and Thierry Verdier, Can't We All Be More Like Scandinavians? Asymmetric Growth and Institutions in an Interdependent World (National Bureau of Economic Research, 2012).

¹⁴⁶⁷ Gulbrandsen, *supra*.

¹⁴⁶⁸ *Id.*

¹⁴⁶⁹ *Id.*

¹⁴⁷⁰ *Id.*

¹⁴⁷¹ Ingrid Sogner & Clive Archer, Norway and Europe: 1972 and Now, 33 J. COMMON MKT. Stud. 389 (1995).

¹⁴⁷² *Id.*

¹⁴⁷³ *Id.*

¹⁴⁷⁴ *Id.*

¹⁴⁷⁵ Marit Bakke, Cultural Policy in Norway, 31 J. Arts MGMT. L. & Soc'y 10 (2001).

There are many examples that clarify the role of the government in the economic system. For instance, the government has interfered heavily in the health sector, aiming to achieve the most welfare possible for its citizens by enacting the National Insurance Act (1997).¹⁴⁷⁶ This law was based on the idea that the government is responsible for its citizens and must provide comprehensive universal services to them.¹⁴⁷⁷ More specifically, the law focuses on protecting women due to their reproductive and productive roles,¹⁴⁷⁸ and it aims to prevent the unequal treatment of women in employment due to their reproductive role.¹⁴⁷⁹ Moreover, Norway created the Health Project (2005) to support public care, following the guidelines of the Organization for Economic Co-operation and Development (OECD).¹⁴⁸⁰ This project has the second-highest position in long-term care public expenditures among 12 countries, measured as a GDP percentage.¹⁴⁸¹ Hence, the country is considered to be a social-democratic welfare regime with a high degree of decommodification,¹⁴⁸² meaning that citizens depend minimally on factors such as the market or their income for care.¹⁴⁸³

There are different approaches to wealth and equality in democracies. In his book, Jedediah Purdy addressed the issue of inequality in the United States, and he claimed that wealth should be equal and not an issue for democracy.¹⁴⁸⁴ In *Capital in the 21st Century*, Thomas Piketty explored the significant inequality around the world despite the growing wealth.¹⁴⁸⁵ Clearly, a neo-liberal economy cannot sufficiently address inequality without government

¹⁴⁷⁶ Look the National Insurance Act (1997): available at: <https://extranet.who.int/nutrition/gina/en/node/24181>

¹⁴⁷⁷ Id.

¹⁴⁷⁸ Id.

¹⁴⁷⁹ Id.

¹⁴⁸⁰ Karen Christensen, Towards a Mixed Economy of Long-Term Care in Norway, 32 CRITICAL Soc. POL'y 577 (2012).

¹⁴⁸¹ Id.

¹⁴⁸² Id.

¹⁴⁸³ Id.

¹⁴⁸⁴ JEDEDIAH PURDY, *Wealth and Democracy*, 58 Nomos 235-260 (2015).

¹⁴⁸⁵ Id.

intervention. In *The Theory of Justice*, John Rawls argued that equal rights in political participation are linked to economic equality.¹⁴⁸⁶ Rawls also believed that unequal political power is a result of unequal economic power, which is reflected in the legal rules and policies that favor the wealthy.¹⁴⁸⁷ Following his argument, the government should continually improve the distribution of wealth to avoid excessive concentrations of economic power.¹⁴⁸⁸

Purdy proposed a different kind of economy and laws to address inequality and climate change.¹⁴⁸⁹ More specifically, he asserted that neo-liberal laws and economics can be replaced with more democratic laws and political-economic approaches to promote “an economy and ecology of common care.”¹⁴⁹⁰ This new vision should guarantee a commonwealth for the citizens.¹⁴⁹¹ This vision might be applicable through significant partisan resourcefulness, as, according to Purdy, law and economics are simply the jurisprudence of the winner.¹⁴⁹² Purdy outlined that the limited role of the government in achieving minimum welfare for its citizens has allowed the winners of wealth and power to barricade themselves away from their obligations to the common people.¹⁴⁹³

Moreover, Purdy argued that protecting nature is important for human survival and spiritualism.¹⁴⁹⁴ In particular, protecting nature is essential to providing a sense of wonder and imagination to humans.¹⁴⁹⁵ Purdy also presented imagination as essential for humans to form

¹⁴⁸⁶ *Id.*

¹⁴⁸⁷ *Id.*

¹⁴⁸⁸ *Id.*

¹⁴⁸⁹ JEDEDIAH PURDY, *This Land Is Our Land: The Struggle for a New Commonwealth* (Princeton University Press, 2019).

¹⁴⁹⁰ *Id.*

¹⁴⁹¹ *Id.*

¹⁴⁹² *Id.*

¹⁴⁹³ *Id.*

¹⁴⁹⁴ JEDEDIAH PURDY, *After Nature: A Politics for the Anthropocene* (Harvard University Press, 2015).

¹⁴⁹⁵ *Id.*

their civic identity and collective self-creation.¹⁴⁹⁶ This new perspective promotes greater harmony between humans and their environment.¹⁴⁹⁷ Furthermore, Purdy stated that the romantic vision of protecting nature is important in shaping our future economy and policies.¹⁴⁹⁸ Hence, humans must reconnect with nature rather than chase the luxuries that development offers.¹⁴⁹⁹

1.2. Impact of fossil fuels on the Norwegian economy

However, the latest oil crisis challenged Norway's ability to provide the usual level of public welfare.¹⁵⁰⁰ Norway's oil has enabled the country to boost its citizens' welfare, and thus, the cost of welfare has largely been determined by oil revenues.¹⁵⁰¹ Because of the oil crisis, suppliers to the oil industry executed cost reduction measures and made large workforce cuts, causing ripple effects in other related industries as the demand for goods and services decreased.¹⁵⁰² This made the government consider engaging the private sector more in the economy. Previously, the government provided welfare to the citizens even if its methods were not economically efficient. Judge Leif Villars-Dahl with the Oslo Court of Probate and Enforcement wrote a report that suggests the government should make legislative changes to facilitate a more flexible restructuring scheme to save more businesses and preserve jobs.¹⁵⁰³ A formal hearing occurred after the report to study the suggestions provided by Villars-Dahl.¹⁵⁰⁴ Parliament approved these suggestions, and many laws have been changed in response, such as the Bankruptcy Act. It implemented new rules on international bankruptcies, including those that

¹⁴⁹⁶ *Id.*

¹⁴⁹⁷ *Id.*

¹⁴⁹⁸ *Id.*

¹⁴⁹⁹ *Id.*

¹⁵⁰⁰ Stine Snertingdalen & Ingrid Tronshaug, Norway, 37 INT'L FIN. L. REV. 132 (2018).

¹⁵⁰¹ *Id.*

¹⁵⁰² *Id.*

¹⁵⁰³ *Id.*

¹⁵⁰⁴ *Id.*

clarify the effects of foreign insolvency proceedings in Norway, jurisdiction and choice-of-law rules, and recognition and enforcement rules.¹⁵⁰⁵

1.3. The beginning of a competitive market system in Norway

Moreover, until the 1980s, Norway's financial system suffered due to the government's reluctance to provide an easy and competitive market.¹⁵⁰⁶ Norway used to have strict banking regulations, and cumbersome administrative requirements for foreigners and stringent exchange controls were abundant.¹⁵⁰⁷ For example, all cross-border transactions required individual licenses from the Bank of Norway.¹⁵⁰⁸ The country also prevented the establishment of all foreign-based financial institutions in Norway.¹⁵⁰⁹ However, the country adopted a deregulatory trend toward a market-oriented financial system in the 1980s.¹⁵¹⁰ The legislation that covered the bank sector was relaxed.¹⁵¹¹ The country also allowed for foreign financial institutions to establish branches in Norway,¹⁵¹² and the exchange-control regulations were also relaxed, which made it easier to comply with these laws.¹⁵¹³

Crucially, the price of health care is expected to increase due to Norway's aging population.¹⁵¹⁴ An OECD Policy Brief (2005) questioned the methods used in Norway to meet the increasing costs of these services.¹⁵¹⁵ The OECD stated that the private and public sectors

¹⁵⁰⁵ *Id.*

¹⁵⁰⁶ Oyvind Hovland, Tom E. Eide & Laura E. Silverstein, *Norway: A Market Primed to Flourish*, 2 INT'L TAX REV. 57 (1991).

¹⁵⁰⁷ *Id.*

¹⁵⁰⁸ *Id.*

¹⁵⁰⁹ *Id.*

¹⁵¹⁰ *Id.*

¹⁵¹¹ *Id.*

¹⁵¹² *Id.*

¹⁵¹³ *Id.*

¹⁵¹⁴ Christensen, *supra*.

¹⁵¹⁵ *Id.*

must cooperate to provide health care, especially when the number of very old persons in the population will increase steeply.¹⁵¹⁶ However, the government cannot satisfy these needs by itself, especially after the oil crisis, which caused a budget shortage. Evidently, the idea of the welfare state may not be sustainable, as it relies heavily on factors such as the oil price. Some researchers have argued that the welfare state can no longer meet this increasing demand. This would force the welfare state to transfer responsibilities to and include the private market, the voluntary sector, informal networks, and long-term care users themselves.¹⁵¹⁷

1.4. Role of the oil crash in shifting towards a sustainable economy in Norway

The oil crisis has forced the government to provide a competitive market that will support the expected welfare of its citizens. This means that the government has allowed the private sector to engage heavily in the economy. For instance, the government's total control of petroleum operations was abandoned, favoring freer competition in the 1990s.¹⁵¹⁸ As a result, the private sector, including foreign investors, can now invest in oil in Norway. Moreover, the public oil company Statoil sold its stocks to investors, meaning that the government no longer owns the company.¹⁵¹⁹ Therefore, the company should act based on its own goals, regardless of the government's goals. The interest of the state in such activities was completely terminated in 1992.¹⁵²⁰ The sliding scale of participation was dropped the following year, and Statoil ceased to receive an automatic 50% of every license from 1996.¹⁵²¹ Overall, the country has shifted from

¹⁵¹⁶ *Id.*

¹⁵¹⁷ *Id.*

¹⁵¹⁸ Amanda Slevin, *Gas, oil and the Irish state: Norway and Ireland Too different to compare?* 130-158 (Manchester University Press, 2016).

¹⁵¹⁹ *Id.*

¹⁵²⁰ *Id.*

¹⁵²¹ *Id.*

Norwegianization to internationalization by allowing the private sector to become a major part of all aspects of the country's economic system.¹⁵²²

1.5. Agreement on the European Economic Area

Norway has also taken a further step to adapt its market system by signing the European Economic Area Agreement (EEA).¹⁵²³ The European Economic Area includes both the EU members and the three European Free Trade Association (EFTA) states: Iceland, Liechtenstein, and Norway.¹⁵²⁴ The EEA is an international agreement that aims to allow the EFTA states to fully engage in the EU's single market.¹⁵²⁵ This agreement covers what is known as the four freedoms.¹⁵²⁶ These freedoms ensure the free movements of goods, capital, services, and people, and they are supported by relevant competition and state aid rules and horizontal areas.¹⁵²⁷ The agreement also seeks to standardize the application of laws relating to the single market¹⁵²⁸ and cover policies that address issues other than the four freedoms, such as consumer protection, company law, environment, social policy, and statistics.¹⁵²⁹ The EEA also encourages cooperation between members of the agreement in research and technological development, education, training and youth, employment, tourism, culture, civil protection, enterprise, entrepreneurship, and small- and medium-sized enterprises.¹⁵³⁰ It also outlines that the Court of

¹⁵²² *Id.*

¹⁵²³ Look at the European Economic Area (EEA) site: The Basic Features of the EEA Agreement, available at:

<https://www.efta.int/eea/eea-agreement/eea-basic-features>

¹⁵²⁴ *Id.*

¹⁵²⁵ *Id.*

¹⁵²⁶ *Id.*

¹⁵²⁷ *Id.*

¹⁵²⁸ *Id.*

¹⁵²⁹ *Id.*

¹⁵³⁰ *Id.*

Justice of the EU is of relevance to the EEA Agreement, and members states are thus obligated to adhere to the court's rulings.¹⁵³¹

1.6. Role of the government in the economy

Although Norway has integrated the private sector into the economy, this does not mean that Norway has become a neoliberal economy within which the state's role is limited. Instead, the state has a clear role in the economy and can therefore resist the idea of "profits over welfare." In other words, while the private sector can benefit economically in the Norwegian market, it cannot do so in a way that will hurt the citizens. Moreover, the tax in Norway is high, aiming to provide all the social benefits to the citizens that the government cannot provide by itself. For instance, Norway enacted the Working Environment Act in 2005.¹⁵³² The law placed many restrictions on employers that they must adhere to regarding their employees.¹⁵³³ Article 3 of the act contains requirements regarding systematic health, the environment, and safety to safeguard employees at all levels.¹⁵³⁴ Employers must satisfy all requirements without alleging that such requirements would affect their profits and incentives to invest in the country. Evidently, the government has adopted a hybrid system between free-market and state-welfare ideologies.

Many examples clarify that Norway has allowed the private sector to become an important factor in the economy while also supporting the government's influence in it. For instance, Norway has adopted "flexicurity" in its market system.¹⁵³⁵ Flexicurity refers to the combination of liberal employment protection legislation (EPL) with generous income

¹⁵³¹ *Id.*

¹⁵³² The Working Environment Act, available at: http://ilo.org/dyn/natlex/natlex4.detail?p_lang=en&p_isn=70972

¹⁵³³ *Id.*

¹⁵³⁴ *Id.*

¹⁵³⁵ Tomas Berglund & Bengt Furaker, Flexicurity Institutions and Labour Market Mobility, 27 *Int'l J. Comp. Lab. L. & Indus. Rel.* 111 (2011).

protection, extensive active labor market policies (ALMPs), and good opportunities for lifelong learning (LLL) to combat unemployment.¹⁵³⁶ Flexicurity was intensely discussed in the labor markets in Europe during the first decade of the new millennium,¹⁵³⁷ and it follows the theory that flexibility and security do not contradict each other.¹⁵³⁸ Instead, it argues that employers can enjoy workforce flexibility while the workers' security needs can also be met.¹⁵³⁹ Flexibility and security can be created by certain institutional arrangements adopted by a government.¹⁵⁴⁰ In a non-regulated market, companies want to reorganize themselves and adjust their workforces' sizes quickly, without giving any kind of security to workers.¹⁵⁴¹ Hence, the government should find policy arrangements that can satisfy both employers and employees.¹⁵⁴²

Another example is the government's adoption of legal aid.¹⁵⁴³ Legal aid is built on three assumptions: some people cannot independently handle all of their legal problems, some experts can help vulnerable people who cannot independently solve their legal problems, and society has an implied obligation to provide legal aid to any individual who cannot afford it.¹⁵⁴⁴ Norway actively provided legal aid by enacting the Civil Procedure Act of 1915.¹⁵⁴⁵ Legal aid has been adopted based on the fact that if the parties handle the proceedings themselves, the risk of injustice might increase.¹⁵⁴⁶

¹⁵³⁶ *Id.*

¹⁵³⁷ *Id.*

¹⁵³⁸ *Id.*

¹⁵³⁹ *Id.*

¹⁵⁴⁰ *Id.*

¹⁵⁴¹ *Id.*

¹⁵⁴² *Id.*

¹⁵⁴³ Jon T. Johnsen, How Has the Complexity of the Law and the Market for Legal Expertise Impacted on the Development of Legal Aid in Norway, 13 INT'L J. LEGAL PROF. 19 (2006).

¹⁵⁴⁴ *Id.*

¹⁵⁴⁵ *Id.*

¹⁵⁴⁶ *Id.*

Furthermore, Norway was very active in moving toward a greener economy regardless of the private sector's interests.¹⁵⁴⁷ In fact, the Norwegian Constitution declares that the government shall protect the environment for its citizens.¹⁵⁴⁸ More specifically, Article 112 states the following: "Every person has the right to an environment that is conducive to health and to a natural environment whose productivity and diversity are maintained. Natural resources shall be managed based on comprehensive long-term considerations which will safeguard this right for future generations as well."¹⁵⁴⁹ This shows that the government must do more than create a competitive market. Rather, it must also protect the welfare of its citizens.

The Norwegian government has taken serious steps toward pursuing a greener economy.¹⁵⁵⁰ The UN Conference on Sustainable Development (UNCSD) specified that countries must be serious about protecting the environment.¹⁵⁵¹ The EU committed to a greener economy by adopting Directive 2009/28/EC to promote the use of renewable energy.^{1552 1553} Moreover, the EU's Renewable Energy Directive targeted a 20% share of renewable energy in the EU's overall energy consumption and a mandatory 10% minimum to be achieved in the transport sectors of its member states by 2020.¹⁵⁵⁴ The EU has allowed the member states to adopt whatever measures are suitable for them to achieve these goals. In this context, Norway has actively planned to support clean energy.¹⁵⁵⁵ Norway went even further than countries such

¹⁵⁴⁷ Markus W. Gehring, Legal Transition to the Green Economy, 12 MCGILL INT'L J. Sust. DEV. L. & POL'y 135 (2016).

¹⁵⁴⁸ Hans Petter Graver, Business Enterprises and the Environmental Information Act in Norway, 12 Frontiers L. CHINA 3 (2017).

¹⁵⁴⁹ *Id.*

¹⁵⁵⁰ Gehring, *supra*.

¹⁵⁵¹ *Id.*

¹⁵⁵² *Id.*

¹⁵⁵³ Note: The shift towards renewable energy in Norway will be discussed heavily below.

¹⁵⁵⁴ *Id.*

¹⁵⁵⁵ Mikal Brondmo, Oil and Gas Projects in Norway: Recent Developments within Offshore Construction, 13 Const. L. INT'L 33 (2018).

as Sweden by setting a very ambitious energy target, pledging for over 50% of its total energy use to be from renewable sources by 2020.

In fact, Norway went even further in protecting the environment by forcing companies to provide information to the public about how their activities impact it.¹⁵⁵⁶ In 2003, Norway enacted an act that gives the public the right to request environmental information from private entities such as business enterprises.¹⁵⁵⁷ Therefore, Norway goes beyond international rules regarding environmental protection, such as the Aarhus Convention.¹⁵⁵⁸ Norway created this act because whenever the public awareness of the environment and factors affecting it or likely to affect it increases, the quality of the environment improves.¹⁵⁵⁹ People might pressure their government to protect the environment when information about it is accessible from both the government and business enterprises. In other words, access to information may contribute to democracy and public participation in decision making that affects the environment.¹⁵⁶⁰ Those individuals who are concerned about the environment want to understand how business enterprises operate and perform and also seek out the plans that such enterprises have for their future operations.¹⁵⁶¹ Hence, the Norwegian government actively provides a competitive market for the private sector while also working toward internationally oriented goals and the political agenda of promoting global welfare-capitalism.¹⁵⁶²

¹⁵⁵⁶ Graver, supra.

¹⁵⁵⁷ *Id.*

¹⁵⁵⁸ *Id.*

¹⁵⁵⁹ *Id.*

¹⁵⁶⁰ *Id.*

¹⁵⁶¹ *Id.*

¹⁵⁶² Øyvind Ihlen and Heidi von Weltzien Hoivik, Ye Olde CSR: The Historic Roots of Corporate Social Responsibility in Norway, 127 *Journal of Business Ethics* 109-120 (2015).

The strong presence of the government in regulating the market appears to favor equality in terms of its outcomes.¹⁵⁶³ Compared to other Western countries, Norway more efficiently upholds fairly high employment rates and supports a welfare state that offers the citizens universal and relatively generous economic benefits.¹⁵⁶⁴ Furthermore, the Norwegian model rests on the historical elite compromises forged between various class and interested organizations and movements.¹⁵⁶⁵ Hence, the government represents the people's interests as a whole, and it does not merely select the economy's rules and then allow for private enterprises to compete regardless of the inequality that might occur to citizens. The social role of the state in Norway can clearly be seen through various important welfare programs. Ultimately, the Norwegian model results from a successful combination of facilitating conditions such as an active labor movement, a unique wage determination system, influential economists, a historically uncorrupted and efficient civil service, a strong rural counter-culture, and overall egalitarian values.¹⁵⁶⁶ Despite the argument that the neo-liberal economic model is more efficient for society than other models, Norway has become an attractive holding location for the European market.¹⁵⁶⁷

2. Norwegian sovereign wealth fund

Andrew Rozanov viewed the sovereign wealth fund (SWF) as a distinct entity from traditional public pension funds and reserve assets supporting currencies.¹⁵⁶⁸ There is no

¹⁵⁶³ Berglund and Furaker, supra.

¹⁵⁶⁴ Gulbrandsen, supra.

¹⁵⁶⁵ Id.

¹⁵⁶⁶ Id.

¹⁵⁶⁷ Rainer Zielke, Norway as an Attractive Holding Location for the European Market, 41 Intertax 49 (2013).

¹⁵⁶⁸ Gordon L. Clark, Adam D. Dixon and Ashby H. B. Monk, Sovereign Wealth Funds: Legitimacy, Governance, and Global Power (Princeton University Press, 2013).

standardized definition as SWFs differ in size, age, structure, funding sources, governance, and policy objectives.¹⁵⁶⁹ When a country runs a current account surplus and accumulates more reserves than it feels it needs for immediate purposes, it can create a sovereign fund to manage those “extra” resources.¹⁵⁷⁰ Although SWFs were created back in the 1950s, they increased significantly in the 1990s.¹⁵⁷¹ Many studies have agreed that SWFs became popular after the Asian financial crisis in 1997.¹⁵⁷² This crisis radically changed the demands for international reserves, leading to increased hoarding by the affected countries over time.¹⁵⁷³ Another study has argued that SWFs were created as a form of self-insurance for countries because of the conditions imposed by the International Monetary Fund (IMF) and the associated loss of sovereignty.¹⁵⁷⁴

2.1. Government Pension Fund Act

Norway created its SWF in 1990 by enacting the Government Pension Fund Act.¹⁵⁷⁵ The GPFG, previously “the Oil Fund,”¹⁵⁷⁶ is the largest in Europe and second-largest in the world.¹⁵⁷⁷ The GPFG aims to use oil revenues without affecting general income flow to the government, thereby buffering the impact of volatile oil revenues on government spending.¹⁵⁷⁸ Article 1 of the act states that the fund is an instrument to make financial savings that benefit both the current

¹⁵⁶⁹ *Id.*

¹⁵⁷⁰ Look at the IMF's report written by Simon Johnson: *The Rise of Sovereign Wealth Funds* (2007). Available at: <https://www.imf.org/external/pubs/ft/fandd/2007/09/pdf/straight.pdf>

¹⁵⁷¹ *Id.*

¹⁵⁷² Clark, Dixon and Monk, *supra*.

¹⁵⁷³ *Id.*

¹⁵⁷⁴ *Id.*

¹⁵⁷⁵ The Government Pension Fund Act, *supra*.

¹⁵⁷⁶ Larry Cata Backer, *The Norwegian Sovereign Wealth Fund: Between Private and Public*, 40 *GEO. J. INT'L L.* 1271 (2009).

¹⁵⁷⁷ Anita M. Halvorssen, *Norwegian Sovereign Wealth Fund's Ethical Guidelines: A Model for Investors*, *The*, 8 *Eur. Company L.* 88 (2011).

¹⁵⁷⁸ Halvorssen and Eldredge, *supra*.

generation and also future generations.¹⁵⁷⁹ Since the 1970s, the government has recognized the danger of its overreliance on oil.¹⁵⁸⁰ Thus, the government began depositing 90% of the total oil revenue into the fund to reinvest it, the first payment occurring in 1996.¹⁵⁸¹ The fund invests the royalties from natural resource developments to earn a return above the national rate of growth.¹⁵⁸² Article 6 affirms that the GPF is prohibited from investing in Norway because of the concerns regarding the perverse impacts that this could have on the domestic economy.¹⁵⁸³

The Norwegian government is the owner of the GPF, which is managed by the Ministry of Finance (MoF) according to the act.¹⁵⁸⁴ The ministry dictates only the overall strategy of the fund,¹⁵⁸⁵ as the operational management has been delegated to the Norwegian central bank.¹⁵⁸⁶ Because the operational management of the fund is not a central bank function, it must be separated from the central bank's other activities, and this division is referred to as the Norges Bank Investment Management (NBIM).¹⁵⁸⁷ The fund is designed to invest 35–40% in bonds, 60% in equities, and 5% in real estate.¹⁵⁸⁸ It invests in 70 developed and emerging markets to manage risk.¹⁵⁸⁹ Moreover, it invests in 8,000 companies and owns approximately 1.3% of all globally listed shares.¹⁵⁹⁰ The GPF has a higher risk-bearing capacity than many comparable funds since it has a very long investment horizon and must not provide short-term liquidity.¹⁵⁹¹

¹⁵⁷⁹ The Government Pension Fund Act (Article 1), supra.

¹⁵⁸⁰ The Government Pension Fund Act (Article 4), supra.

¹⁵⁸¹ Heather Hachigian, Ambiguity, discretion and ethics in Norway's sovereign wealth fund, 17 *Business and Politics* 603–631 (2015).

¹⁵⁸² *Id.*

¹⁵⁸³ The Government Pension Fund Act (Article 6), supra.

¹⁵⁸⁴ The Government Pension Fund Act (Article 3(1)), supra.

¹⁵⁸⁵ Halvorssen and Eldredge, supra.

¹⁵⁸⁶ Halvorssen, supra.

¹⁵⁸⁷ *Id.*

¹⁵⁸⁸ Hachigian, supra.

¹⁵⁸⁹ Halvorssen and Eldredge, supra.

¹⁵⁹⁰ *Id.*

¹⁵⁹¹ *Id.*

Nevertheless, despite this capacity, Article 2 of the act states that the fund must achieve maximum financial return with moderate risk.¹⁵⁹²

2.2. Council on Ethics

Norway established the Council on Ethics by royal decree to fulfill its ethical obligations to future generations.¹⁵⁹³ The Council on Ethics, consisting of five members, has two obligations: the GPFG must make returns from the oil wealth contingent on sustainable development and the companies in which the GPFG invests must not violate human rights.¹⁵⁹⁴ These obligations have formed the premises for the Ethical Guidelines.¹⁵⁹⁵ The Ethical Guidelines are based on the works of international organizations such as the UN, OECD, and International Labor Organization (ILO).¹⁵⁹⁶ The Council of Ethics uses these organizations to define the minimum requirements for the companies that the GPFG aims to invest in, targeting fundamental rights and protecting the environment, human life, and health.¹⁵⁹⁷ There are three mechanisms that the GPFG can use to achieve these obligations: exercising ownership rights (e.g., active ownership), placing companies under observation, and excluding companies.¹⁵⁹⁸ Since 2014, the council has reported directly to the central bank.¹⁵⁹⁹

The other arm of the fund's ethical investment policy has been implemented by the NBIM, which focuses mainly on six issues: climate change, water management, children's rights, and three corporate governance issues.¹⁶⁰⁰ The NBIM has the discretion to decide the

¹⁵⁹² *Id.*

¹⁵⁹³ Halvorssen, *supra*.

¹⁵⁹⁴ *Id.*

¹⁵⁹⁵ *Id.*

¹⁵⁹⁶ *Id.*

¹⁵⁹⁷ *Id.*

¹⁵⁹⁸ *Id.*

¹⁵⁹⁹ Hachigian, *supra*.

¹⁶⁰⁰ *Id.*

companies the fund will engage with and how it does so.¹⁶⁰¹ The MoF created the Strategy Council for the GPFG in 2013.¹⁶⁰² The Strategy Council has provided many suggestions to the GPFG regarding responsible investment.¹⁶⁰³ These suggestions include expanding the grounds for exclusion to include fossil fuels companies, giving more autonomy to Council of Ethics, increasing the transparency of the GPFG regarding its strategies, and considering the OECD Guidelines for Multinational Enterprises whenever there is a significant risk of actual or potential adverse environmental or social impacts.¹⁶⁰⁴

The GPFG can benefit in many ways if it pursues long-term investments in socially responsible companies. For example, companies that focus on sustainability outperform their competitors over time.¹⁶⁰⁵ Many companies have started to address environmental, social, and corporate governance (ESG) issues, and this strategy is referred to as a responsible investment.¹⁶⁰⁶ The process of incorporating environmental and social costs into the cost of production is called “internalizing the negative externalities of production,” and adapting such a principle leads companies to outperform their competitors in the long run.¹⁶⁰⁷ Unfortunately, many companies and investors ignore environmental costs and focus on short-term profits rather than long-term sustainability.¹⁶⁰⁸ SWFs aim to achieve both the intersection of sustainable investments and the maximization of financial returns, and they can also influence companies that want their investment to become more socially responsible.¹⁶⁰⁹

¹⁶⁰¹ *Id.*

¹⁶⁰² Halvorssen and Eldredge, *supra*.

¹⁶⁰³ Hachigian, *supra*.

¹⁶⁰⁴ *Id.*

¹⁶⁰⁵ Halvorssen and Eldredge, *supra*.

¹⁶⁰⁶ *Id.*

¹⁶⁰⁷ *Id.*

¹⁶⁰⁸ *Id.*

¹⁶⁰⁹ *Id.*

The Council of Ethics used to apply standards grounded in the home state and international consensus standards.¹⁶¹⁰ Both standards were applied to project international norms into “weak governance zones” or address the extraterritorial application of Norwegian law.¹⁶¹¹ However, the Council of Ethics has since discounted both standards and given the GPFG the discretion to decide the legitimacy of an investment itself.¹⁶¹² The GPFG usually applies Norwegian law to its investment activities.¹⁶¹³ Such a strategy encourages private sectors to adhere to the Norwegian law, such as in protecting the environment, if they want to be invested in.¹⁶¹⁴ This means that the fund can affect the companies’ governance decisions even if it cannot affect the targeted host state’s regulatory climate.¹⁶¹⁵ The fund can withdraw investments from companies that have damaged the environment but did not violate a domestic law. This can occur when many companies clearly violate domestic laws, but the host state does nothing to stop the violation.¹⁶¹⁶ In other words, companies that seek to receive an investment from the GPFG must follow domestic laws and also the Norwegian laws that protect the environment.

However, the Council of Ethics and the GPFG in general have been criticized for ethical reasons. For instance, the fund focuses on limited human rights and does not concentrate on other important issues such as labor rights.¹⁶¹⁷ The fund also has broad discretion in deciding which companies to invest in or exclude, which leads to corruption due to the ambiguity of the selection process. Moreover, Statoil seems to be engaged in foreign activities that would be

¹⁶¹⁰ Larry Cata Backer, *Sovereign Investing and Markets-Based Transnational Rule of Law Building: The Norwegian Sovereign Wealth Fund in Global Markets*, 29 AM. U. INT’L L. REV. 1 (2013).

¹⁶¹¹ *Id.*

¹⁶¹² *Id.*

¹⁶¹³ *Id.*

¹⁶¹⁴ *Id.*

¹⁶¹⁵ *Id.*

¹⁶¹⁶ *Id.*

¹⁶¹⁷ Hachigian, *supra*.

prevented in Norway.¹⁶¹⁸ In their report, Ryggvik and Engen asserted that Statoil extracts large values from desperately developing countries in immoral ways.¹⁶¹⁹ In Angola, the company was caught paying exorbitant consultancy fees to a company related to the president's son, and the primary explanation was corruption.¹⁶²⁰

Furthermore, Statoil has also engaged in prohibited activities in countries such as Canada, the U.S., and Ireland.¹⁶²¹ The company has been involved in sands development in Canada and gas production widely known as "fracking" in the US, and it has a 36.5% share of the Irish Corrib gas field.¹⁶²² The government seems to overlook the companies' activities, especially if they happen abroad. A former member of Statoil's board of directors, "Erik," said that he did not like some activities that the company was engaged in regarding unconventional gas (e.g., shale) in the U.S. because of the risk to underground drinking water posed by fracking.¹⁶²³ Erik also said that the company has engaged in oil sands development in Canada, causing a large amount of CO₂ to be released into the atmosphere.¹⁶²⁴ Nevertheless, Erik argued that Statoil does these activities with 30% less pollution than other companies would produce.¹⁶²⁵

Although there are issues with the Norwegian government's public oil company and the GPFG, the country's approach has contributed to a socio-economic transformation that promises wealth for future generations.¹⁶²⁶ The GPFG has also encouraged many companies to protect environmental and human rights to receive the necessary investment, which has increased the

¹⁶¹⁸ Slevin, *supra*.

¹⁶¹⁹ Helge Ryggvik and OAH Engen, *The Hidden Agenda: Framework for an Alternative Policy. A Norwegian Trade Union Perspective on the Internationalisation of Statoil* (Rogaland: SAFE, 2005).

¹⁶²⁰ *Id.*

¹⁶²¹ Slevin, *supra*.

¹⁶²² *Id.*

¹⁶²³ *Id.*

¹⁶²⁴ *Id.*

¹⁶²⁵ *Id.*

¹⁶²⁶ *Id.*

number of socially responsible companies.¹⁶²⁷ The GPFG is not supposed to reflect the state's power, but rather it should maximize the profits from socially responsible companies, given that the GPFG is a non-sovereign investment entity and not a regulator.¹⁶²⁸ Consequently, the fund is beneficial for global financial markets.¹⁶²⁹

2.3. Long-term goal of the Norwegian sovereign wealth fund

SWFs should be seen as model investors because they seek long-term profits.¹⁶³⁰

According to a U.S. official, they act like long-term investors and are expected to stick with a strategic asset allocation despite short-term losses.¹⁶³¹ SWFs must not be impacted by capital requirements that aim to liquidate positions rapidly.¹⁶³² As many in the private sector also use private fund managers, consultants, administrators, and custodians, SWFs essentially function as many private entities already do.¹⁶³³ SWFs also have the potential to facilitate an efficient allocation of revenues from commodity surpluses across countries and enhance market liquidity, including during times of global financial stress.¹⁶³⁴ Many SWF managers have decided to take higher returns and improve diversification by investing more heavily in equities.¹⁶³⁵ This means that SWFs act as private entities in the global market and thus must not be treated differently.

However, SWFs have faced many criticisms regarding their effectiveness for the host countries. Many argue that SWFs are not privately owned but rather owned by other

¹⁶²⁷ Halvorssen, supra.

¹⁶²⁸ Backer, supra.

¹⁶²⁹ *Id.*

¹⁶³⁰ Richard A. Epstein and Amanda M. Rose, *The Regulation of Sovereign Wealth Funds: The Virtues of Going Slow*, 76 *The University of Chicago Law Review* 111-134 (2009).

¹⁶³¹ *Id.*

¹⁶³² *Id.*

¹⁶³³ *Id.*

¹⁶³⁴ *Id.*

¹⁶³⁵ *Id.*

countries.¹⁶³⁶ This by itself should be a concern since their goals might not be to make pure profits. Instead, the countries with SWFs might invest to achieve political goals or increase their ownership and control of international assets.¹⁶³⁷ Many countries have expressed their concern about SWFs, as a host country's defense, media, or technology industries could be adversely influenced by them.¹⁶³⁸ This would not be an issue if the SWFs were only pursuing profits.¹⁶³⁹ Lawrence Summers, the Director of the National Economic Council, claimed that SWFs must trigger alarm bells.¹⁶⁴⁰ He argued that many countries would aim to extract technology or to achieve influence.¹⁶⁴¹ Likewise, Cox declared that the world should ask themselves whether they believe that SWFs controlled by other governments would seek only profits, not their own political interests.¹⁶⁴² For many in the U.S. and Europe, this fact is cause for much alarm.¹⁶⁴³

Moreover, SWFs have also been criticized due to their negative effect on the global market system. Because SWFs are absent from regulatory rules regarding transparency and accountability, their strategies and performance are shrouded in secrecy.¹⁶⁴⁴ Michael Fidora and Roland Beck pointed out that the seven largest SWFs, who owned half of all global SWF holdings at the time, were the least transparent compared to other funds.¹⁶⁴⁵ Thus, SWFs are expected to have systemic implications for the global financial system in the case of their failure due to their growing sizes.¹⁶⁴⁶ The IMF stated that “actual or rumored transactions may affect

¹⁶³⁶ Jamie Manzer and Jan Martin Witte, *Global Energy Governance: The New Rules of the Game* (Brookings Institution Press, Global Public Policy Institute, 2010).

¹⁶³⁷ *Id.*

¹⁶³⁸ Halvorssen, *supra*.

¹⁶³⁹ *Id.*

¹⁶⁴⁰ Epstein and Rose, *supra*.

¹⁶⁴¹ *Id.*

¹⁶⁴² *Id.*

¹⁶⁴³ Manzer and Witte, *supra*.

¹⁶⁴⁴ *Id.*

¹⁶⁴⁵ *Id.*

¹⁶⁴⁶ *Id.*

relative valuations in particular sectors and result in herding behavior, adding to volatility.”¹⁶⁴⁷ If SWFs adopt risk strategies in their investments, they may amplify rather than stabilize cycles.¹⁶⁴⁸ A small number of SWFs have a clear and comprehensive strategy that makes many countries skeptical about these funds.¹⁶⁴⁹

Nevertheless, these arguments tend to ignore private funds, which are similar to SWFs in that they mainly pursue their own interests.¹⁶⁵⁰ Many private funds use their investment power to effect changes in governments’ behaviors in a way that can only be described as broadly political.¹⁶⁵¹ Consequently, SWFs do not act differently than private funds.¹⁶⁵² The problem is that neither type of fund can function in a substantially apolitical way.¹⁶⁵³ In fact, the argument that SWFs harm the market because they prioritize their own interests contradicts with the core of capitalism described by Smith in *The Wealth of Nations*.¹⁶⁵⁴ Furthermore, the countries skeptical of how SWFs use their large capital positions to participate in private markets for political ends may take political actions themselves that can be criticized as harmful to other entities.¹⁶⁵⁵

Notably, the argument that SWFs would negatively affect the global financial market if they failed is exaggerated.¹⁶⁵⁶ Although the state-owned funds are ongoing developments, they account for a mere 3% of the equity and bond markets globally.¹⁶⁵⁷ Other assets such as pension

¹⁶⁴⁷ *Id.*

¹⁶⁴⁸ *Id.*

¹⁶⁴⁹ Gawdat Bahgat, *Sovereign Wealth Funds: Dangers and Opportunities*, 84 *Royal Institute of International Affairs* 1189-1204 (2008).

¹⁶⁵⁰ Backer, *supra*.

¹⁶⁵¹ *Id.*

¹⁶⁵² *Id.*

¹⁶⁵³ *Id.*

¹⁶⁵⁴ Smith, *supra*.

¹⁶⁵⁵ Backer, *supra*.

¹⁶⁵⁶ Epstein and Rose, *supra*.

¹⁶⁵⁷ Manzer and Witte, *supra*.

funds, bank assets, and securities still dominate the global market.¹⁶⁵⁸ The IMF projected that this percentage is unlikely to change in the near future.¹⁶⁵⁹ Consequently, the potential for SWFs to distort capital markets in this manner is limited.¹⁶⁶⁰ Even if SWFs are assumed to have political goals, they would only be able to bid up the prices of some securities and let the prices of others fall.¹⁶⁶¹ This by itself could be seen as distortion, but that ignores the corrective steps that other players, freed of such inhibitions, could take in the market.¹⁶⁶²

Many host countries have strict rules to monitor SWF investments in their countries to ensure that they do not threaten national security.¹⁶⁶³ For instance, the U.S. created the Committee on Foreign Investment in the United States (CFIUS), an inter-agency committee chaired by the Secretary of the Treasury to monitor SWFs.¹⁶⁶⁴ More specifically, the CFIUS completes reviews to protect national security while maintaining the credibility of the nation's open-investment policy and preserving the confidence of foreign investors.¹⁶⁶⁵ In other words, the CFIUS aims to welcome foreign investments while protecting national security. To monitor SWFs even more extensively, the U.S. later enacted the Foreign Investment and National Security Act of 2007 (FINSIA).¹⁶⁶⁶ The act places additional scrutiny on transactions involving foreign government-owned investments.¹⁶⁶⁷ Although U.S. officials have claimed that there was no evidence of oil funds pursuing political goals in their investments, the House of

¹⁶⁵⁸ *Id.*

¹⁶⁵⁹ *Id.*

¹⁶⁶⁰ Epstein and Rose, *supra*.

¹⁶⁶¹ *Id.*

¹⁶⁶² *Id.*

¹⁶⁶³ Bahgat, *supra*.

¹⁶⁶⁴ *Id.*

¹⁶⁶⁵ *Id.*

¹⁶⁶⁶ *Id.*

¹⁶⁶⁷ *Id.*

Representatives created a Sovereign Fund Task Force in February 2008 to examine these funds' transparency and accountability.¹⁶⁶⁸

In short, SWFs aim to boost their states' economies through long-term investments. The GPFG mainly serves as a financial reserve and long-term savings plan so that both current and future generations can benefit from the oil wealth.¹⁶⁶⁹ Clearly, Norway does not want to be under the mercy of oil revenues in the long term, whereas other oil-producing countries are struggling now that oil prices have decreased and the world is shifting toward renewable energy. Since the establishment of the fund, Norway has sought to wean itself from the oil addiction that impacts its spending.¹⁶⁷⁰ Although the fund receives its money from oil and gas revenues, these deposits now account for less than half the fund's value. Most of it has been earned by investing in equities, fixed income, and real estate.¹⁶⁷¹ Currently, the GPFG is the world's largest SWF, owning 1.5% of all shares in listed companies.¹⁶⁷²

3. Renewable Energy Laws in Norway

Norway is known as a country that has successfully shifted to renewable energy to satisfy its electricity demands. Approximately 98% of its total electricity production is from renewable resources, primarily from hydropower.¹⁶⁷³ More specifically, Norway relies heavily on hydropower, which comprises 129 TWh of its total 134 TWh of renewable energy production.¹⁶⁷⁴ This makes the country unique in terms of electricity production from both a

¹⁶⁶⁸ *Id.*

¹⁶⁶⁹ Look at the official Norges Bank site. Available at: <https://www.nbim.no/en/the-fund/about-the-fund/>

¹⁶⁷⁰ *Id.*

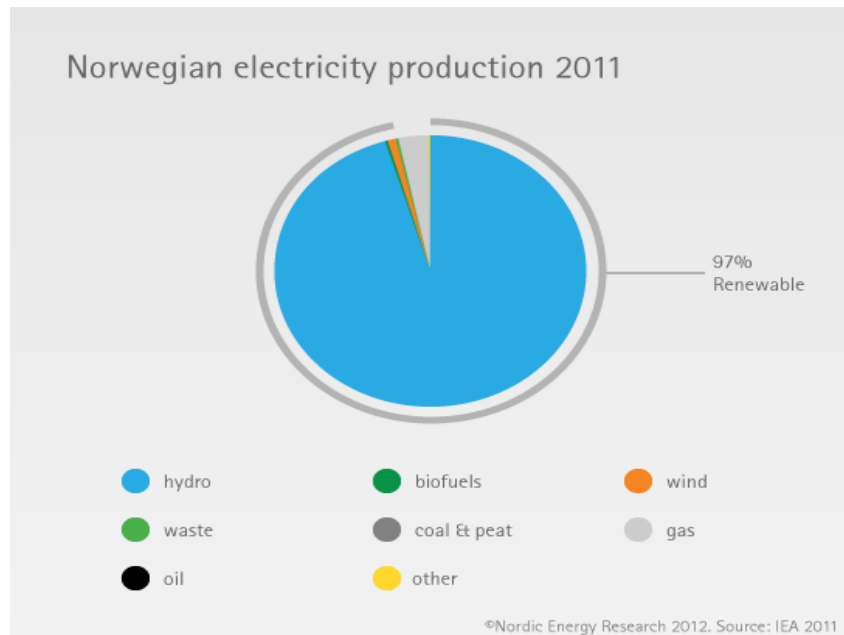
¹⁶⁷¹ *Id.*

¹⁶⁷² *Id.*

¹⁶⁷³ the official Norwegian government's site: Renewable energy production in Norway (2016), *supra*.

¹⁶⁷⁴ *Id.*

European and global perspective.¹⁶⁷⁵ Today, Norway is Europe's biggest hydropower producer and number six in the world,¹⁶⁷⁶ and it is considered to be a superpower in terms of renewable energy production.¹⁶⁷⁷ Moreover, Norway has taken international leadership roles in the U.N. and the World Bank to promote sustainable water resource management standards.¹⁶⁷⁸



3.1. Main role of hydropower in generating clean energy in Norway

According to many analysts, Norway has favored a scientific approach to hydropower in its decision making, which is essential to effectively diagnose problems and prescribe solutions.¹⁶⁷⁹ Although Norway has used informed management to apply scientific findings as premises for its policies, this does not mean that economic and political considerations became

¹⁶⁷⁵ Id.

¹⁶⁷⁶ the official Norwegian government's site: The History of Norwegian Hydropower in 5 Minutes (2016), supra.

¹⁶⁷⁷ Kristin Rosendal, Jon Birger Skjærseth and Steinar Andresen, Knowledge-based management of protected areas and hydropower: the case of Norway, 19 International Environmental Agreements: Politics, Law and Economics 515-530 (2019).

¹⁶⁷⁸ Id.

¹⁶⁷⁹ Id.

secondary. Rather, science was simply an important factor in its decision making.¹⁶⁸⁰ Because science can only provide a plan of how to protect and manage the environment, policies are needed to apply these scientific insights, which means that the separation of science and policy is difficult.¹⁶⁸¹

The idea of using water to generate energy is not new.¹⁶⁸² Ancient people discovered that they could harness the energy of water moving from higher to lower elevations, and the first use of the normal water cycle for labor-intensive work in the form of watermills was reported roughly 2,000 years ago in the Near East.¹⁶⁸³ In the late 19th century, people used hydropower to generate electricity, which boosted the industrialization process.¹⁶⁸⁴ As a result, countries with the relevant natural assets made huge hydropower projects to generate large amounts of electricity.¹⁶⁸⁵ In the 19th century, Sam Eyde, the pioneer industrialist, was the first person to gain the right to build power plants to generate energy in Norway, with the aim of producing cheap electricity for industrial production.¹⁶⁸⁶ This paved the way for prominent Norwegian companies such as Norsk Hydro and Elkem.¹⁶⁸⁷ The success of hydropower in generating electricity made Knutsen send his famous letter to Parliament in 1892, thus encouraging further investment in hydropower.¹⁶⁸⁸ Parliament quickly promoted the generation of electricity from hydropower and issued laws for concessions and reversionary rights.¹⁶⁸⁹

¹⁶⁸⁰ *Id.*

¹⁶⁸¹ *Id.*

¹⁶⁸² Auestad, Nilsen and Rydgren, *supra*.

¹⁶⁸³ *Id.*

¹⁶⁸⁴ *Id.*

¹⁶⁸⁵ *Id.*

¹⁶⁸⁶ the official Norwegian government's site: The History of Norwegian Hydropower in 5 Minutes (2016), *supra*.

¹⁶⁸⁷ *Id.*

¹⁶⁸⁸ *Id.*

¹⁶⁸⁹ *Id.*

Norwegian counties and municipalities now generate more than 90% of their electricity from hydropower.¹⁶⁹⁰ The first hydropower plant owned by a municipality was created in 1891 in Hammerfest.¹⁶⁹¹ Hammerfest became the first city with electric street lighting, and Oslo, the capital city, followed its lead and later powered its own electric street lights with hydropower.¹⁶⁹² In 1900, the Hamneren power station was built in Oslo to produce electricity for the entire city using hydropower.¹⁶⁹³ Once the Hamneren power station was established, it was declared that Oslo had secured power forever,¹⁶⁹⁴ owing to the amount of electricity produced from hydropower. Many reports noted that modern Norway became industrialized when it utilized rivers and waterfalls to produce electricity.¹⁶⁹⁵ In essence, hydropower has been the backbone of Norway's power system in the past and will continue to fulfill this role in the foreseeable future.¹⁶⁹⁶

Hydropower has notable advantages over other renewable energy sources. The main benefit is that it increases the stability and reliability of electricity systems.¹⁶⁹⁷ System operation depends on the generation sources' flexibility to meet peak demands and re-establish the supply after a blackout, and hydropower energy can be injected into an electricity system faster than that produced from any other renewable energy source.¹⁶⁹⁸ Hydropower can also very quickly reach the maximum production from zero, which effectively uses ancillary services to the electricity

¹⁶⁹⁰ Id.

¹⁶⁹¹ Id.

¹⁶⁹² Id.

¹⁶⁹³ Id.

¹⁶⁹⁴ Id.

¹⁶⁹⁵ Id.

¹⁶⁹⁶ Id.

¹⁶⁹⁷ Look at the U.S. Department of the Interior report, Hydroelectric Power: Advantages of Production and Usage. Available at: https://www.usgs.gov/special-topic/water-science-school/science/hydroelectric-power-advantages-production-and-usage?qt-science_center_objects=0#qt-science_center_objects

¹⁶⁹⁸ Id.

system and thus can balance electrical supply and demand.¹⁶⁹⁹ Moreover, hydropower provides guaranteed energy and price stability because river water is a domestic resource and not subject to market fluctuations.¹⁷⁰⁰ The price stability is also supported by the nature of hydropower, as it is the only large renewable source of electricity and its cost-benefit ratio and reliability assist in the optimization of thermal power plants.¹⁷⁰¹

3.2. Industrial Concessions Act

Because of the importance of hydropower in modern Norway, the country has established many laws to regulate the use of river water in energy generation. Norway enacted its first law regarding waterfalls in 1917.¹⁷⁰² Section 1 of the Industrial Licensing Act states that the country owns all waterfalls rights.¹⁷⁰³ The license obligation also applies to agreements related to the acquisition of long-term disposition rights to hydropower resources.¹⁷⁰⁴ The law declares that the country can give a license to state-owned enterprises, municipalities, and counties, provided that this does not damage the public's interests.¹⁷⁰⁵ The same law applies to private companies if the government owns two-thirds of their capital and votes.¹⁷⁰⁶

3.3. Energy Act

In 1990, Norway passed its most famous act to regulate the energy sector, known as the Energy Act.¹⁷⁰⁷ The act focuses on energy generation, conversion, transmission, trading, and distribution, and it promotes society's interests by considering any public and private interests

¹⁶⁹⁹ Id.

¹⁷⁰⁰ Id.

¹⁷⁰¹ Id.

¹⁷⁰² The Industrial Concessions Act, available at <http://www.fao.org/faolex/results/details/en/c/LEX-FAOC019194>

¹⁷⁰³ Id.

¹⁷⁰⁴ Id.

¹⁷⁰⁵ Id.

¹⁷⁰⁶ Id.

¹⁷⁰⁷ Energy Act (No. 50 of 1990): Available at: <http://www.fao.org/faolex/results/details/en/c/LEX-FAOC115735>

that will be affected by projects or developments.¹⁷⁰⁸ Unlike the Industrial Licensing Act, the Energy Act gives the private sector the right to receive a license that allows it to use hydropower to generate electricity.¹⁷⁰⁹ However, this right is limited to only 30 years and has certain conditions.¹⁷¹⁰ Section 3-3 mandates that private entities that receive a license to provide electricity for customers can only do so within the geographical area where the license is applicable.¹⁷¹¹ Section 3-1 gives the ministry the right to give further conditions to these private entities, such as ensuring that granting the license will not cause significant damage to the environment and cultural heritage sites.¹⁷¹² The act also gives the Ministry the right to specify conditions regarding the construction, design, commission, maintenance, operation, and shut-down procedure of the electrical installation.¹⁷¹³

The Norwegian government directly engages in the market for many reasons.¹⁷¹⁴ The main reason to correct market failures and prevent monopolies from occurring in important sectors, such as the energy sector.¹⁷¹⁵ The government also maintains that natural resources belong to society as a whole and, therefore, the benefits of these resources also belong to society, not to certain private companies.¹⁷¹⁶ This method of governance reflects the Nordic system, in which the government is the main entity responsible for the welfare of its citizens and the state is the representation of the will of its citizens.¹⁷¹⁷ Moreover, the state possesses specific

¹⁷⁰⁸ Id.

¹⁷⁰⁹ Id.

¹⁷¹⁰ Id.

¹⁷¹¹ Id.

¹⁷¹² Id.

¹⁷¹³ Id.

¹⁷¹⁴ Look at the article written in the official Norwegian government site, State-ownership in the energy sector (2016). Available at: <https://www.regjeringen.no/en/topics/energy/state-ownership-in-the-energy-sector/state-ownership-in-the-energy-sector/id2344797/>

¹⁷¹⁵ Id.

¹⁷¹⁶ Id.

¹⁷¹⁷ Gulbrandsen, *supra*.

characteristics that may make it a good owner from a broader perspective.¹⁷¹⁸ Namely, because the government is financially strong, this may motivate investors to invest in the Norwegian market.¹⁷¹⁹ The government can also provide stability and stimulate Norwegian companies' growth and build their competencies over time.¹⁷²⁰

Many companies that the government either partly or completely owns have been successful in the market. For instance, the Norwegian government owns 67% of Equinor's shares, which are managed by the Ministry of Petroleum and Energy (MoPE).¹⁷²¹ Equinor is an international energy company with more than 21,000 employees in 30 countries.¹⁷²² It operates 70% of all oil and gas production on the Norwegian shelf and is listed on the Oslo and New York stock exchanges.¹⁷²³ Hence, the company should operate to gain profits for its shareholders, but since the Norwegian government partly owns it, the company must simultaneously follow strict guidelines.¹⁷²⁴ Because Equinor is successful, it demonstrates how government-owned companies can be compatible with the market system.

3.4. Plan and Building Act

Norway has a well-regulated market with strict rules implemented by the government in the private sector to protect the citizens' welfare and well-being.¹⁷²⁵ Consequently, the private

¹⁷¹⁸ the official Norwegian government site, State-ownership in the energy sector (2016), supra.

¹⁷¹⁹ Id.

¹⁷²⁰ Id.

¹⁷²¹ Look at the article written in the official Norwegian government site, Part-owned company (2019). Available at: <https://www.regjeringen.no/en/topics/energy/state-ownership-in-the-energy-sector/part-owned-company/id2353247/>

¹⁷²² Id.

¹⁷²³ Id.

¹⁷²⁴ Id.

¹⁷²⁵ Gulbrandsen, supra.

sector is welcome to invest in Norway as long as it does not violate the rules that benefit society as a whole. For instance, the government has updated its building codes, mainly the Plan and Building Act, to a passive house level, mandatory from January 2016.¹⁷²⁶ All houses must be built by applying “the passive standard,” which leads to energy efficiency and sustainability.¹⁷²⁷ A passive house generates its own electricity through renewable energy sources such as the sun.¹⁷²⁸ A passive house also uses high-density building materials, well-fitted windows, solar panels, and a heat-exchange system.¹⁷²⁹ This law has increased the demand for energy efficiency and sustainability.¹⁷³⁰ Moreover, the country has encouraged the adoption of optional environmental management systems that exceed the minimum requirement.¹⁷³¹ Voluntary certification is used to indicate the quality of these systems that exceed the minimum requirement.¹⁷³²

3.5. European Union Directive 2001/77/EC

The EU has been crucial in increasing the renewable energy use of its state members, and although Norway is not a member, it has worked to achieve and even surpass many of the same sustainability goals.¹⁷³³ ¹⁷³⁴ According to Directive 2001/77/EC, European countries must decrease their carbon emissions by 20% compared to 1990.¹⁷³⁵ The EU has also introduced the Emissions Trading System to reduce greenhouse gas (GHG) emissions with a cap-and-trade

¹⁷²⁶ Hilde Nykamp, Policy Mix for a Transition to Sustainability: Green Buildings in Norway, 12 Sustainability 1-17 (2020).

¹⁷²⁷ Id.

¹⁷²⁸ Wolfgang Feist, Jürgen Schnieders, Viktor Dorer and Anne Haas, Re-inventing air heating: Convenient and comfortable within the frame of the Passive House concept, 37 Energy and Buildings 1186-1203 (2005).

¹⁷²⁹ Id.

¹⁷³⁰ Nykamp, *supra*.

¹⁷³¹ Id.

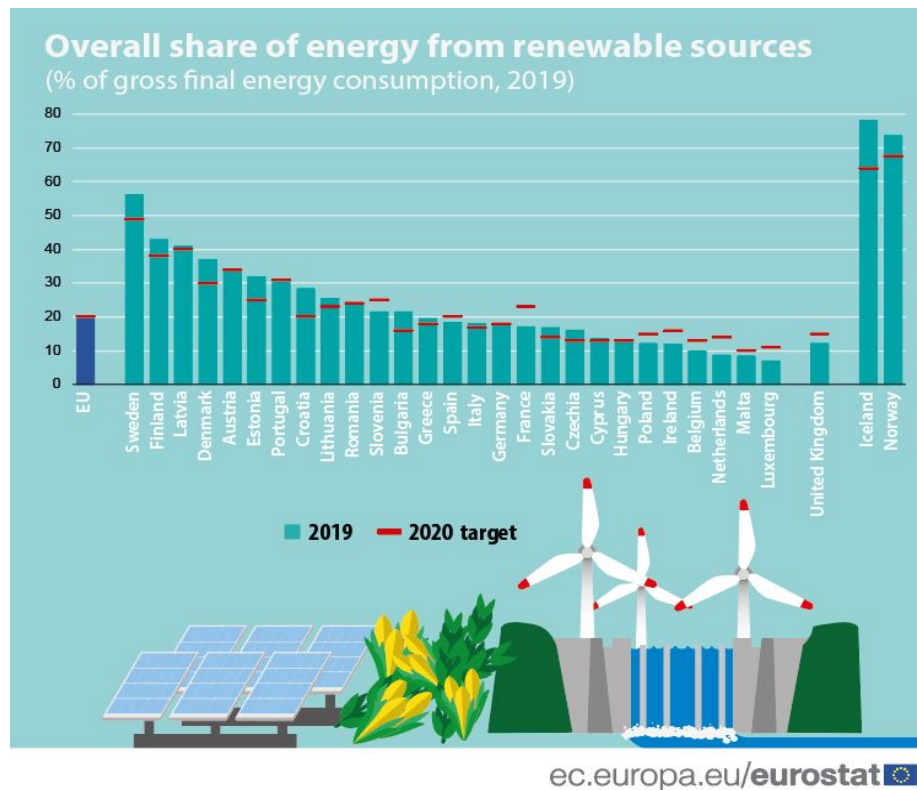
¹⁷³² Id.

¹⁷³³ Sandra Schusser and Jurate Jaraite, Explaining the Interplay of Three Markets: Green Certificates, Carbon Emissions and Electricity, 10 CERE Working Paper 1-28 (2016).

¹⁷³⁴ Note: Norway is a part of the European Economic Area (EEA).

¹⁷³⁵ Id.

program.¹⁷³⁶ The cap refers to the set total amount of certain GHGs emitted by the largest GHG emitters in the system. The cap is reduced over time so that the total GHG emissions will fall.¹⁷³⁷ Notably, Norway has exceeded the EU’s own goals by aiming to have 67.5% of all energy produced in the country be from clean energy sources by 2020.¹⁷³⁸ ¹⁷³⁹ As outlined previously, Norway intends to achieve this by using hydropower and other renewable energy sources.¹⁷⁴⁰



3.6. Challenges of renewable energy in Norway

However, the country’s reliance on hydropower will make it difficult to satisfy future electricity demands. Although hydropower can satisfy the current electricity needs, it will not be

¹⁷³⁶ Id.

¹⁷³⁷ Id.

¹⁷³⁸ Olav Boge, The Norwegian-Swedish Electricity Certificates Market, 10 European Energy Law Report (Martha Roggenkamp & Henrik Bjernebye, eds.) 199.

¹⁷³⁹ Note: The 98% of clean energy produced by Norway is related to only electricity.

¹⁷⁴⁰ the official Norwegian government’s site: Renewable energy production in Norway (2016), supra.

able to do so in the future due to population growth in Norway.¹⁷⁴¹ While hydropower can produce a lot of energy, it has many disadvantages that prevent it from satisfying these future demands, such as its reliance on expansive dams that can only be established in limited locations.¹⁷⁴² Especially in the Global South, hydropower has caused social disruptions and the loss of livelihoods due to the flooding of houses and pastures, therefore making development less socially sustainable in the affected regions.¹⁷⁴³ These downsides encourage many countries to rely on other renewable energy sources in addition to hydropower.

When he was faced with the consequences of population growth and the corresponding electricity demands, former Prime Minister Kjell Magne Bondevik refused to satisfy these demands with gas.¹⁷⁴⁴ However, a parliamentary majority opposed him. Thus, Stoltenberg, the next prime minister, decided to support gas instead of wind power to address the demands, although Norway has the potential to generate electricity from wind power.¹⁷⁴⁵ His administration was concerned with the intermittency of wind power and thus preferred gas.¹⁷⁴⁶ Therefore, Norway uses very little wind power despite its potential and lags far behind other European countries in this regard.¹⁷⁴⁷

Norway produces 700 MW from wind energy, which is very low in comparison to Germany's 31 GW and Denmark's 4 GW.¹⁷⁴⁸ Although Norway and Denmark have common advantages regarding wind power generation, wind is one of the most successful industries in

¹⁷⁴¹ Moe, *supra*.

¹⁷⁴² Look at the U.S Energy Information Administration report, Hydropower explained: Hydropower and the environment. Available at <https://www.eia.gov/energyexplained/hydropower/hydropower-and-the-environment.php>

¹⁷⁴³ Auestad, Nilsen and Rydgren, *supra*.

¹⁷⁴⁴ Moe, *supra*.

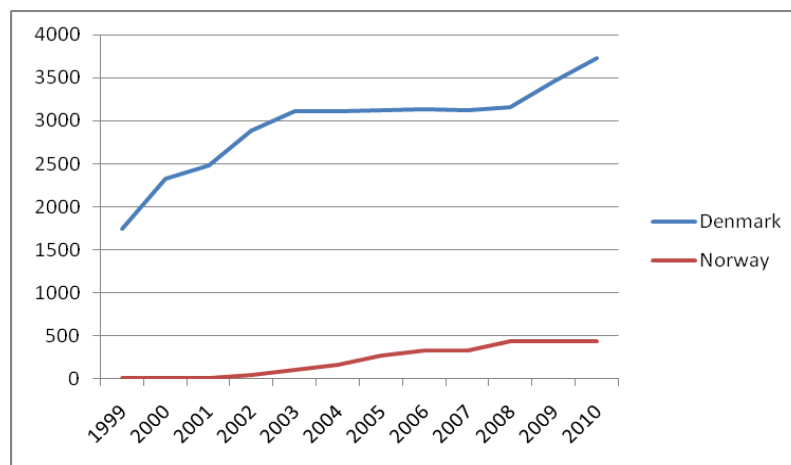
¹⁷⁴⁵ Blindheim, *supra*.

¹⁷⁴⁶ Moe, *supra*.

¹⁷⁴⁷ *Id.*

¹⁷⁴⁸ *Id.*

Denmark, while it survives as a subcontractor in Norway.¹⁷⁴⁹ Following its 1999 goals, Norway failed to produce 3 TWh of wind power by 2010.¹⁷⁵⁰ The country continues to rely on hydropower, which delivers approximately 129 TWh of electricity.¹⁷⁵¹ Wind energy has not received adequate funding from the government. In 2006, a subsidy of 8 øre/kWh for wind energy production (roughly €0.01) was introduced.¹⁷⁵² This is the third-lowest rate in Europe and less than half of the amount necessary for an effective number of installations to be built.¹⁷⁵³ Thus, many actors have given up on wind energy in Norway.¹⁷⁵⁴



Cumulative Installed Wind Power Capacity (MW), 1999-2010

Source: Espen Moe, Structural Change, Vested Interests, and Scandinavian Energy Policy-Making: Why Wind Power Struggles in Norway and not in Denmark, 5 *The Open Renewable Energy Journal* 19-31 (2012).

Grassroots movements have argued that Norway has already produced almost all of its needed electricity from hydropower and therefore should not consider shifting to wind energy.¹⁷⁵⁵ Many have claimed that Norway has abundant energy from hydropower and thus it

¹⁷⁴⁹ Id.
¹⁷⁵⁰ Id.
¹⁷⁵¹ Id.
¹⁷⁵² Id.
¹⁷⁵³ Id.
¹⁷⁵⁴ Id.
¹⁷⁵⁵ Id.

must consider improving energy efficiency rather than shifting to other renewable energy sources.¹⁷⁵⁶ Moreover, they have added that future climate measures will pose a greater threat to the natural environment in Norway than climate change.¹⁷⁵⁷ Hence, the lack of popular support might be one of the reasons that the use of wind energy in Norway has not increased.¹⁷⁵⁸ Moreover, no active parties in Norway have supported the use of wind energy. Even Norwegian conservationists have opposed both hydropower and wind power and advocated for energy conservation rather than production.¹⁷⁵⁹ Nevertheless, these conservationists have preferred the use of renewable energy over gas to satisfy electricity needs.¹⁷⁶⁰

Others have argued that bureaucracy in the government has prevented the use of other renewable energy sources.¹⁷⁶¹ Many companies interested in wind energy have complained about the wall of MoPE bureaucrats.¹⁷⁶² A senior member of the ministry was asked if the government would change its positions on wind energy in the future.¹⁷⁶³ The member believed that no increase in wind energy would occur because the bureaucracy would ensure that the relevant policies remained stable.¹⁷⁶⁴ Even institutions such as the Ministry of the Environment (MoE) and the Norwegian Climate and Pollution Agency (NCPA) do not seem effective and tend to be overruled.¹⁷⁶⁵ This neglect of wind energy stems from the fact that Norway does not need sources of energy other than hydropower to satisfy its short-term needs.

¹⁷⁵⁶ Anne Therese Gullberg, The political feasibility of Norway as the 'green battery' of Europe, 57 Energy Policy 615-623 (2013).

¹⁷⁵⁷ Moe, supra.

¹⁷⁵⁸ Id.

¹⁷⁵⁹ Id.

¹⁷⁶⁰ Id.

¹⁷⁶¹ Blindheim, supra.

¹⁷⁶² Moe, supra.

¹⁷⁶³ Id.

¹⁷⁶⁴ Id.

¹⁷⁶⁵ Id.

This issue of bureaucracy that faces many emerging sectors, such as wind energy, can clearly be seen in the Norwegian Energy Regulatory Authority's concession process.¹⁷⁶⁶ The concession process takes more time to address renewable energy than it does petroleum.¹⁷⁶⁷ A wind power application is estimated to take four years, which are split between the Norwegian water resources and energy directorate (1.5 years) and MoPE (2.5 years).¹⁷⁶⁸ This is because almost every application is appealed in the MoPE.¹⁷⁶⁹ The length of these appeals shows that the MoPE is not enthusiastic about wind energy and prefers well-known solutions such as hydropower to address future demands.¹⁷⁷⁰ As was predicted in 2007, the government's goal of 3 TWh from wind power by 2010 was impossible to achieve due to MoPE bureaucracy.¹⁷⁷¹

The bureaucracy could be justified due to vested interest structures.¹⁷⁷² Since renewable energy has become more competitive over time, it might face some resistance from the current vested interest structures.¹⁷⁷³ Economically prosperous old industry has gained political influence that aims to serve the industry.¹⁷⁷⁴ Since the fossil fuels industry has been the strongest industry for more than a century, the use of other energy sources would neither be easy nor smooth. In general, institutions create stability, meaning that they act as bulwarks against radical change.¹⁷⁷⁵ Hence, old industries may unwittingly hinder upcoming industries because of the institutional framework,¹⁷⁷⁶ and they may thus have advantages that newcomers cannot compete

¹⁷⁶⁶ Id.

¹⁷⁶⁷ Id.

¹⁷⁶⁸ Id.

¹⁷⁶⁹ Id.

¹⁷⁷⁰ Id.

¹⁷⁷¹ Id.

¹⁷⁷² Espen Moe, Structural Change, Vested Interests, and Scandinavian Energy Policy-Making: Why Wind Power Struggles in Norway and not in Denmark, 5 *The Open Renewable Energy Journal* 19-31 (2012).

¹⁷⁷³ Id.

¹⁷⁷⁴ Christopher Hood, J. G. March and J. P. Olsen *Rediscovering Institutions: The Organizational Basis of Politics*, 10 Cambridge University Press 349 (1990).

¹⁷⁷⁵ Id.

¹⁷⁷⁶ Moe, supra.

with.¹⁷⁷⁷ This might justify the failure of Norway to increase its wind energy. The country has relied on fossil fuels for a long time, while Denmark, which has significantly increased its use of wind energy, did not rely on a dominant source of energy in the past.¹⁷⁷⁸

However, it is not accurate to claim that the oil industry has hindered the development of renewable energy. Although the fossil fuels industry might affect the decisions of the Norwegian government regarding its energy policies, this does not mean that the industry actively blocks renewables.¹⁷⁷⁹ In fact, Norway is both an oil-producing country and a leader in renewable energy production. Hence, there is no fundamental conflict between its promotion of renewable energy policies and its relative reliance on fossil fuels. Although fossil fuels are a dominant sector, many laws have been enacted that go against the industry, such as the carbon tax law.¹⁷⁸⁰

3.7. Offshore Energy Act

Moreover, Norway enacted the Offshore Energy Act to increase offshore renewable energy production.¹⁷⁸¹ The act provides a legal framework related to planning, constructing, operating, and removing facilities that produce renewable energy and transforming and transmitting electricity at sea.¹⁷⁸² The act targets the new challenges created by electricity demands and aims to satisfy such demands with renewable energy sources.¹⁷⁸³ The act deals with some other elements of the national strategy in accordance with the climate compromise, such as

¹⁷⁷⁷ Joel Mokyr, *The Lever of Riches: Technological Creativity and Economic Progress* (Oxford University Press, 1992)

¹⁷⁷⁸ Moe, *supra*.

¹⁷⁷⁹ *Id.*

¹⁷⁸⁰ *Id.*

¹⁷⁸¹ The Offshore Energy Act No. 107 (2008–2009), available at:

https://www.regjeringen.no/contentassets/21abe2eb6e604475ad7f179812da6583/en-gb/pdfs/otp200820090107000en_pdfs.pdf

¹⁷⁸² *Id.*

¹⁷⁸³ *Id.*

the future development of offshore renewable energy.¹⁷⁸⁴ The act also established three research centers for environment-friendly energy to lead to the development of the renewable energy sector.¹⁷⁸⁵ Furthermore, the act shed light on possible locations for wind energy in Norwegian sea areas.¹⁷⁸⁶ By using the advantages created by this act, Norway can develop various renewable industries, such as wind energy, regardless of the dominant government energy strategy that still relies on oil and hydropower.

3.8. Water Resources Act

Crucially, Norway has considered climate safety in the rivers from which most hydropower energy is generated. For instance, the Water Resources Act aims to avoid harm or nuisance in the river systems that would affect public or private interests.¹⁷⁸⁷ The law limits the harm that is acceptable in rivers and encourages projects to reach only the minimum amount of harm.¹⁷⁸⁸ Harm is acceptable only if the projects cannot be established without it.¹⁷⁸⁹ Chapter 2(8) of the act clearly states that no harm shall occur in the river system or in the sea unless it does not violate Section 12 or Section 15 or the project has a license from the water authorities.¹⁷⁹⁰ This means that if such a project can be applied without the minimum harm, it would be a violation of the act if the project was established with the minimum harm. These measures in a river system must prevent hazards to people, property, and the environment.¹⁷⁹¹

¹⁷⁸⁴ Id.

¹⁷⁸⁵ Id.

¹⁷⁸⁶ Id.

¹⁷⁸⁷ Water Resources Act No. 82 of 24 November 2000. Available at:

https://www.regjeringen.no/globalassets/upload/oed/vedlegg/lover-og-reglement/act_no_82_of_24_november_2000.pdf

¹⁷⁸⁸ Id.

¹⁷⁸⁹ Id.

¹⁷⁹⁰ Id.

¹⁷⁹¹ Id.

Chapter 2(8) gives the water authorities a wide discretion to stipulate that measures outside of the river system that may have tangible impacts on it and require the projects have a license.¹⁷⁹²

These examples, as well as others, refute the arguments that the oil industry hinders the development of renewable energy. Instead, it can be argued that Norway's underdeveloped wind energy has not been caused by interference from other sectors but rather by the government and Parliament. These entities seem unconvinced that sources of renewable energy other than hydropower can satisfy the future demand for electricity. Every entity, including the MoE, acts based on cost-effectiveness language. The government seems to ignore wind energy because of factors like the adequate amount of electricity produced by hydropower and the unpopularity of wind energy. Thinking about the situation in terms of cost-effectiveness, gas seems to be more efficient than wind energy and does not suffer from the same problems regarding intermittency and energy storage.

3.9. Electricity Certificate Act

Regardless, Norway is putting in the effort to increase its renewable energy generation from sources besides hydropower. For instance, Norway made an agreement with Sweden to establish the joint electricity certificates market,¹⁷⁹³ which will last from 2012 to 2036.¹⁷⁹⁴ Pursuant to the agreement, Norway has enacted the EI-Certificate Act to increase the production of renewable electricity.¹⁷⁹⁵ The essence of this agreement is that pre-approved renewable energy electricity suppliers will receive one certificate per MWh produced, and this certificate can then be sold to suppliers that are forced to purchase certificates according to a certain proportion of

¹⁷⁹² Id.

¹⁷⁹³ Boge, *supra*.

¹⁷⁹⁴ The Electricity Certificates Act, No. 39 of 2011. Available at: <https://climate-laws.org/geographies/norway/laws/electricity-certificates-act-no-39-of-2011>

¹⁷⁹⁵ Id.

the electricity that they sell or use.¹⁷⁹⁶ The agreement between Norway and Sweden focuses on achieving 26.4 TWh of new renewable electricity from the established joint electricity certificates market.¹⁷⁹⁷ The green certificate system is a technology-neutral arrangement, which means that the market determines what and where to build, not politics.¹⁷⁹⁸ This also means that the price of these certificates will be based on supply and demand, not fixed prices.¹⁷⁹⁹

The establishment of the joint electricity certificates market has been widely criticized. Bergek and Jacobsson argued that although green certificates are available for any government targeting a specific amount of renewables in its system, they do not aid in the development of the renewable energy sector and its technologies.¹⁸⁰⁰ The U.K. has left a technology-neutral support scheme that based its prices on supply and demand and instead gave its government the discretion to favor technologies with advantages beyond their MWh outputs.¹⁸⁰¹ David Cameron, a former U.K. prime minister, stated that the approach adopted in relation to renewable energy, mainly wind energy, aims to both reach a specific amount of wind energy in its system and also develop the wind energy sector in the long term, as the U.K. intends to become a leader in wind energy production.¹⁸⁰² Despite criticism of the joint electricity certificates market, Norway continues to seriously pursue it.

3.10. Prosumer principle

¹⁷⁹⁶ Gard Hopsdal Hansen, *Nature, Industry and Society* (Fagbokforlaget 1ed, 2013).

¹⁷⁹⁷ *Id.*

¹⁷⁹⁸ *Id.*

¹⁷⁹⁹ *Id.*

¹⁸⁰⁰ Anna Bergek and Staffan Jacobsson, Are tradable green certificates a cost-efficient policy driving technical change or a rent-generating machine? Lessons from Sweden 2003--2008, 38 *Energy Policy* 1255-1271 (2010).

¹⁸⁰¹ David Toke, The UK offshore wind power programme: A sea-change in UK energy policy?, 39 *Energy Policy* 526-534 (2011).

¹⁸⁰² Hansen, *supra*.

As another example of its diversification of its renewable energy sources, Norway has adopted the concept of “the prosumer” in its energy act.¹⁸⁰³ A prosumer is a person who sells their surplus electricity. In contrast, a consumer is a person who only consumes electricity and does not sell it afterward. A prosumer is an end-user, and both prosumers and consumers are connected to the grid.¹⁸⁰⁴ Regulations on network tariffs occur at “the point in the electric transport network where electricity is fed in or fed-out, or where there is electricity exchange between grid companies.”¹⁸⁰⁵ Many households benefit from becoming prosumers when electricity prices are high.¹⁸⁰⁶ Because renewable energy sources, mainly solar and wind, are continually developing, more consumers are electing to use these sources to become prosumers.¹⁸⁰⁷ In short, increased electricity prices and decreased renewable energy technology prices motivate many households and businesses to become prosumers.

There are many incentives for households and businesses to become prosumers. As a general rule, all prosumers must pay tariffs for feeding the grid.¹⁸⁰⁸ However, prosumers are exempted from certain charges.¹⁸⁰⁹ In addition, prosumers do not have to pay value-added tax (VAT) for the surplus electricity that they sell.¹⁸¹⁰ They would also be allowed to sell Guarantees of Origin.¹⁸¹¹ Producers gives guarantees to prosumers for their surplus electricity.¹⁸¹² These guarantees help prosumers because most residential prosumers barely reach the production

¹⁸⁰³ Catherine Banet, Prosumer Legislation in Norway: A First Step for Empowering Small Energy Consumers, European Energy Law Report 169-189 (2018).

¹⁸⁰⁴ *Id.*

¹⁸⁰⁵ *Id.*

¹⁸⁰⁶ *Id.*

¹⁸⁰⁷ *Id.*

¹⁸⁰⁸ *Id.*

¹⁸⁰⁹ *Id.*

¹⁸¹⁰ *Id.*

¹⁸¹¹ *Id.*

¹⁸¹² *Id.*

threshold (1 MWh over a set period).¹⁸¹³ Producers will not be motivated to engage in electricity trading with prosumers if there is no measurement requirement for their production.¹⁸¹⁴ Thus, these guarantees could be essential for prosumers to continue selling their surplus electricity.

3.11. Norwegian incentive policy for electric vehicles

Norway has also played a major role in reducing CO₂ emissions by promoting electric vehicles (EVs). The government supports many policies to motivate Norwegian citizens to use EVs.¹⁸¹⁵ For instance, citizens with EVs are exempted from the tax on CO₂ and gain a discount of 25% VAT; the free use of ferries, car parks and public charging stations; and free movement on streets otherwise dedicated to buses and trams.¹⁸¹⁶ It is predicted that these policies will reduce greenhouse gas emissions by 40% in 2030.¹⁸¹⁷ These policies have encouraged many citizens to purchase EVs for both ethical and financial reasons. A study conducted in Norway reported that 41% of EV owners bought their vehicles for financial reasons.¹⁸¹⁸ Internal combustion engine cars are relatively expensive in Norway, costing double the price in EU countries due to import taxes.¹⁸¹⁹ Hence, citizens are motivated to buy EVs instead of internal combustion engine cars because they have the same price.¹⁸²⁰ EV owners can charge their EVs in their homes, at work, and at public charging stations.¹⁸²¹ Overall, the increase of EVs in Norway has resulted from government incentives and the citizens' incomes, which are among the highest

¹⁸¹³ *Id.*

¹⁸¹⁴ *Id.*

¹⁸¹⁵ Fabio Viola and Michela Longo, On the strategies for the diffusion of EVs: Comparison between Norway and Italy, 7 *International Journal of Renewable Energy Research* 1376-1382.

¹⁸¹⁶ *Id.*

¹⁸¹⁷ *Id.*

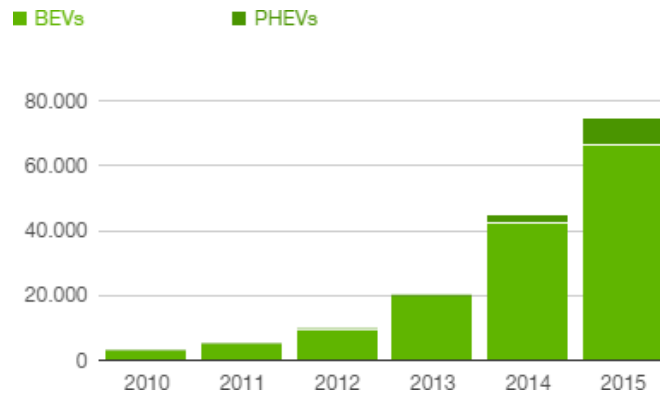
¹⁸¹⁸ *Id.*

¹⁸¹⁹ *Id.*

¹⁸²⁰ *Id.*

¹⁸²¹ Morris Brenna, Federica Foidelli, Michela Longo and Dario Zaninelli, e-Mobility Forecast for the Transnational e-Corridor Planning, 17 *IEEE Transactions on Intelligent Transportation Systems* 680-689 (2016).

in Europe.¹⁸²² In 2015, more than 50,000 EVs were registered, meaning that EVs constituted 33.1% of all cars in the country.¹⁸²³ In 2016, the number increased to 100,000 EVs.¹⁸²⁴ Hence, the government's support of EVs has increased clean energy and reduced GHG emissions in the country.



Source: Fabio Viola and Michela Longo, On the strategies for the diffusion of EVs: Comparison between Norway and Italy, 7 International Journal of Renewable Energy Research 1376-1382.

All these examples prove that although the oil sector remains dominant in the Norwegian GDP, it does not hinder the development of the renewable energy sector and its relevant policies. It is inaccurate to assume that the Norwegian government has failed to develop wind energy because of its ties to the fossil fuels industry. If the government intended to limit any industry that might harm the oil industry, it would not have implemented policies and laws that promote the use of clean energy, such as encouraging prosumers and the use of EVs. Instead, as a consequence of its own cost-benefit analysis, the government seems to prefer gas over wind energy to address its future electricity demands. Ironically, when the government discovered oil

¹⁸²² Viola and Longo, *supra*.

¹⁸²³ *Id.*

¹⁸²⁴ *Id.*

in the 1970s, it recognized the danger of its overreliance on oil in government spending.¹⁸²⁵ Norway, unlike almost all oil-producing countries, has historically targeted the long-term benefits over the short-term benefits of its oil revenue, which have saved the country from an economic crisis due to falling oil prices. While Norway seems to be taking some steps to increase its use of renewable energy other than hydropower, the results are hardly impressive. Yet, it must be taken into consideration that almost 100% of its electricity comes from hydropower, which might not put pressure on the government to increase the use of other renewable energy sources.

Conclusion

This chapter discussed the economic system of Norway and how the country has acted efficiently in investing its oil revenues. Norway has become a leading country in non-oil sectors such as renewable energy. The first part of the chapter focused on economics and outlined the special group of democratic and welfare-capitalist systems that Norway has adopted. This system makes the government responsible for the welfare of its citizens since it is a representation of their will. Thus, the government is actively engaged in the economic system of Norway, aiming to regulate the market in a way that ensures the welfare of its citizens. The second part discussed SWFs and the GPF. The Norwegian fund invests the oil revenue in bonds by 35–40%, equities by 60%, and real estate by 5%. This has diversified the economy of Norway, preventing its overdependence on oil revenues. The third part examined the extent to which Norway has moved beyond fossil fuels. It sheds light on the role of the law in promoting renewable energy and the current challenges that the country faces.

¹⁸²⁵ The Government Pension Fund Act, *supra*.

Because the Norwegian government has recognized that the oil boom will not last and subsequently diversified the economy, Norway is not significantly impacted by decreasing oil prices, unlike most oil-producing countries. In other words, the government has historically preferred sustainable long-term gains over short-term gains when investing its oil revenues. However, the government is now challenged by an increasing population and rising demands for renewable electricity. Hydropower cannot satisfy these demands since it has reached its full potential in Norway, and thus the country must focus on other renewable energy sources.

Notably, Norway has the potential to become a leading producer of wind energy, given that the country has wind most of the year. However, Norway has decided to satisfy the new electricity demand with gas, presumably because gas is more cost-efficient than wind. Wind also faces issues with intermittency and energy storage. In the use of wind energy, Norway is far behind other European countries. Ironically, Norway seems to have chosen short-term solutions over long-term solutions to satisfy its growing demand for electricity. Regardless, Norway can be seen as a helpful model for other oil-producing countries, such as Saudi Arabia, because it has diversified its economy and boosted its use of renewable energy. Hence, Norway's success in taking legitimate steps to move beyond fossil fuels can be beneficial for other oil-producing countries.

Chapter 6 Challenges and issues facing Saudi Arabia

Introduction

After the oil crash in 2014, Saudi Arabia became determined to shift from relying on its fossil fuel sector to non-oil sectors, such as the renewable energy sector. Vision 2030 proposes radical changes to the Saudi economy and aims to increase its non-oil revenue from 10% to 70% of the total government revenue by 2030.¹⁸²⁶ Most importantly, Saudi Arabia will generate more electricity from renewable energy sources to meet the continuing demand caused by population growth.¹⁸²⁷ Vision 2030 recommends that Saudi Arabia should deploy 58.7 GW of renewable energy to reduce the proportion of oil used for its electricity.¹⁸²⁸ This would increase the renewable energy share to 30% of the kingdom's total generation capacity.¹⁸²⁹

However, there are many challenges that the country must face to achieve its Vision 2030 goals. The first challenge is that the private sector has largely been inactive throughout Saudi history,¹⁸³⁰ resulting in the absence of a regulatory framework. Because the government has historically led the economy, mainly by using its fossil fuel revenues, no laws were needed to regulate the private sector or create a competitive market system. Notably, the country is

¹⁸²⁶ Look at the full report of McKinsey Global Institute (Hereinafter: the Saudi 2030 vision): SAUDI ARABIA BEYOND OIL: THE INVESTMENT AND PRODUCTIVITY TRANSFORMATION. available at: https://www.mckinsey.com/~media/McKinsey/Featured%20Insights/Employment%20and%20Growth/Moving%20Saudi%20Arabias%20economy%20beyond%20oil/MGI%20Saudi%20Arabia_Full%20report_December%202015.pdf

¹⁸²⁷ Mohammad Salam and Sami Khan, Transition towards sustainable energy production – A review of the progress for solar energy in Saudi Arabia, 36 Energy Exploration & Exploitation 3-27 (2018).

¹⁸²⁸ Blazquez, *supra*.

¹⁸²⁹ Look at the ministry of investment report regarding the application of the 2030 vision regarding the renewable energy sector Hereinafter: (Hereinafter: the Saudi's Renewable energy plan 2030). available at: <https://investsaudi.sa/media/1375/renewable-energy-17th-feb.pdf>

¹⁸³⁰ Mehdi Abid, Mohammed Alotaibi, Crude oil price and private sector of Saudi Arabia: Do globalization and financial development matter? New evidence from combined cointegration test, 69 Resources Policy 101774 (2020).

struggling to attract foreign investments.¹⁸³¹ The second challenge is the decrease in oil prices combined with the increase in the domestic demand for energy. Oil prices have decreased and will continue to decrease because many countries have become less interested in generating energy from fossil fuels due to their contributions to climate change. Moreover, the development of renewable energy technology is also decreasing the use of fossil fuels, and this development is expected to advance even further in the future.¹⁸³² The third challenge is that Saudi Arabia's administrative laws are complex and bureaucratic. Unfortunately, the expensive and hierarchical public sector has serious flaws that may inhibit the Saudi economy and its plans for the future. One such flaw is bureaucracy in the public sector, which negatively affects emerging sectors.

The rest of this chapter will proceed as follows. The first part will discuss the limited role of the private sector and the lack of a regulatory framework, with a focus on the importance of the private sector and how this lack of a regulatory framework may prevent Saudi Arabia from achieving its Vision 2030 goal of providing a competitive market system. The second part will cover the impact of low oil prices on the Vision 2030 goals and, more specifically, shed some light on how low oil prices have obstructed the development of the domestic renewable energy sector. The third part will investigate administrative laws in Saudi Arabia and the extent to which administrative and bureaucratic complexities may hinder the Vision 2030 goal of increasing the role of the private sector in the economy.

¹⁸³¹ Look at the report of the Atlantic Council by Stephen Grand, Katherine Wolff: Assessing Saudi Vision 2030: A 2020 review. Available at: <https://www.atlanticcouncil.org/in-depth-research-reports/report/assessing-saudi-vision-2030-a-2020-review/>

¹⁸³² Ulrichsen, *supra*.

1. The limited role of the private sector and the lack of a regulatory framework

Saudi Arabia provides many free services to its citizens, such as health care and education.¹⁸³³ The government used to satisfy their needs based on the idea that it should provide welfare to benefit society.¹⁸³⁴ This situation has led many Saudis to take these services and their high incomes for granted.¹⁸³⁵ For example, many government jobs were created to be lucrative rather than to address specific needs.¹⁸³⁶ In only 50 years, Gulf Cooperation states applied their high oil revenues to create public institutions that took centuries to establish in other developed countries.¹⁸³⁷ In 1974, Saudi Arabia used massive capital infusions to transform the electricity industry and place it under public-sector control.¹⁸³⁸ After the oil boom, the government aimed to satisfy the its citizens' social objectives, particularly in remote regions, by offering electricity at low and affordable prices.¹⁸³⁹ This intervention reflects how many Saudi citizens view their government, namely as an entity responsible for increasing their welfare.

Decreasing oil prices have placed significant pressure on Saudi Arabia to diversify its economy.¹⁸⁴⁰ Vision 2030 seeks to generate additional revenue sources and gradually wean the Saudi economy off its long-standing dependence on oil, and it hinges on the expansion of the private sector.¹⁸⁴¹ Currently, two-thirds of all Saudi employees work in the public sector. Given

¹⁸³³ Shmuel Even and Yoel Guzansky, *Saudi Arabia's Vision 2030: Reducing the Dependency on Oil*, Institute for National Security Studies 1-5 (2016).

¹⁸³⁴ *Id.*

¹⁸³⁵ *Id.*

¹⁸³⁶ Mhamed Biygautane, Paula Gerber and Graeme Hodge, *The Evolution of Administrative Systems in Kuwait, Saudi Arabia, and Qatar: The Challenge of Implementing Market Based Reforms*, 26 *Digest of Middle East Studies* 97-126 (2017).

¹⁸³⁷ *Id.*

¹⁸³⁸ Ahmed Alrajhi and Bashier Al-Abdulrazag, *THE RELATIONSHIP BETWEEN ELECTRICITY CONSUMPTION AND ECONOMIC GROWTH IN THE KINGDOM OF SAUDI ARABIA: AN ARDL APPROACH*, 44 *The Journal of Energy and Development* 299-316 (2019).

¹⁸³⁹ *Id.*

¹⁸⁴⁰ Abdullah Al Otaibi, *A REVIEW OF PUBLIC MANAGEMENT REFORM IN SAUDI ARABIA*, 2 *International Journal of Management and Administrative Sciences* 35-44 (2015).

¹⁸⁴¹ *Id.*

that the public sector has provided jobs for its citizens with high salaries as a social service, the government has not hired employees and functioned according to cost-benefit analysis, and this behavior led to an economic crisis when the oil price decreased.

1.1. Challenge of attracting foreign investments

Stemming from the limited role of its private sector, Saudi Arabia struggles to attract foreign investments.¹⁸⁴² Outside capital from foreign direct investments shrank dramatically in 2017 to only 0.2% of gross domestic product (GDP) from average investments of 1%–1.25% since 2013.¹⁸⁴³ Foreign direct investments reached \$22.9 billion USD in 2018, which is equivalent to 2.9% of the GDP, meaning that the country invested more worldwide, mainly through the Public Investment Fund, than it received in return.¹⁸⁴⁴ Saudi investments worldwide reached \$80 billion in 2017, which indicates that even wealthy Saudi citizens tend to view the Saudi market as risky and thus prefer to invest in other countries.¹⁸⁴⁵ Ultimately, Saudi Arabia is not attracting the investments both domestically and abroad that are required to make Vision 2030 a success.¹⁸⁴⁶

There are many reasons for the limited role of the private sector in the Saudi economy, including the lack of a legal environment to attract investments.¹⁸⁴⁷ Many developed countries seek to facilitate an environment that motivates entrepreneurs to achieve success.¹⁸⁴⁸ Crucially,

¹⁸⁴² Look at the report of the Atlantic Council by Stephen Grand, Katherine Wolff: Assessing Saudi Vision 2030: A 2020 review. Available at: <https://www.atlanticcouncil.org/in-depth-research-reports/report/assessing-saudi-vision-2030-a-2020-review/>

¹⁸⁴³ *Id.*

¹⁸⁴⁴ *Id.*

¹⁸⁴⁵ *Id.*

¹⁸⁴⁶ *Id.*

¹⁸⁴⁷ Hussam Fallatah, Addressing the Need for a Proper Legal Environment to Support Entrepreneurship in Saudi Arabia, 13 J. POL. & L. 40 (2020).

¹⁸⁴⁸ Peter Nijkamp, Entrepreneurship in a Modern Network Economy, 37 Regional Studies 395-405 (2010).

the success of the private sector is inseparable from its legal environment,¹⁸⁴⁹ as many studies have demonstrated.¹⁸⁵⁰ For instance, Porta et al. (1997) examined the role of the private sector in many countries and concluded that the countries that lacked adequate legal rules to support entrepreneurs did not facilitate an environment for entrepreneurship.¹⁸⁵¹ Consequently, Saudi Arabia must offer simple legal procedures for start-ups and provide entrepreneurs with rights and protections.¹⁸⁵² In this context, the simplicity of these laws would help to efficiently regulate start-up procedures rather than merely reduce regulations.¹⁸⁵³ Efficient regulations remove unnecessary bureaucratic procedures from the regulatory framework,¹⁸⁵⁴ although this process must also take into account concerns such as business permits, paperwork for the Ministry of Commerce, and loan applications.¹⁸⁵⁵

A successful privatization program must provide a fair, competitive environment and an efficient capital market, including a market for corporate control.¹⁸⁵⁶ This means that information must be fairly available to all investors.¹⁸⁵⁷ If the flow of information is imperfect, it becomes difficult to identify insider trading and malpractice in the capital market,¹⁸⁵⁸ which affects the valuation of stocks and bonds in the market.¹⁸⁵⁹ The government should have strict rules for the flow of information, allowing data to be made available fairly.¹⁸⁶⁰ Moreover, when authorities

¹⁸⁴⁹ *Id.*

¹⁸⁵⁰ Fallatah, *supra*.

¹⁸⁵¹ Rafael la Porta, Florencio Silanes, Andrei Shleifer and Robert Vishny, Legal Determinants of External Finance, 52 *The Journal of Finance* 1131-1150 (1997).

¹⁸⁵² Fallatah, *supra*.

¹⁸⁵³ *Id.*

¹⁸⁵⁴ *Id.*

¹⁸⁵⁵ Mustafa Almuzel and Timothy Anderson, An Assessment of Entrepreneurial Ecosystem: The case of Saudi Arabia, IEEE Technology & Engineering Management Conference (TEMSCON) (2020).

¹⁸⁵⁶ Ibrahim Onour, Implementing Privatization Strategy of Saudi Arabia: Issues and Challenges, University of Khartoum (2012). Available at SSRN: <https://ssrn.com/abstract=2189804>

¹⁸⁵⁷ *Id.*

¹⁸⁵⁸ *Id.*

¹⁸⁵⁹ *Id.*

¹⁸⁶⁰ *Id.*

allow buyers to sell privatization bonds in the capital markets to raise funds to buy enterprises, commercial banks should underwrite or purchase bonds issued to finance the leveraged buyout of a given public enterprise.¹⁸⁶¹ In essence, there should not be any state subsidies to the buyer of an enterprise, and the private owner must assume full financial and managerial responsibility for running it.¹⁸⁶²

1.2. Lack of intellectual property protection

Significantly, Saudi Arabia lacks legislation to address many issues that are important to investors, such as intellectual property rights. Although intellectual property rights go against the idea of the free market, these rights are necessary for the market to encourage innovation.

Companies will not invest their money in research if they learn that their inventions will not be properly protected.¹⁸⁶³ This rationale is the basis of intellectual property rights, such as patent rights. Patent law gives investors the exclusive right to exploit their innovations in the market as a reward for their contributions to society.¹⁸⁶⁴ In other words, a patent is the only reason for investors to put the time and effort into innovation.¹⁸⁶⁵ Thus, protecting these intellectual property rights would attract companies to invest in Saudi Arabia.

In addition, Saudi Arabia's trade laws do not seem to provide sufficient protection for intellectual property rights, such as safeguarding trade secrets.¹⁸⁶⁶ Therefore, private entities tend to depend on contracts to safeguard their trade secrets.¹⁸⁶⁷ Because the "subject matter" of trade

¹⁸⁶¹ *Id.*

¹⁸⁶² *Id.*

¹⁸⁶³ John Duffy, Rethinking the Prospect Theory of Patents, 71 *The University of Chicago Law Review* 439-510 (2004).

¹⁸⁶⁴ Paul Torremans, *Holyoak and Torremans Intellectual Property Law* (8th ed., 2016, OUP).

¹⁸⁶⁵ Corinne Langinier and GianCarlo Moschini, The Economics of Patents: An Overview, *Intellectual Property Rights in Animal Breeding and Genetics* 31-50 (2002).

¹⁸⁶⁶ Wahj Wazzan, Updating the Law of Trade Secrets in Saudi Arabia, 5 *INDON. J. INT'L & COMP. L.* 43 (2018).

¹⁸⁶⁷ *Id.*

secrets is too broad, Saudi courts have struggled to define it.¹⁸⁶⁸ Hence, Saudi laws lack cause of action and remedies to prevent trade secrets from being violated.¹⁸⁶⁹ They also do not provide methods for equitable recovery if trade secrets have been violated.¹⁸⁷⁰ Although Saudi Arabia signed the Agreement on Trade-Related Aspects of Intellectual Property Rights, which provides proper protection to many businesses, the country took a different position on the issue than other countries.¹⁸⁷¹ The Saudi act considers any information to be a trade secret,¹⁸⁷² meaning that trade secrets do not have any special characteristics under the law that require further protection. In other words, due to the wide definition of trade secrets, any information could be viewed as a trade secret.¹⁸⁷³

Another issue relating to intellectual property rights in Saudi Arabia is demonstrated by the Saudi Franchise Law.¹⁸⁷⁴ The law makes franchise registration burdensome and implemented regulations that raise many questions.¹⁸⁷⁵ For instance, Article 10 of the law requires both parties to act in good faith without defining this term.¹⁸⁷⁶ Furthermore, Article 1 obligates the franchisor to impart technical knowledge and expertise to the franchisee.¹⁸⁷⁷ The term “technical expertise” has not been adequately defined, and the terms “technical knowledge” and “expertise” are subject to interpretation.¹⁸⁷⁸ The law is particularly ambiguous in Article 3 and Article 23.¹⁸⁷⁹ Article 23 allows for both parties to settle disputes under “franchise agreements” or the

¹⁸⁶⁸ *Id.*

¹⁸⁶⁹ *Id.*

¹⁸⁷⁰ *Id.*

¹⁸⁷¹ *Id.*

¹⁸⁷² *Id.*

¹⁸⁷³ *Id.*

¹⁸⁷⁴ Akshatha Achar & S. K. George, *Franchising in Kingdom of Saudi Arabia*, 7 CT. UNCOURT 17 (2020).

¹⁸⁷⁵ *Id.*

¹⁸⁷⁶ *Id.*

¹⁸⁷⁷ *Id.*

¹⁸⁷⁸ *Id.*

¹⁸⁷⁹ *Id.*

application of the law.¹⁸⁸⁰ Article 3, however, states in clear language that dispute resolution shall apply to a franchise agreement that is implemented within Saudi Arabia.¹⁸⁸¹ This is problematic for the private sector since the dispute resolution regarding franchise agreements is unclear, making the process of compensation ambiguous.

The lack of legislation must not be viewed as secondary in terms of its effects on the private sector. Intellectual property rights and trade secrets are significant to business.¹⁸⁸² For secret owners, protecting trade secrets is as important as protecting family secrets, and revealing these secrets would have unfavorable consequences.¹⁸⁸³ Safeguarding trade secrets gives companies a competitive edge in the market field,¹⁸⁸⁴ and the importance of trade secrets has been recognized for hundreds of years.¹⁸⁸⁵ For instance, an Armenian family was known as one of the foremost, if not the best, producers of orchestral cymbals for more than four hundred years,¹⁸⁸⁶ and this fame relied on the protection of their commercial secret.¹⁸⁸⁷ The importance of trade secrets is arguably more imperative nowadays than ever before due to how competitive domestic markets have become. Therefore, companies' secrets must be protected.

Despite the issues that Saudi Arabia faces in increasing the role of the private sector in its economy, the country aims to provide incentives for further investment. For instance, Saudi Arabia opened up its health care sector to foreign investment, unlike other sectors of the economy, and allowed for foreign investors to retain 100% ownership.¹⁸⁸⁸ This increased foreign

¹⁸⁸⁰ *Id.*

¹⁸⁸¹ *Id.*

¹⁸⁸² Wazzan, *supra*.

¹⁸⁸³ *Id.*

¹⁸⁸⁴ *Id.*

¹⁸⁸⁵ *Id.*

¹⁸⁸⁶ *Id.*

¹⁸⁸⁷ *Id.*

¹⁸⁸⁸ Redwanur Rahman, *The Privatization of Health Care System in Saudi Arabia*, 13 *Health Services Insights* 1-8 (2020).

investments to a total of \$3.5 billion USD in 2018 and enabled foreign companies to engage in joint ventures with Saudi investors and individuals.¹⁸⁸⁹ The investments in the health sector are expected to increase to reach \$100 billion in the short term,¹⁸⁹⁰ and engaging the private sector in the health sector is predicted to add 26,000 beds by 2035.¹⁸⁹¹ Notably, Saudi Arabia went even further to develop “medical cities” to provide specialized health care services and expand coverage, with intending investments of \$4.3 billion.¹⁸⁹² In the long term, the government intends to privatize all public hospitals and build Public–private partnership (PPPs).¹⁸⁹³ In the short term, the government plans to privatize 290 hospitals and 2,300 Primary Health Centers (PHCs) by 2030.¹⁸⁹⁴

Vision 2030 highlights the importance of the private sector in the Saudi economy. Saudi Arabia used to fund the health sector and provide free health care almost exclusively with its oil revenues.¹⁸⁹⁵ Because the country still relies on oil as a major source of income in its GDP, the decline of this source would place a financial burden on almost all public sectors, including the health sector. Currently, the country has 494 hospitals with 75,225 beds.¹⁸⁹⁶ These hospitals employ 104,775 doctors, 184,565 nurses, 4,006 pharmacists, and 69,530 allied health

¹⁸⁸⁹ *Id.*

¹⁸⁹⁰ *Id.*

¹⁸⁹¹ Look at the Global Health Exhibition report: 2019 Saudi Arabia Healthcare Industry Overview: Towards the Healthcare Goals of Saudi Vision 2030. Available at: <https://www.globalhealthsaudi.com/content/dam/Informa/globalhealthsaudi/downloads/GHE19-KSA-HEALTHCARE-INDUSTRY-OVERVIEW.pdf>

¹⁸⁹² Rahman, *supra*.

¹⁸⁹³ KSA. Saudi Arabian Private Sector Participation Law Saudi Arabia Cabinet Decision No. 213/1418, Saudi Arabia Cabinet Decision No. 169/1419, through Saudi Arabia Cabinet Decision No. 308/1437, Saudi Arabia Cabinet Decision No. 355/1438, Saudi Arabia Cabinet Decision No. 665/1438. Riyadh National Centre for Privatisation 2019.

¹⁸⁹⁴ Rahman, *supra*.

¹⁸⁹⁵ Mohammed Mufti, *Healthcare development strategies in the Kingdom of Saudi Arabia* (Springer Science & Business Media, 2000).

¹⁸⁹⁶ Ministry of Health. *Annual Statistical Book*. Riyadh, Saudi Arabia: Ministry of Health; 2019.

personnel.¹⁸⁹⁷ The country needs 20,000 more beds by 2035¹⁸⁹⁸ and more than 13,700 doctors by 2030¹⁸⁹⁹ to meet the needs of the growing population. Taking the global average bed density into consideration, Saudi Arabia had a deficit of 14,000 beds in 2016.¹⁹⁰⁰ The deficit is expected to increase to 40,000 beds by 2035.¹⁹⁰¹ To achieve economic sustainability, the government plans to transfer some of the costs of providing health care to the private sector and use it to address future demands, thus compensating for decreasing oil prices.¹⁹⁰² To improve sustainable development, the government is expected to bring the public and private sectors closer together.¹⁹⁰³ This connection should improve the level of care, increase patient satisfaction, and reduce financial risks in the public sector.¹⁹⁰⁴

1.3. Limited role of the private sector in the Saudi economy

The private sector has not been active in the Saudi economy due to the country's dependency on oil, resulting in a lack of skilled Saudi workers in the private sector.¹⁹⁰⁵ This is problematic because Saudi Arabia aims to shift toward a market-based economy.¹⁹⁰⁶ Hence, the country must invest in education to create skilled Saudi workers. Currently, there is a perceived labor supply-demand mismatch.¹⁹⁰⁷ Many studies have highlighted the mismatch between the

¹⁸⁹⁷ Id.

¹⁸⁹⁸ Id.

¹⁸⁹⁹ Global Health Exhibition report, supra.

¹⁹⁰⁰ Rahman, supra.

¹⁹⁰¹ Id.

¹⁹⁰² Mohammed S Alnaif, Physicians perception of health insurance in Saudi Arabia, 30 Saudi Medical Journal 693-699 (2006).

¹⁹⁰³ Jens Roehrich, Michael Lewis and Gerard George, Are public-private partnerships a healthy option? A systematic literature review, 113 Social Science & Medicine 110-119 (2014).

¹⁹⁰⁴ Rahman, supra.

¹⁹⁰⁵ Abdullah Baqadir, Fiona Patrick and George Burns, Addressing the skills gap in Saudi Arabia: does vocational education address the needs of private sector employers?, 63 Journal of Vocational Education & Training 551-561 (2011).

¹⁹⁰⁶ Al-Asmari, Saudi labor force: Challenges and ambitions, 16 Arts and Humanities Journal 19-59 (2008).

¹⁹⁰⁷ Id.

labor force needs and the educational expectations of employers in Saudi Arabia.¹⁹⁰⁸ One of the reasons for this mismatch is the fact that Saudi Arabia has not emphasized the development of its education and training sector due to its dependency on oil.¹⁹⁰⁹ Thus, graduated domestic students cannot meet its labor demands.¹⁹¹⁰ One study argued that inadequate coordination between business and education, a lack of specialized programs, and a lack of employment practices among potential workers has resulted in a lack of skilled Saudi workers.¹⁹¹¹ Notably, the limited role of the private sector has left potential employees with no room to practice.

1.4. Shortage of qualified labor

Although Saudi Arabia spends more money on education than any other Middle Eastern country, many graduates lack the necessary qualifications for the job market.¹⁹¹² Evidently, there is an imbalance between what the market demands and what the education system produces.¹⁹¹³ The health sector accounts for 16.6% of the 591 academic programs in Saudi public universities, followed by business and management (11%) and the humanities.¹⁹¹⁴ Therefore, students do not receive an adequate education if they do not study these specific fields.¹⁹¹⁵ Limiting technical and vocational training clearly means that the country has failed to prepare its Saudi graduates for the global economy.¹⁹¹⁶ This issue is crucial given that the country wants to prioritize non-oil sectors and allow the private sector to play a major role in the economy.

¹⁹⁰⁸ Baqadir, Patrick and Burns, supra.

¹⁹⁰⁹ Al-Asmari, supra.

¹⁹¹⁰ Jane Higgins, Karen Nairn and Judith Sligo, Vocational imagination and labour market literacy: young New Zealanders making education–employment linkages, 62 *Journal of Vocational Education & Training* 13-25 (2010).

¹⁹¹¹ Nabih Maroun et al, How to succeed at education reform: The case for Saudi Arabia and the broader GCC region, 109 *Ideation Center* 1-33 (2010).

¹⁹¹² Abdulaziz Aldossari, Vision 2030 and reducing the stigma of vocational and technical training among Saudi Arabian students, 12 *Empirical Research in Vocational Education and Training* (2020).

¹⁹¹³ Mohammed Bosbait and Rodney Wilson, Education, School to Work Transitions and Unemployment in Saudi Arabia, 41 *Middle Eastern Studies* 533-546 (2006).

¹⁹¹⁴ Aldossari, supra.

¹⁹¹⁵ Bosbait and Wilson, supra.

¹⁹¹⁶ Aldossari, supra.

Even when the oil price was high, there was a lack of specialized Saudi workers.¹⁹¹⁷ From 1969 to the 1980s, the economy of the country grew due to the increased oil price. In response, technical and vocational training were not emphasized.¹⁹¹⁸ Since the 1970s, Saudi citizens have tended to choose an university education over technical and vocational training, aiming to be employed in the public sector.¹⁹¹⁹ This caused a domestic shortage of manufacturers, technicians, operators, and other skilled laborers.¹⁹²⁰ Consequently, the country has hired skilled foreign workers to bridge the gap.¹⁹²¹ High government salaries that require neither efficiency nor time seem to attract Saudi citizens to public-sector jobs over private-sector jobs, causing the private sector to rely on foreign workers over Saudi citizens.¹⁹²²

Official data show that 77.7% of private-sector workers are non-Saudi citizens.¹⁹²³ This will create serious long-term challenges when Saudi citizens seek jobs within a market system economy. It is obvious that the main reason why Saudi citizens are not employed in the private sector is because of its low wages compared to the public sector. The private sector employs many foreign workers from poor countries, and the low wages are seemingly enough to provide for their families back home. Evidently, the low wages are not sufficient to satisfy the basic needs of a family that aims to live in Saudi Arabia. Due to the absence of minimum wages, companies prefer employing foreign workers with low wage expectations rather than Saudi citizens. Companies have also exploited high unemployment rates among Saudi women and hired them at very low wages that are insufficient to pay for the rent of a small apartment.

¹⁹¹⁷ *Id.*

¹⁹¹⁸ *Id.*

¹⁹¹⁹ Makio Yamada, Can Saudi Arabia Move beyond "Production with Rentier Characteristics"? Human Capital Development in the Transitional Oil Economy, 72 *The Middle East Journal* 587-609 (2018).

¹⁹²⁰ *Id.*

¹⁹²¹ *Id.*

¹⁹²² *Id.*

¹⁹²³ Aldossari, *supra*.

Overall, the absence of regulation in the market system hinders the country's shift toward a market-based economy.

2. Limited role of the renewable energy sector

Saudi Arabia is a large country with a total area of 2,149,690 km², which is equivalent to half of Europe.¹⁹²⁴ The country only has two seasons, summer and winter, which usually create a high demand for electricity, especially in the summertime when the temperature is high.¹⁹²⁵ It is estimated that 85% of the total population lives in cities,¹⁹²⁶ which causes the country to consume oil at a much higher rate than the global average.¹⁹²⁷ Namely, oil consumption in Saudi Arabia is three times higher than the global average,¹⁹²⁸ and this number has increased by 6% over the last five years.¹⁹²⁹ The housing sector is responsible for 70% of the total electricity consumption in the country, meaning that it consumes the most oil as well.¹⁹³⁰ Crucially, many of the structures in Saudi Arabia lack insulation, which strongly contributes to the housing sector's electricity consumption.¹⁹³¹ The Saudi Electricity Company increased its total power transmission by 60% between 2000 and 2010.¹⁹³² Electricity consumption is expected to increase due to the rapidly growing population and the increasing number of people who live in urban areas.¹⁹³³

¹⁹²⁴ Salam and Khan, supra.

¹⁹²⁵ ShafiqurRehmana, Maher A.Badera and Said A.Al-Moallemb, Cost of solar energy generated using PV panels, 11Renewable and Sustainable Energy Reviews 1843-1857 (2007).

¹⁹²⁶ Peter Vincent, Saudi Arabia: an environmental overview (CRC Press, 2008).

¹⁹²⁷ Salam and Khan, supra.

¹⁹²⁸ Id.

¹⁹²⁹ Id.

¹⁹³⁰ Id.

¹⁹³¹ Id.

¹⁹³² Id.

¹⁹³³ Id.

2.1. Possible end of oil exportation

This high demand for fossil fuels to generate electricity will stop the country from exporting oil by 2025, as electricity consumption will have doubled in a decade.¹⁹³⁴ Currently, the consumption is increasing by 7% each year, and thus more fossil fuels are needed to generate electricity.¹⁹³⁵ Continuing at this rate would prevent the country from exporting oil to global markets,¹⁹³⁶ which would significantly affect the Saudi economy and put more pressure on government spending.¹⁹³⁷ In fact, consuming oil instead of exporting it would make it almost impossible achieve Vision 2030 due to the reliance of the GDP on oil. Even the current services that Saudi citizens enjoy would be affected if electricity consumption continues to increase at the same rate. Ultimately, it would exhaust Saudi Arabia's spare production capacity, causing greater volatility in the world oil markets.¹⁹³⁸

Population growth means that Saudi Arabia will require more electricity to desalinate water.¹⁹³⁹ As Saudi Arabia does not have rivers or water sources other than the sea, it relies on the desalination of seawater to satisfy its water demands.¹⁹⁴⁰ Saudi Arabia has 27 desalination plants, which consume 16% of its daily oil production.¹⁹⁴¹ The use of desalination water is expected to increase by 40% by 2025 if no alternative energy sources are found,¹⁹⁴² resulting in the use of more fossil fuels, which will worsen the country's dependency on oil and contribute to

¹⁹³⁴ Makbul Ramli et al, Optimal sizing of grid-connected photovoltaic energy system in Saudi Arabia, 75 *Renewable Energy* 489-495 (2015).

¹⁹³⁵ Salam and Khan, *supra*.

¹⁹³⁶ *Id.*

¹⁹³⁷ *Id.*

¹⁹³⁸ *Id.*

¹⁹³⁹ Arif Hepbasli and Zeyad Alsuhaibani, A key review on present status and future directions of solar energy studies and applications in Saudi Arabia, 15 *Renewable and Sustainable Energy Reviews* 5021-5050 (2011).

¹⁹⁴⁰ *Id.*

¹⁹⁴¹ Mamdouh Salameh, Saudi Arabia's Oil Price Dilemma: Between a Rock & a Hard Place, 17 *USAEE Working Paper* 1-23 (2017).

¹⁹⁴² *Id.*

climate change. Although it is possible to satisfy these domestic electricity demands with solar power, oil is cheaper to use because of its low price and massive subsidies.

2.2. Deficit in the Saudi economy after the oil crash

Decreased oil prices have affected the government revenues of many oil-producing countries.¹⁹⁴³ This decrease seems to have become the norm, creating challenges for oil-producing countries,¹⁹⁴⁴ and it has clearly affected Saudi Arabia, as the country relies on fossil fuels for 50% of its GDP.¹⁹⁴⁵ The oil crash in 2014 harshly affected the Saudi economy, and it has been draining the government's budget.¹⁹⁴⁶ As a result of the oil crash, the deficit in Saudi Arabia reached more than \$118 billion in 2016, which equals 16% of its GDP.¹⁹⁴⁷ Decreased oil prices would push policymakers to make difficult decisions that may affect the welfare of the Saudi people and thus affect almost all domestic sectors, including the health and education sectors.¹⁹⁴⁸ If the welfare of the citizens decreases because of the government's measures to address the deficit, then the government may have to give incentives to poor people in the country. Most importantly, Saudi Arabia would struggle to finance projects to shift its dependency on the oil sector to non-oil sectors.¹⁹⁴⁹

In 2016, Saudi Arabia made an arrangement known as OPEC+ with both OPEC and non-OPEC countries to combat the persistent supply glut.¹⁹⁵⁰ This arrangement helped the OPEC+

¹⁹⁴³ Hany Abdel-Latif, Rehab Osman and Heba Ahmed, Asymmetric Impacts of Oil Price Shocks on Government Expenditures: Evidence from Saudi Arabia, 6 *Cogent Economics & Finance* 1-22 (2018).

¹⁹⁴⁴ *Id.*

¹⁹⁴⁵ Look at OPEC report at: https://www.opec.org/opec_web/en/about_us/169.htm

¹⁹⁴⁶ Abdel-Latif, *supra*.

¹⁹⁴⁷ *Id.*

¹⁹⁴⁸ *Id.*

¹⁹⁴⁹ *Id.*

¹⁹⁵⁰ Gregory Brew, COVID-19 and the Oil Price Crash: Twin Crises Impacting Saudi-Iran Relations, *Istituto Affari Internazionali* 1-7 (2020).

countries to stabilize oil prices between \$50–60 USD after the oil crash.¹⁹⁵¹ This price range enabled Saudi Arabia to finance its Vision 2030 projects¹⁹⁵² and its government spending.¹⁹⁵³ However, despite these measures, the oil price is not always stable. For instance, when the COVID-19 outbreak began, Saudi Arabia tried to rally the rest of the OPEC+ countries with a new campaign focused on production cuts, but Russia disagreed with the new cuts and resisted them.¹⁹⁵⁴ This conflict made Saudi Arabia abandon its plan for a production cut. Instead, it increased its oil production to the maximum to force Russia back to the negotiating table.¹⁹⁵⁵ This made the oil price decrease to less than \$30, making it more challenging for Saudi Arabia to achieve its Vision 2030 goals.

Issues caused by OPEC+ countries make it difficult to stabilize oil prices between \$50–60. Many OPEC+ countries would refuse deeper cuts to their oil production due to their own economic issues,¹⁹⁵⁶ and Saudi Arabia does not want to carry the burden of the cut by losing its market share in order to stabilize oil prices.¹⁹⁵⁷ In fact, many countries such as Russia can function with an oil price of \$40 or less, placing Saudi Arabia in a difficult position when it proposes further cuts to oil production.¹⁹⁵⁸ Without high oil prices between \$50–60, the country would face an imminent financial crisis and difficulties in applying its Vision 2030.¹⁹⁵⁹ Low oil prices have significantly affected the Saudi foreign currency reserves.¹⁹⁶⁰ For instance, when the oil price crashed, the Saudi foreign currency reserves decreased from \$744 billion in July 2014 to

¹⁹⁵¹ *Id.*

¹⁹⁵² Saudi Arabia, Vision 2030, 2016, <https://www.vision2030.gov.sa/en>.

¹⁹⁵³ Brew, *supra*.

¹⁹⁵⁴ *Id.*

¹⁹⁵⁵ *Id.*

¹⁹⁵⁶ Salameh, *supra*.

¹⁹⁵⁷ *Id.*

¹⁹⁵⁸ *Id.*

¹⁹⁵⁹ *Id.*

¹⁹⁶⁰ *Id.*

\$524 billion in January 2017.¹⁹⁶¹ Evidently, Saudi Arabia must deal with the challenges posed by other OPEC+ countries to stabilize the oil price.

2.3. Inefficiency of exploiting renewable energy sources

Because of these challenges, renewable energy is viewed as an alternative source of electricity in Saudi Arabia.¹⁹⁶² Relying only on oil would cause serious issues for the country since this source is both exported for oil revenues and used to generate electricity domestically. Saudi Arabia needs to generate an additional 4 GW each year to meet the rising demand.¹⁹⁶³ Renewable energy could be a solution to this high demand as well as combat climate change and substantially improve energy production, thus alleviating the current strain on the economy and the environment.¹⁹⁶⁴ The growth of the domestic economic sector and the residential sector relies on a stable and increasing energy supply. Renewable energy can serve as a driver for diversifying the energy mix by installing renewable energy sources and adding them to the national grid. This idea has been recognized by Khalid al-Falih, the Minister of Energy, and he noted that renewable energy will be essential to energy generation in Saudi Arabia and realizing Vision 2030.¹⁹⁶⁵

Many experts have stated that Saudi Arabia has one of the best locations for generating electricity using photovoltaic solar energy.¹⁹⁶⁶ The European Commission Institute for Energy reported that 0.3% of the light falling on Saudi's deserts could generate electricity for the whole of Europe.¹⁹⁶⁷ A Solar Radiation Atlas developed by both King Abdulaziz City for Science and

¹⁹⁶¹ *Id.*

¹⁹⁶² Katrine Wiulsrød Ratikainen, *Transitioning to renewable energy in Saudi Arabia: A multi-level perspective analysis of the Saudi renewable energy policies*, MA Thesis at UNIVERSITY OF OSLO 1-94 (2017).

¹⁹⁶³ *Id.*

¹⁹⁶⁴ *Id.*

¹⁹⁶⁵ Ratikainen, *supra*.

¹⁹⁶⁶ Salam and Khan, *supra*.

¹⁹⁶⁷ *Id.*

Technology (KACST) and the United States National Renewable Energy Laboratory monitored the sun radiation in Saudi Arabia throughout the year.¹⁹⁶⁸ The atlas found that in some regions in the summer, the sun radiation reached 30 MJ/m²/day and was not less than 24 MJ/m²/day anywhere in the country, even in the month of January.¹⁹⁶⁹ This means that the solar radiation falling on Saudi Arabia is among the highest in the world,¹⁹⁷⁰ which gives the country the potential to generate a lot of renewable energy. Although the currently unstable oil prices may create an imbalance in the supply and demand of electricity,¹⁹⁷¹ renewable energy can bridge this supply gap.¹⁹⁷² Saudi Arabia even has the potential to both satisfy its domestic demand for electricity from renewable energy and export surplus electricity.¹⁹⁷³

2.4. Lack of renewable energy laws and policies

Nevertheless, the progress of adding renewable energy to the energy mix in Saudi Arabia has been relatively slow.¹⁹⁷⁴ Since 2015, Saudi Arabia has produced an additional 17 MW each year, which is still low in comparison to the annual increase in the demand for energy, which is 4 GW per year.¹⁹⁷⁵ For renewable energy to become the major source in the energy mix, it must be financially competitive with fossil fuels. This is especially problematic in Saudi Arabia because almost all sources of energy and electricity come from fossil fuels. Hence, renewable energy needs government support and subsidies to compete with fossil fuels due to the long history of

¹⁹⁶⁸ NREL (2000) National Renewable Energy Laboratory. Renewable energy technology photo database. Available at: <https://images.nrel.gov/bp/#/>

¹⁹⁶⁹ Id.

¹⁹⁷⁰ Salam and Khan, *supra*.

¹⁹⁷¹ Id.

¹⁹⁷² Id.

¹⁹⁷³ Id.

¹⁹⁷⁴ Ratikainen, *supra*.

¹⁹⁷⁵ Industry Saudi Arabia's Ministry of Energy, and Mineral Resources, "Saudi Arabia's Ministry of Energy, Industry, and Mineral Resources Issues First Request for Qualifications for Round 1 Projects of the National Renewable Energy Program (Nrep)," news release, 20.02.2017, https://www.powersaudi Arabia.com.sa/web/attach/news/RFQ_Press_Release_SaudiArabiaMinistryofEnergy.pdf.

subsidies for the fossil fuels industry.¹⁹⁷⁶ The International Renewable Energy Agency (IRENA) reported that Gulf region countries such as Saudi Arabia must adopt both long-term policies and create a stable and transparent regulatory and investment climate to support the early deployment of renewable energy.¹⁹⁷⁷ Such policies, aside from promoting the ongoing development of renewable energy technology, would make it more competitive and even more cost-efficient than fossil fuels in the near future.¹⁹⁷⁸

Despite the government policies proposed to support the use of renewable energy, these sources still suffer from their intermittency.¹⁹⁷⁹ Renewable energy sources, mainly solar and wind, cannot produce a steady and secure supply throughout the day and night. In particular, the main issue that faces solar energy is proper storage so that the energy obtained during the day can be used at night.¹⁹⁸⁰ Energy storage technologies are still not competitive for renewable energy sources in comparison to fossil fuels.¹⁹⁸¹ Thus, Saudi Arabia must improve its storage of clean energy for solar energy to be more competitive with fossil fuels. Therefore, energy storage is an added cost of establishing solar energy. In a show of support, the Saudi Electricity Company has committed to buying power that comes from renewable energy sources with independent power purchase contracts.¹⁹⁸² The Saudi company also plans to create an independent company that will only purchase clean energy with long-term contracts.¹⁹⁸³ Regardless, it is unclear when the issues caused by intermittency will be solved.

¹⁹⁷⁶ Yasser Al-Saleh, An empirical insight into the functionality of emerging sustainable innovation systems: the case of renewable energy in oil-rich Saudi Arabia, 1 International Journal of Transitions and Innovation Systems 302-320 (2011).

¹⁹⁷⁷ Ratikainen, supra.

¹⁹⁷⁸ Id.

¹⁹⁷⁹ This issue has been explained heavily in chapter 2

¹⁹⁸⁰ Joskow, supra.

¹⁹⁸¹ BRUCE, supra.

¹⁹⁸² Ratikainen, supra.

¹⁹⁸³ Id.

For a long time, Saudi Arabia adopted a system of double subsidies to support fossil fuels.¹⁹⁸⁴ Saudi Aramco, the national oil company, sells its fuels at subsidized prices to power plants that generate electricity, which in turn is sold at a subsidized price to the end consumer.¹⁹⁸⁵ At the same time, transportation fuels are also subsidized, meaning that the fossil fuel sector receives two double subsidies.¹⁹⁸⁶ The power plant purchases oil from Saudi Aramco at \$5–15 per barrel, which is obviously far below the market price.¹⁹⁸⁷ The International Monetary Fund (IMF) reported that the subsidies to the Saudi fossil fuel sector have reached “\$107 billion, which is equal to 13.2% of the GDP in 2015.”¹⁹⁸⁸ This is a loss for the Saudi economy, especially when the country faces a deficit in its budget.¹⁹⁸⁹ Most importantly, these subsidies benefit the fossil fuel sector and block the way for renewable energy, as these subsidies create favorable conditions for the fossil fuel sector.¹⁹⁹⁰ Although Saudi Arabia has lowered its subsidies to the fossil fuel industry, the support for it still exists.¹⁹⁹¹ Therefore, it is critical to cut these subsidies to promote renewable energy and achieve the Vision 2030 goals.¹⁹⁹²

The low price of electricity is the main reason for its overconsumption in Saudi Arabia.¹⁹⁹³ The price directly affects the demand for electricity by influencing the consumption of fuel and electricity and also indirectly affects it because of the choices made regarding energy-consuming equipment, its efficiency, and how often it is used.¹⁹⁹⁴ Electricity prices are set by the

¹⁹⁸⁴ *Id.*

¹⁹⁸⁵ *Id.*

¹⁹⁸⁶ *Id.*

¹⁹⁸⁷ *Id.*

¹⁹⁸⁸ *Id.*

¹⁹⁸⁹ *Id.*

¹⁹⁹⁰ *Id.*

¹⁹⁹¹ *Id.*

¹⁹⁹² *Id.*

¹⁹⁹³ Jim Krane, *Energy Governance in Saudi Arabia: An assessment of the kingdom’s resources, policies, and climate approach*, James A. Baker III Institute for Public Policy of Rice University 1-36 (2019).

¹⁹⁹⁴ *Id.*

government in Saudi Arabia, placing them far below the international market prices and thus increasing overconsumption.¹⁹⁹⁵ Subsidized electricity prices result from the role of the government in serving the people and increasing their welfare, as stated in the constitution.¹⁹⁹⁶ Although these subsidy policies were not intended to be permanent, their removal would create some political challenges.¹⁹⁹⁷ Hence, the government would find it difficult to make any reforms that would affect the people.¹⁹⁹⁸

2.5. Previous failures of shifting towards renewable energy sources

Previously, the country failed to achieve one renewable energy goal.¹⁹⁹⁹ Namely, the King Abdullah City for Atomic and Renewable Energy (KA CARE) failed to generate 41 GW of energy by 2012.²⁰⁰⁰ Although KA CARE is the head of the renewable energy program, other entities were involved, including Saudi Aramco, the Saudi Electricity Company (SEC), and the Electricity & Cogeneration Regulatory Authority (ECRA).²⁰⁰¹ Many reports noticed the missing regulations for cooperation between these entities, which contributed to KA CARE's failure.²⁰⁰² Other reports expressed that although the different entities agreed on their goals, the means to achieve these goals was debated.²⁰⁰³ Imtiaz Mahtab, the president of the Middle East Solar Industry Association (MESIA), observed that there was no clear particular ministry leading the initiative and with the balance sheet to conclude power purchase agreements directly.²⁰⁰⁴ In other

¹⁹⁹⁵ Id.

¹⁹⁹⁶ Id.

¹⁹⁹⁷ Id.

¹⁹⁹⁸ Id.

¹⁹⁹⁹ Ratikainen, supra.

²⁰⁰⁰ Id.

²⁰⁰¹ Id.

²⁰⁰² Id.

²⁰⁰³ Id.

²⁰⁰⁴ Id.

words, the project was subjected to government bureaucracy and lacked a leading ministry that would take quick and serious actions to achieve its goals.²⁰⁰⁵

In 2020, the COVID-19 crisis created even more challenges for Saudi Arabia in addition to those caused by the low oil price.²⁰⁰⁶ The shut-down that occurred in most countries decreased the demand for oil, causing a decrease in the oil price, which was already low. In addition, the COVID-19 pandemic put pressure on the health sector, and Saudi Arabia also had to shut down the economy for some time, creating even more challenges for the Saudi economy and small businesses. The annual Hajj pilgrimage, which brings billions into the Saudi economy, was suspended in 2020 and will probably be suspended in 2021.²⁰⁰⁷ In addition to low oil prices, these economic problems caused by the pandemic will put further pressure on Vision 2030.

3. Administrative law issues in Saudi Arabia

Public administration is an important sector in any given society. This administration aims to serve communities by enacting laws that will benefit society as a whole.²⁰⁰⁸ Therefore, public administration intends to efficiently manage a society's needs and must build a strong relationship with the citizens.²⁰⁰⁹ The administrations' role in maintaining the welfare of society can be seen in, for instance, classic public administration theory, which emerged and succeeded in the nineteenth century.²⁰¹⁰ The theory created bureaucracies as a means to manage the

²⁰⁰⁵ *Id.*

²⁰⁰⁶ Brew, *supra*.

²⁰⁰⁷ *Id.*

²⁰⁰⁸ Al Otaibi, *supra*.

²⁰⁰⁹ Jocelyne Bourgon, Responsive, responsible and respected government: towards a New Public Administration theory, 73 *International Review of Administrative Sciences* 7-26 (2007).

²⁰¹⁰ Al Otaibi, *supra*.

significant changes associated with the industrial revolution and argued that public administration must be hierarchical to achieve impartiality, compliance, and predictability.²⁰¹¹

For the past thirty years, many countries have focused on developing different administrative laws with the intention of making public administration more efficient, productive, and responsive.²⁰¹² Some countries have focused on privatization and deregulations,²⁰¹³ whereas others such as Norway have adopted decentralization while still recognizing the role of the state in the economy.²⁰¹⁴ The varied experiences of different countries in developing administrative laws have made it easier for developing countries to select the most successful laws for their public sectors and to discard unsuccessful ventures.²⁰¹⁵ For instance, New Zealand and Australia successfully adopted administrative laws based on New Public Management (NPM).²⁰¹⁶ NPM a set of management techniques and practices that seek to organize the public sector into the market system and support decentralization.²⁰¹⁷ Norway applied the same system but added some features to increase the role of the private sector, following the belief that the public sector represents the will of the people and must be active to improve welfare.²⁰¹⁸

3.1. Modernization effort of the public sector in Saudi Arabia

²⁰¹¹ *Id.*

²⁰¹² *Id.*

²⁰¹³ *Id.*

²⁰¹⁴ Karl Henrik Sivesind, *Promoting active citizenship: The changing roles of for-profit and nonprofit welfare provision in Norway, Sweden, and Denmark* (Palgrave Macmillan, 2017).

²⁰¹⁵ Al Otaibi, *supra*.

²⁰¹⁶ Tor Hernes, *Four ideal-type organizational responses to New Public Management reforms and some consequences*, 71 *International Review of Administrative Sciences* 5-17 (2005).

²⁰¹⁷ *Id.*

²⁰¹⁸ Sivesind, *supra*.

Saudi Arabia spent a significant amount of money on modernizing its public administration.²⁰¹⁹ The government established the General Memorandum Committee Administrative Reform, with the goal of improving the public sector at large.²⁰²⁰ Before the reforms, the structures of Saudi public agencies had not changed for 40 years,²⁰²¹ and they were full of overlaps and duplications.²⁰²² After the reforms, government expenditure was reduced, given that many agencies were canceled or unified.²⁰²³ Regardless, public administration in Saudi Arabia is still impacted by the inefficiency of its procedures, such as unsystematic flows of information and insufficient coordination.²⁰²⁴ In addition, a significant part of the GDP goes to this sector. Ultimately, an inefficient public sector will be unable to regulate the private sector and will needlessly consume a significant part of the GDP.

Despite the effort to modernize the Saudi public administration, the development of this sector has been slow.²⁰²⁵ Overall, the sector seems to be weak in addressing the application of the public sector in the market system and does not take into account the country's organizational and institutional structure.²⁰²⁶ As the structure of the public sector is not suited for a market-based economy, this will affect the economy. Considering how the public sector functions as well as public finance and budgeting, it is clear that such a structure will not attract investments in the Saudi economy from the private sector.²⁰²⁷ For instance, one main issue with the administrative laws in Saudi Arabia is the long approval process for any administrative action

²⁰¹⁹ Al Otaibi, supra.

²⁰²⁰ Id.

²⁰²¹ Id.

²⁰²² Id.

²⁰²³ Id.

²⁰²⁴ Joseph Jabbara and Nancy Jabbara, Administrative culture in the Middle East: the case of the Arab world, 28 Africanus 33-52 (1998).

²⁰²⁵ Bassam A. Bassam, Public Finance in Saudi Arabia: The Need for Reform, 26 Middle East Policy 35-44 (2019).

²⁰²⁶ Biygautane, Gerber and Hodge, supra.

²⁰²⁷ Bassam, supra.

or project “centralization.”²⁰²⁸ The public sector takes a long time to update its regulations and clarify its procedures since the country suffers from outdated regulations and unclear procedures.²⁰²⁹ Moreover, the country seems to lack transparency in the governing process, making the private sector skeptical of investing in it.²⁰³⁰ Therefore, any reforms to the economy must take the development of the administrative laws for the public sector into consideration.

3.2. Economic complexity index

Many reports have observed the inefficiency of the public sector in Saudi Arabia.²⁰³¹ For instance, the economic complexity index (ECI) noted that the administration of the public sector in Saudi Arabia is unstable.²⁰³² The ECI defined economic complexity as “the composition of a country’s productive output and represented the structures that emerge to hold and combine the knowledge.”²⁰³³ Consequently, the ECI measures the knowledge intensity of an economy by considering the knowledge intensity of the products that the country exports.²⁰³⁴ Economic complexity has a greater potential for economic growth if it generates the products requiring advanced technology and a high level of knowledge.²⁰³⁵ Such economies can more easily resist economic crises than economies that rely on raw materials in their GDPs.²⁰³⁶ The superiority of complex economies results from their high levels of diversification and development in comparison to non-complex economies.²⁰³⁷ The public sector is the core of achieving a complex,

²⁰²⁸ Id.

²⁰²⁹ Id.

²⁰³⁰ Id.

²⁰³¹ Id.

²⁰³² Id.

²⁰³³ Birol Erkan and Elif Yildirimcib, Economic Complexity and Export Competitiveness, 195 *Procedia - Social and Behavioral Sciences* 524-533 (2015).

²⁰³⁴ Bassam, supra.

²⁰³⁵ Id.

²⁰³⁶ Id.

²⁰³⁷ Id.

strong economy through its administrative laws and structure.²⁰³⁸ Following the ECI, Saudi Arabia currently lacks the knowledge base and economic diversification of a complex economy.²⁰³⁹ Hence, administrative reforms are needed for Saudi Arabia to obtain a complex economy that is compatible with Vision 2030.²⁰⁴⁰

3.3. Bureaucracy in Saudi Arabia

The Saudi public administration is hierarchical and functional, meaning that it provides services to the public in a highly bureaucratic fashion.²⁰⁴¹ The Council of Ministers, which is responsible for many internal and external affairs, answers to the king.²⁰⁴² Many reports have shown that public administrations in Gulf Cooperation Council countries are similar to each other, as they are all bureaucratic and highly centralized.²⁰⁴³ A bureaucratic public administration has hierarchical control, with a pyramidal structure underlying this formal control.²⁰⁴⁴ Over-centralization creates many problems for managers since policies take a long time and they cannot make the independent decisions that people need.²⁰⁴⁵ In this context, public employees do not seem to participate in the decisions of their sector.²⁰⁴⁶ This leads subordinates to rely heavily on their superiors for minor administrative issues, which distracted these superiors from more important issues.²⁰⁴⁷

²⁰³⁸ Id.

²⁰³⁹ Id.

²⁰⁴⁰ Id.

²⁰⁴¹ Arwa Bokhari and Rizwan Qureshi, Business Process Re-Engineering in Public Administration of Kingdom of Saudi Arabia, 8 International Journal of Information Engineering and Electronic Business 1-10 (2016).

²⁰⁴² Jabbra and Jabbra, supra.

²⁰⁴³ Richard Common, Administrative change in the Gulf: Modernization in Bahrain and Oman, 74 International Review of Administrative Sciences 177-193 (2008)

²⁰⁴⁴ Id.

²⁰⁴⁵ Jabbra and Jabbra, supra.

²⁰⁴⁶ Id.

²⁰⁴⁷ Id.

Since Saudi Arabia is a rentier state, it does not have the incentive to change its highly bureaucratic public administration. This bureaucracy developed because the government controls the major sources of the economy, oil and gas, which means that any decision regarding these matters must be made by the Council of Ministers. There is a link between political stability and oil prices in Saudi Arabia, which makes the country govern bureaucratically through its public sector.²⁰⁴⁸ Moreover, the social culture of Saudi Arabia is based on tradition, religious values, and community, all of which seem to support bureaucracy.²⁰⁴⁹ Consequently, Saudi culture is amicable with bureaucracy and has resulted in a rigid environment that is resistant to administrative change.²⁰⁵⁰

Bureaucracy affects the quality of services in terms of their delays and performance issues.²⁰⁵¹ The complicated rules and regulations of the public sector prevent it from providing the required services, and this lack of clarity will thus dissuade businesses from investing in the country.²⁰⁵² The negative effects of bureaucracy are seen clearly in time-consuming procedures where approval must be sought from a chain of several officials before a matter can be sent to a top bureaucrat for his approval.²⁰⁵³ In fact, many individuals and business owners have to travel to major cities to finalize transactions.²⁰⁵⁴ Bureaucracy is responsible for emerging nepotism, a feature of bureaucracy in Saudi public management.²⁰⁵⁵ Although the government has used e-

²⁰⁴⁸ Pawan Budhwar and Kamel Mellahi, *Handbook of Human Resource Management in the Middle East* (Edward Elgar Publishing, 2016).

²⁰⁴⁹ Al Otaibi, *supra*.

²⁰⁵⁰ *Id.*

²⁰⁵¹ Bokhari and Qureshi, *supra*.

²⁰⁵² Al Otaibi, *supra*.

²⁰⁵³ *Id.*

²⁰⁵⁴ *Id.*

²⁰⁵⁵ *Id.*

government strategies to improve service quality, e-government operations merely reflect actual bureaucratic operations.²⁰⁵⁶

3.4. Issues of the public procurement law

The negative impact of bureaucracy in Saudi Arabia is clear from, for instance, the public projects established through public procurement law.²⁰⁵⁷ Formal statistics in Saudi Arabia show that 70% of public sector projects in the past decade have been delayed.²⁰⁵⁸ A questionnaire to more than 300 project managers from different sectors and disciplines reported that 80% of the projects were subject to overrun costs and 97% faced time issues.²⁰⁵⁹ These studies referred to public procurement law as the main reason for delays and overrun costs.²⁰⁶⁰ More specifically, the Saudi procurement system delivery method seems to be inefficient as it relies on a correlation between low performance and the low-bid method.²⁰⁶¹ Many studies have clearly expressed that the low-bid method is a major factor in project performance.²⁰⁶²

Since the public procurement law was enacted in the 1970s, Saudi Arabia has made few reforms to this law.²⁰⁶³ A member of the Chamber of Commerce stated that the Saudi public procurement law focuses only on low prices and does not address quality.²⁰⁶⁴ He clearly argued that the law is outdated and has not been developed over the years.²⁰⁶⁵ There are many gaps in the law, and the issue of bureaucracy makes it difficult to reform. Public procurement must not

²⁰⁵⁶ Bokhari and Qureshi, *supra*.

²⁰⁵⁷ Dhafer Al Ahmari and Paul Davis, PUBLIC PROCUREMENT SYSTEMS: A COMPARATIVE STUDY OF IRELAND AND SAUDI ARABIA, AHMARI & DAVIS 55-83.

²⁰⁵⁸ Abdullah Albogamy, Darren Scott and Nashwan Dawood, Addressing Construction Delays in the Kingdom of Saudi Arabia, 45 International Proceedings of Economics Development & Research 148-153 (2012).

²⁰⁵⁹ Ahmed Alofi, Yasir Alhammadi, Dean Kashiwagi and Kenneth Sullivan, Upgrade the Saudi Arabian Procurement System Delivery Method, 7 Journal for the Advancement of Performance Information and Value 1-13 (2015).

²⁰⁶⁰ *Id.*

²⁰⁶¹ *Id.*

²⁰⁶² *Id.*

²⁰⁶³ *Id.*

²⁰⁶⁴ *Id.*

²⁰⁶⁵ *Id.*

be seen as a secondary issue in the Saudi economy. In fact, public procurement is a key economic activity for any government.²⁰⁶⁶ Piga and Treumer asserted that public procurement is a valuable public policy tool that can improve the GDP of a country.²⁰⁶⁷ Hence, an effective procurement system requires a law that ensures a competitive environment, with the perspective of achieving the best outcomes.²⁰⁶⁸ Because public procurements contribute to an estimated 15% of the GDP,²⁰⁶⁹ addressing these issues with public procurement laws would benefit the GDP as a whole.

3.5. Impact of bureaucracy on the renewable energy sector

Administrative and bureaucratic complexities affect most emerging sectors.²⁰⁷⁰ In particular, bureaucratic complexities can harshly affect the development of the renewable energy sector in many ways, such as by causing planning delays and implementing restrictions.²⁰⁷¹ The lack of coordination between different parts of the public sector and the unnecessarily long time needed to obtain authorization increases the costs of a project by extending its development phase.²⁰⁷² Evidently, a bureaucratic and inactive public administration might hinder the growth of new sectors. Importantly, the renewable energy sector requires financial support to be competitive with the fossil fuel sector,²⁰⁷³ including financial incentives and taxes on imported equipment for renewable energy plants.²⁰⁷⁴ Although feed-in tariffs are the measure that the government intends to use to support renewable energy and make it cost-competitive with fossil

²⁰⁶⁶ Al Ahmari and Davis, *supra*.

²⁰⁶⁷ *Id.*

²⁰⁶⁸ *Id.*

²⁰⁶⁹ Public Procurement Law in Kingdom of Saudi Arabia, 7 CT. UNCOURT 33 (2020).

²⁰⁷⁰ Seetharaman, Krishna Moorthy, Nitin Patwa, Saravanan and Yash Gupta, Breaking barriers in deployment of renewable energy, 5 Heliyon (2019).

²⁰⁷¹ *Id.*

²⁰⁷² *Id.*

²⁰⁷³ *Id.*

²⁰⁷⁴ *Id.*

fuel-based technologies, the absence of these adequate financial incentives results in high costs that hinder the industry's development, operation, and potential.²⁰⁷⁵

The lack of a regulated market and clean energy infrastructure creates more challenges for the renewable energy sector.²⁰⁷⁶ The emerging sector cannot compete with fossil fuels since the latter is mature and uses conventional generation technologies that are often subsidized.²⁰⁷⁷ While the renewable energy sector is transparent due to the defined feed-in tariffs or other support mechanisms, the fossil fuel sector is much less transparent, and its operations remain largely unknown to the general public.²⁰⁷⁸ This may cause the general public to dislike clean energy due to the negative publicity following increased electricity prices.²⁰⁷⁹ Overall, the public sector that does not provide efficient support to the renewable energy sector and continues to subsidize the fossil fuel sector, which it has done so for decades. This behavior will not attract investors to the new sector or motivate the general public to use clean energy sources.

3.6. Gap between governments' targets and actual results

There is a gap between the Saudi governments' policy targets and actual results.²⁰⁸⁰ A government must acknowledge the features of its administrative public sector before setting targets, given that it is responsible for creating realistic targets and addressing loopholes in the implementation process itself.²⁰⁸¹ Laws and policies should offer solutions based on the reality of

²⁰⁷⁵ Id.

²⁰⁷⁶ Look at the IRENA Executive Strategy Workshop on Renewable Energy in South East Europe: Overcoming Barriers to Authorizing Renewable Power Plants and Infrastructure. Available at: https://www.irena.org/-/media/Files/IRENA/Agency/Events/2013/Jan/12_1/Background_Paper-D.pdf?la=en&hash=CAE94D402BD2800E38B02F1F45D8833AE64C2D1D

²⁰⁷⁷ Id.

²⁰⁷⁸ Id.

²⁰⁷⁹ Id.

²⁰⁸⁰ Seetharaman, Moorthy, Patwa and Gupta, *supra*.

²⁰⁸¹ Id.

any given country, not on what it hopes to achieve.²⁰⁸² For instance, southeastern European countries made laws to invest in the establishment of their renewable energy sectors that did not fully comply with the regulations and renewable energy targets of the European Union.²⁰⁸³ In short, setting any governmental goal requires an active public sector that will enact laws and regulations in support market competitiveness and communicate clearly with businesses. In this context, Saudi Arabia suffers from an overly bureaucratic public sector and unclear laws on many important matters.²⁰⁸⁴

A complex bureaucratic administrative sector will harm the economy of the country. A study assessed the negative impact of bureaucracy in Saudi Arabia on the economy, and it showed that outdated procedures and techniques have all resulted in the misuse and misallocation of public funds.²⁰⁸⁵ This will make it more difficult to achieve Vision 2030.²⁰⁸⁶ A similar study of the budgeting system stated that relying on the current administrative system in Saudi Arabia will cause problems in the budgeting system and contribute to the low quality of public services and increased corruption.²⁰⁸⁷ An active, non-centralized, and accountable public sector that provides a competitive market environment is necessary for diversifying the Saudi economy.²⁰⁸⁸ In general, the current administrative sector in Saudi Arabia seems to have many significant issues, such as the absence of an internal audit function or an inactive one.²⁰⁸⁹ Problems with this function may justify the misallocation of public funds, which is problematic to Saudi Arabia, especially after the significant decrease of the oil price in 2016.

²⁰⁸² *Id.*

²⁰⁸³ *Id.*

²⁰⁸⁴ *Id.*

²⁰⁸⁵ Bassam, *supra*.

²⁰⁸⁶ *Id.*

²⁰⁸⁷ *Id.*

²⁰⁸⁸ *Id.*

²⁰⁸⁹ *Id.*

The non-active, outdated administrative sector will lead to corruption. In 2020 alone, the Oversight and Anti-Corruption Authority reported to the public on many corruption cases involving millions of misused funds.²⁰⁹⁰ For instance, the authority investigated 48 parties on one such matter, including 19 employees of the Ministry of Defense, three government employees, 18 businessmen, and eight employees of contracting companies with the joint forces, including three ex-pats.²⁰⁹¹ The authority found that 44 officials, businessmen, and employees of different nationalities were involved in the crimes of forgery, squandering of public funds, and exploiting the influence of the public office for illicit financial gain. The total amount obtained from them reached 1,229,400,000 SAR.²⁰⁹² Another case that the authority reported to the public occurred in the Ministry of the Interior.²⁰⁹³ A retired major general from the Presidency of State Security, a former advisor at the Ministry of Interior, a retired brigadier general from the Ministry of the Interior, and two businessmen were involved in the case.²⁰⁹⁴ The authority found that a public procurement contract had been given to two businessmen using corrupt methods.²⁰⁹⁵ The public contract amounted to 11,000,000 SAR, and the two businessmen had paid 1,600,000 SAR to receive this contract.²⁰⁹⁶ In 2020 alone, these cases and many others have been solved, and legal actions were taken. Clearly, administrative law must be updated to address the public sector and prevent corruption in the future.

²⁰⁹⁰ Note: The oversight and anti-corruption institution became active after 2016 when the vision 2030 was established and the country took serious steps in anti-corruption.

²⁰⁹¹ Look at the official site of the Saudi Oversight and Anti-Corruption authority's website, available at: <https://www.nazaha.gov.sa/en-us/mediacenter/news/pages/news1327.aspx>

²⁰⁹² Id.

²⁰⁹³ Look at the official site of the Saudi Oversight and Anti-Corruption authority's website, available at: <https://www.nazaha.gov.sa/en-us/mediacenter/news/pages/news1340.aspx>

²⁰⁹⁴ Id.

²⁰⁹⁵ Id.

²⁰⁹⁶ Id.

Conclusion

This chapter discussed the issues that Saudi Arabia must address to shift from relying on fossil fuels to non-oil sectors, mainly the renewable energy sector. The first part focused on the limited role of the private sector in the Saudi economy. One of the main reasons for this limitation is the present lack of a regulatory framework that promotes a competitive market, as the country has historically relied on fossil fuels in its economy. The second part explored the impact of low oil prices on the implementation of Vision 2030 and the challenges that the renewable energy sector faces in becoming competitive with the fossil fuel sector, especially when the price of oil is low and the generation of clean energy is relatively expensive. The last part of the chapter examined the role of Saudi administrative law in providing a competitive market system and supporting emerging sectors, particularly the renewable energy sector. This part also analyzed the administrative issues that Saudi Arabia suffers from and the extent to which they affect the development of the renewable energy sector.

The inspired Vision 2030 seems to address more serious problems than any that the country has ever dealt with before. Following the oil crash in 2014, the country struggled to cover its government spending, let alone finance the huge projects needed to realize Vision 2030. The IMF stated that the financial reserve of Saudi Arabia will only be able to fill the budget deficit for 15 more years. Hence, the country intends to make the necessary economic shift and build a strong, sustainable economy. Nevertheless, numerous challenges must be addressed to achieve Vision 2030. Most importantly, Saudi Arabia must provide a more competitive market system, support emerging sectors with additional subsidies and laws, and solve the issue of bureaucracy in the public sector.

Chapter 7 Possible Solutions for Saudi Arabia

Introduction

As outlined in Chapter 5, Saudi Arabia faces challenges in shifting toward a sustainable economy that does not rely on fossil fuels, particularly oil. After the oil crash in 2014, Saudi Arabia became determined to promote its non-oil sectors, including its renewable energy sector. As explained in Chapter 3, Saudi Arabia established Vision 2030 to increase its non-oil revenues from 10% to 70% of its total government revenue by 2030.²⁰⁹⁷ In particular, Vision 2030 seeks to generate 58.7 GW of renewable energy by 2030 to reduce the proportion of oil used for electricity.²⁰⁹⁸ This will increase the renewable energy share to 30% of the Kingdom's total generation capacity.²⁰⁹⁹

This chapter provides possible solutions that the government can adopt to lessen the economy's reliance on oil. The first solution is to provide a competitive environment for the private sector to invest in the country. The second solution is to implement comprehensive renewable energy laws. Although government-established renewable energy projects will increase the use of renewable energy in Saudi Arabia, they alone cannot develop this sector in the long term. Instead, the government must provide a legal environment that will enable the private sector to invest in the renewable energy sector. The third solution is to exploit new gas discoveries to finance non-oil sectors. Fortunately, the Saudi Press Agency (SPA) reported that

²⁰⁹⁷ Look at the full report of McKinsey Global Institute (Hereinafter: the Saudi 2030 vision): SAUDI ARABIA BEYOND OIL: THE INVESTMENT AND PRODUCTIVITY TRANSFORMATION. available at: https://www.mckinsey.com/~media/McKinsey/Featured%20Insights/Employment%20and%20Growth/Moving%20Saudi%20Arabias%20economy%20beyond%20oil/MGI%20Saudi%20Arabia_Full%20report_December%202015.pdf

²⁰⁹⁸ Blazquez, *supra*.

²⁰⁹⁹ Look at the ministry of investment report regarding the application of the 2030 vision regarding the renewable energy sector Hereinafter: (Hereinafter: the Saudi's Renewable energy plan 2030). available at: <https://investsaudi.sa/media/1375/renewable-energy-17th-feb.pdf>

Saudi Arabia discovered four new oil and gas fields in 2020.²¹⁰⁰ By applying a Norwegian model, Saudi Arabia can exploit its plentiful natural gas resources to create a sustainable economy that does not rely on oil.

1. Role of the public sector in a competitive market system

To achieve the increased welfare outlined in Vision 2030, Saudi Arabia cannot unleash the private sector without a strong public sector and clear policies that will protect society from for-profit ideologies. In addition, its economic concerns must not be addressed at the expense of environmental repairs. Fundamentally, because humans must exist on this planet, damaging and disrupting it will threaten the existence of humans, let alone any economic growth.

The World Bank published a report measuring the ease of doing business.²¹⁰¹ It created an index measures how far others lag the top-performing country.²¹⁰² The baseline for Saudi Arabia was 62.5% in 2018, and it increased to 71.6% in 2020, ranking the country sixty-second out of 190 countries worldwide.²¹⁰³ In addition, based on regulatory reforms enacted from 2018 to 2019, the World Bank ranked Saudi Arabia first in terms of economic improvements made to the ease of doing business.²¹⁰⁴ The World Bank report specified that Saudi Arabia has bolstered its ease of starting a business, protection of minority investors, and electricity availability, and it has provided new online platforms and a “one-stop shop” for business services.²¹⁰⁵ According to

²¹⁰⁰ Look at the CNBC news available at: <https://www.cnbc.com/2020/12/27/saudi-arabia-announces-four-oil-and-gas-discoveries-state-news-.html>

²¹⁰¹ Look at the Atlantic Council report: Assessing Saudi Vision 2030: A 2020 review (2020). Available at: <https://www.atlanticcouncil.org/in-depth-research-reports/report/assessing-saudi-vision-2030-a-2020-review/>

²¹⁰² Id.

²¹⁰³ Id.

²¹⁰⁴ Id.

²¹⁰⁵ Id.

the World Bank database, Saudi Arabia moved up five positions in the rankings from 2007 to 2017,²¹⁰⁶ representing the efforts made by the country to improve its economy.

1.1. World Economic Forum

The World Economic Forum (WEF) used a different measure to more efficiently evaluate global competitiveness.²¹⁰⁷ In 2018, Saudi Arabia scored 67.5%, with the top performer scoring 100%, and ranked thirty-ninth out of 140 countries.²¹⁰⁸ In 2019, Saudi Arabia increased its score to 70% and ranked thirty-sixth out of 141 countries.²¹⁰⁹ This shows that starting in 2018, the country seems to have taken serious steps to improving competitiveness in its market.²¹¹⁰ Nevertheless, the WEF stated that some domestic issues prevent Saudi Arabia from reaching a higher ranking, such as inadequate insolvency regulations, the long time required to start a business, and poor use of talent.²¹¹¹

Evidently, Saudi Arabia wants to support its competitive market and allow the private sector to significantly contribute to its GDP.²¹¹² However, it is not concerned about the extent to which its future economy will rely on the private sector. In other words, it is not clear how the state will, like Norway, both play a major role in regulating the economy and provide welfare to its citizens.²¹¹³ This matter should be properly defined because of how important it is for Saudi Arabia to shape effective laws and policies and inform investors of its legal environment.

Although there is no official stance on the intended function of the Saudi government in a competitive market economy, the constitution of Saudi Arabia seemingly mandates that the

²¹⁰⁶ *Id.*

²¹⁰⁷ *Id.*

²¹⁰⁸ *Id.*

²¹⁰⁹ *Id.*

²¹¹⁰ *Id.*

²¹¹¹ *Id.*

²¹¹² The Saudi 2030 vision, *supra*.

²¹¹³ Koreten, *When Corporations Rule the World*, *supra*.

government must be involved in the economy and take responsibility for the welfare of its citizens. For instance, Articles 27–28 state that the country must ensure that its citizens have a decent livelihood and facilitate employment.²¹¹⁴ Articles 30–31 declare that education and health care must be available to every citizen, presumably free of charge.²¹¹⁵ Article 32 outlines the following: “The State shall endeavor to preserve, protect, and improve the environment and prevent its pollution.”²¹¹⁶ Article 14 asserts that all natural resources belong to the country, and the law can specify means for the exploitation, protection, and development of these resources in the best interests of the state, its security, and its economy.²¹¹⁷ Overall, these articles demonstrate that the government must actively regulate the market in a way that benefits society as a whole. Hence, the constitution cannot accept the neoliberal economic argument that the market is the best mechanism to ensure welfare, which assumes that people’s demands will be met by the market.²¹¹⁸ Therefore, because of its constitution, the Saudi government will likely adopt a regulated market system, such as that in Norway.

1.2. Issues of reducing the government’s role in the economy

In his book *Agenda for a New Economy*, David Korten argued that modern economies do not lead to the welfare of societies but rather become a complicated mechanism over time that benefits a minority of individuals.²¹¹⁹ He stated that a large amount of money simply creates “wealth” without producing anything of real value.²¹²⁰ Thus, the newly created money is phantom wealth, which has catastrophic implications.²¹²¹ Korten also claimed that high

²¹¹⁴ The Saudi Constitution, article (27-28), *supra*.

²¹¹⁵ The Saudi Constitution, article (30-31), *supra*.

²¹¹⁶ The Saudi Constitution, article (32), *supra*.

²¹¹⁷ The Saudi Constitution, article (14), *supra*.

²¹¹⁸ Korten, *When Corporations Rule the World*, *supra*.

²¹¹⁹ David Korten, *Agenda for a New Economy: From Phantom Wealth to Real Wealth* (Second edition, 2010).

²¹²⁰ *Id.*

²¹²¹ *Id.*

unemployment, housing foreclosures, large debts on citizens, and a shrinking middle class must be urgently addressed.²¹²² Therefore, following Korten's work, the competitive market does not provide welfare without a strong public sector. Korten claimed that any increase in the economy must lead to the welfare of society as a whole.²¹²³ He asserted that the human brain is wired to support caring and sharing, and he then demonstrated how a new economic model can offer a reallocation of resources that will bolster community, increase equity, be ecologically sound, and spur human health and happiness.²¹²⁴

Likewise, in his new book *Consequences of Capitalism: Manufacturing Discontent and Resistance*, Noam Chomsky stated that unregulated market systems have placed profits over welfare in modern economies.²¹²⁵ Chomsky said that the COVID-19 crisis has shown, without any doubt, that the state must play a major role in the economy, such as in the health sector.²¹²⁶ The private sector only pursues profits, and the idea that the private profits of many individuals will lead to the public benefit as a whole, following the logic of Adam Smith, is inaccurate.²¹²⁷ Chomsky observed that the world has known since the Spanish flu crisis that diseases will inevitably spread into societies and therefore that health sectors and hospitals must contain a minimum amount of preparation to face the future challenges.²¹²⁸ Health professionals and research scientists previously discussed the likelihood of a new and dangerous pandemic, especially after outbreaks of HIV/AIDS, SARS, MERS, and EBOLA.²¹²⁹ Nevertheless, health

²¹²² *Id.*

²¹²³ *Id.*

²¹²⁴ *Id.*

²¹²⁵ Noam Chomsky, *Consequences of Capitalism: Manufacturing Discontent and Resistance* (Haymarket Books, 2021).

²¹²⁶ *Id.*

²¹²⁷ *Id.*

²¹²⁸ *Id.*

²¹²⁹ *Id.*

sectors and hospitals were not prepared for the pandemic because these preparations were viewed as additional costs and unprofitable. In other words, Chomsky clearly argued that neoliberal economies that rely totally on the private sector put profits over people.²¹³⁰

In fact, Klaus Schwab, chairman of the World Economic Forum, argued in 2020 that the unregulated market system has proven to be inefficient.²¹³¹ In his book *The Great Reset*, Schwab strongly claimed that an unregulated market system is a failed economic system and cannot provide prosperity to societies.²¹³² He asserted that a democratic government must actively regulate the market system because the private sector will only seek profits.²¹³³ Schwab stated that countries must place a sense of duty and generational solidarity before individual rights and also highly value measures and rules that benefit the community as a whole.²¹³⁴ Following Schwab, COVID-19 has provided a vital lesson, which is that the market system on its own cannot handle a health crisis. Therefore, an active government is necessary.²¹³⁵ Similar to Chomsky, Schwab pointed out the success of countries with active positions in their economies, such as South Korea and Singapore, in managing the COVID-19 crisis efficiently.²¹³⁶ Ultimately, it seems difficult to imagine how an exogenous shock of such magnitude could be addressed with purely market-based solutions.²¹³⁷ Schwab noted that rather than simply fixing market failures when they arise, countries should heed the advice of economist Mariana

²¹³⁰ *Id.*

²¹³¹ Klaus Schwab and Thierry Malleret, *COVID-19: The Great Reset* (ISBN Agentur Schweiz, 2020).

²¹³² *Id.*

²¹³³ *Id.*

²¹³⁴ *Id.*

²¹³⁵ *Id.*

²¹³⁶ *Id.*

²¹³⁷ *Id.*

Mazzucato and “move towards actively shaping and creating markets that deliver sustainable and inclusive growth.”²¹³⁸

1.3. Need for a regulated market system in Saudi Arabia

Overall, the last century has shown that while an unregulated market system will develop an economy, it will not increase welfare. Since Saudi Arabia must support welfare, such a system might not benefit it. The unregulated market system can be economically efficient, as many fully market-system economies, such as that of the U.S., increase their respective GDPs every year. However, Saudi Arabia cannot leave social welfare hostage to the market.

It is a mistake to believe that a country can be independent without a strong private sector. Many countries in which the state once controlled almost the entire economy, such as Norway, have been dealing with this problem since the 80s. In particular, the oil crisis forced the Norwegian government to provide a competitive market capable of supporting the expected welfare of its citizens. Before the 80s, Norway’s financial system suffered due to the government’s reluctance to provide an easy and competitive market. Norway used to have strict banking regulations, cumbersome administrative requirements for foreigners, and stringent exchange controls. These difficulties occurred because the government formerly used oil and hydropower projects to satisfy the needs and welfare of its society.

1.4. Need for clear intellectual property laws

The world has recognized the importance of the free movement of goods and services between countries as evidenced by many international treaties. For instance, the World Trade Organization (WTO) has clearly stated that under its agreements, countries cannot generally

²¹³⁸ Id.

discriminate against their trading partners.²¹³⁹ Moreover, the Treaty on the Functioning of the European Union (TFEU) states that the concept of the free movement of goods and services shall be adopted by the member states of the European Union (EU).²¹⁴⁰ However, free markets do not always increase innovation.²¹⁴¹ Thus, intellectual property is an exception to the free market idea as it aims to increase innovation.²¹⁴² More specifically, patent law awards innovators the exclusive right to sell their inventions in the market.²¹⁴³

However, overusing patents can be problematic to the market. For example, using patents in a widespread manner increases monopolies and leads to a noncompetitive market. As a result of the low competition in the market, consumers are restricted in their choices, and products are overpriced. This type of market system undermines the Saudi 2030 vision that aims to create a competitive market system. Therefore, Saudi Arabia must update its intellectual property laws in order to attract foreign investors to invest in the country.²¹⁴⁴ Without proper protection of intellectual property, such as patent and trade secret rights, many international investors will hesitate to invest in Saudi Arabia from fear of losing their trade secrets.²¹⁴⁵ Therefore, Saudi Arabia must enact clear intellectual property laws that also consider the consequences to the market when these rights are easily given to investors.

1.5. Lessons from the role of the government in the economy in Norway

²¹³⁹ Look at the WTO official site: https://www.wto.org/english/thewto_e/whatis_e/tif_e/fact2_e.htm

²¹⁴⁰ The treaty on functioning of the European Union Article (34,56)

²¹⁴¹ John Duffy, Rethinking the Prospect Theory of Patents, 71 The University of Chicago Law Review 439-510 (2004).

²¹⁴² Paul Torremans, Holyoak and Torremans Intellectual Property Law, (8th ed., 2016, OUP).

²¹⁴³ Id.

²¹⁴⁴ Wahj Wazzan, Updating the Law of Trade Secrets in Saudi Arabia, 5 INDON. J. INT'L & COMP. L. 43 (2018).

²¹⁴⁵ Id.

However, after the 80s, Norway realized that this government-leading economic approach was neither sustainable nor efficient.²¹⁴⁶ This led the government to adopt a democratic welfare-capitalist system, a so-called “a regulated market system.”²¹⁴⁷ This system specifies that the state is the primary entity responsible for its citizens’ welfare and represents the will of its citizens.²¹⁴⁸ Thus, the government must create a proper environment for the private sector to invest in, as this sector can only support the prosperity of society if the government regulates the market. In essence, the government guides the private sector to benefit society as a whole while providing an incentive environment for this sector. The Norwegian economic model was approved and accepted by all political parties, which stopped the country from becoming a member of the European Union (EU).²¹⁴⁹

There are many examples of this Norwegian model successfully regulating the market and providing social services to its citizens. For instance, the government owns all natural resources, and no private sector shall claim ownership of these resources, as this would harm the public interest.²¹⁵⁰ Specifically, the Norwegian government declared itself the owner of “the ocean floor and the underground of the underwater area off the coast of the Kingdom of Norway,” with these areas under Norwegian sovereignty “as regards the exploitation and research of natural deposits.”²¹⁵¹ This active approach to the ownership of natural resources is similar to that of Saudi Arabia. Moreover, the country enacted the National Insurance Act (1997), which aims to achieve the most welfare possible for its citizens.²¹⁵² The law provides

²¹⁴⁶ Hovland, supra.

²¹⁴⁷ Gulbrandsen, supra.

²¹⁴⁸ Id.

²¹⁴⁹ Barth, Moene and Willumsen, supra.

²¹⁵⁰ Graver, supra.

²¹⁵¹ Slevin, supra.

²¹⁵² Gulbrandsen, supra.

comprehensive universal services to citizens.²¹⁵³ Summarily, Norway has passed laws to address almost all aspects of the economy to ensure that the profits of the private sector cannot harm society as a whole.

Saudi Arabia can adapt the Norwegian model to its own economy. This model is useful because Saudi Arabia will not be able to provide citizens with privileges such as subsidized electricity and cheap oil in the future. While applying the Norwegian model, Saudi Arabia can continue to pursue Vision 2030 and strongly regulate the market system to protect the interests of the general public. Notably, Norway continues to successfully increase the welfare of its citizens, apply heavy regulations to the market, and attract foreign investors to its private sector. This model may be applied by Saudi Arabia in the future to lessen its reliance on oil and achieve a sustainable economy.

2. Comprehensive Renewable Energy Law

Saudi Arabia promotes the use of renewable energy with huge solar and wind projects rather than by enacting laws that would encourage the private sector to complete such projects. Essentially, the country sets public-sector goals for generating renewable energy without creating a proper environment for the private sector to increase its own renewable energy use.²¹⁵⁴ This dynamic can be seen in Vision 2030. Following its goals, Saudi Arabia gave the Saudi Ministry of Energy, Industry, and Mineral Resources (MEIM) the power to strongly shift from fossil fuels to renewable energy.²¹⁵⁵ Recent solar and wind projects include the Sakaka (300 MW), Dumat Al Jandal (400 MW), Qurrayat (200 MW), Alfaisalia (600 MW), Saad (300 MW), Wadi

²¹⁵³ Look the National Insurance Act (1997): available at: <https://extranet.who.int/nutrition/gina/en/node/24181>

²¹⁵⁴ Blazquez, Hunt and Manzano, *supra*.

²¹⁵⁵ Look at the U.S. Department of energy data: U.S.-Saudi Arabia Energy Cooperation. Available at: <https://www.energy.gov/ia/international-affairs-initiatives/us-saudi-arabia-energy-cooperation>

Adwawser (70 MW), Yanbu (850 MW), Madinah (50 MW), Rabigh (300 MW), Alras (300 MW), Qurrayat (40 MW), Rafha (45 MW), Jeddah (45 MW), and Mahad Dahab (20 MW) projects.²¹⁵⁶

Nevertheless, the country faces many difficulties in attracting the private sector to invest in the renewable energy sector. The country is still in the process of establishing a legal framework that can support its power supply, ranging from renewable sources to grid connections.^{2157 2158} The public entities responsible for achieving the goals of Vision 2030 are nascent and must partner with other entities.²¹⁵⁹ In addition, the public sector also has a limited role in the research and development of the renewable energy sector.²¹⁶⁰ Regardless, the most important challenge that the country faces is the current subsidy scheme for its conventional power sources.²¹⁶¹ These subsidies are considered to be high and thus prevent the private sector from developing renewable energy sources.²¹⁶² For example, the electricity tariff system makes power in the Kingdom among the cheapest in the world, and it would be difficult for the private sector to compete.²¹⁶³ The largest source of electrical power is the Saudi Electricity Company (SEC), although the Saline Water Conversion Corporation (SWCC) and Saudi Aramco also own and develop their own conventional power stations.²¹⁶⁴

2.1. Role of law in developing the renewable energy market

²¹⁵⁶ the Saudi's Renewable energy plan 2030, *supra*.

²¹⁵⁷ PricewaterhouseCoopers (PwC) Developing renewable energy projects A guide to achieving success in the Middle East. Available at: <https://www.pwc.com/m1/en/publications/documents/eversheds-pwc-developing-renewable-energy-projects.pdf?platform=hootsuite>

²¹⁵⁸ Note: PwC is a multinational professional services network headquartered in London, United Kingdom. PwC is the second largest professional services company in the world.

²¹⁵⁹ *Id.*

²¹⁶⁰ *Id.*

²¹⁶¹ *Id.*

²¹⁶² *Id.*

²¹⁶³ *Id.*

²¹⁶⁴ *Id.*

Other countries have used the rule of law to increase their renewable energy development. For instance, the U.S. enacted the Energy Security Act in 1980 to become less dependent on oil and provide financial initiatives for the development of alternative resources.²¹⁶⁵ The U.S. Congress recognized that renewable energy will struggle to compete with fossil fuels due to the subsidies received by the sector. Therefore, laws were required to address the issue.²¹⁶⁶ The Renewable Energy and Energy Efficiency Technology Competitiveness Act of 1989 is another example of this approach.²¹⁶⁷ The Energy Policy Act (EPAct) of 1992 requires the Secretary of Energy to use competitive bidding processes for proposals for commercial-use clean energy projects.²¹⁶⁸ In 2009, the U.S. passed the American Recovery and Reinvestment Act, which gives clean energy tax credits in the EPAct.²¹⁶⁹

As a result of its renewable energy laws, the use of clean energy has significantly increased in the U.S.²¹⁷⁰ The U.S. witnessed a 92% increase in clean energy use from 2009 to 2010.²¹⁷¹ In 2010, the country added 900 MW of PV capacity to the grid.²¹⁷² In 2011, clean energy generation increased by 1,855 MW, a 109% increase from 2010.²¹⁷³ In 2012, the U.S. further increased its clean energy generation by 3,313 MW, almost doubling its 2011 capacity.²¹⁷⁴ In 2013, the use of solar panels rapidly increased, adding more than 10,000 MW to the national grid.²¹⁷⁵

²¹⁶⁵ Tomain and Cudahy, supra.

²¹⁶⁶ *Id.*

²¹⁶⁷ *Id.*

²¹⁶⁸ *Id.*

²¹⁶⁹ *Id.*

²¹⁷⁰ Kyle Weismantle, Building a Better Solar Energy Framework, 26 St. Thomas L. Rev. 221 (2014).

²¹⁷¹ *Id.*

²¹⁷² *Id.*

²¹⁷³ *Id.*

²¹⁷⁴ *Id.*

²¹⁷⁵ *Id.*

Many reports have outlined that such development occurs in the renewable energy sector when a government provides a competitive legal market for the private sector that encourages investment.²¹⁷⁶ The use of law to direct the market in certain directions may benefit newly emerging sectors, which can make the renewable energy sector more competitive and efficient.²¹⁷⁷ Not only is solar energy constantly increasing in production and becoming more efficient, but its prices have also decreased in the U.S. from around \$7.60/W to \$3.01/W, including a large price drop to \$1.09/W that occurred in 2012.²¹⁷⁸

2.2. European Union laws in the renewable energy sector

Likewise, the EU has passed many laws that have developed the renewable energy sectors of its member states. Notably, Article 191 of the Treaty on the Functioning of the European Union (TFEU) established the “precautionary principle” and the notion that “the polluter should pay.”²¹⁷⁹ The treaty aims to limit the global average temperature increase to a maximum of two degrees.²¹⁸⁰ In 2019, the EU comprehensively updated its energy policy framework to shift from fossil fuels to renewable energy and deliver on its Paris Agreement commitments regarding the reduction of greenhouse gas (GHG) emissions.²¹⁸¹ The agreement aims to achieve carbon neutrality by 2050.²¹⁸² This framework was included in the Clean Energy for All Europeans package.²¹⁸³ This agreement consists of eight legislative acts, and one such act

²¹⁷⁶ *Id.*

²¹⁷⁷ *Id.*

²¹⁷⁸ *Id.*

²¹⁷⁹ Jonas Myhre, Financing of CCS Demonstration Projects - State Aid, EEPR and NER Funding - An EU and EEA Perspective, *European Business Law Review* 1-100 (2011).

²¹⁸⁰ *Id.*

²¹⁸¹ Look at the official website of the European Union: Clean energy for all Europeans package (2020). Available at: https://ec.europa.eu/energy/topics/energy-strategy/clean-energy-all-europeans_en

²¹⁸² *Id.*

²¹⁸³ *Id.*

is governance regulation, which contains a robust governance system for the Energy Union.²¹⁸⁴ Under this system, EU countries must adopt 10-year National Energy and Climate Plans (NECPs) from 2021 to 2030.²¹⁸⁵ The NECPs outline methods for achieving their respective targets, including those that extend as far as 2050.²¹⁸⁶

Moreover, the EU enacted the revised Renewable Energy Directive (2018/2001/EU) as a part of the Clean Energy for All Europeans package.²¹⁸⁷ The directive pursues the goals of both the package and the Paris Agreement.²¹⁸⁸ Following the directive, the EU intends to generate a minimum of 32% of its energy from renewable energy and have 14% of all transportation fuels be renewable by 2030. The directive also strengthened the criteria for ensuring bioenergy sustainability.²¹⁸⁹ This directive strongly improved the use of solar energy, which increased from 11.3 GW in 2008 to over 116 GW in 2018.²¹⁹⁰ Since 2018, there have been noticeable developments in solar energy among EU member states.²¹⁹¹ Notably, the use of solar energy increased by 50% from 2017 to 2018.²¹⁹² The increase was due to stronger-than-expected markets in Germany (3.1 GW), the Netherlands (1.5 GW), France (>1.3 GW), and Hungary (>0.5 GW).²¹⁹³

Despite its ambitious goals, the EU allows countries to cut down trees and burn them for energy in a way that fully qualifies as low-carbon, renewable energy, even though it obviously

²¹⁸⁴ Id.

²¹⁸⁵ Id.

²¹⁸⁶ Id.

²¹⁸⁷ Look at the official website of the European Union: Renewable energy directive (2021). Available at:

https://ec.europa.eu/energy/topics/renewable-energy/renewable-energy-directive/overview_en

²¹⁸⁸ Id.

²¹⁸⁹ Id.

²¹⁹⁰ Arnulf Jäger-Waldau, et al, The New European Renewable Energy Directive - Opportunities and Challenges for Photovoltaics, IEEE (2019).

²¹⁹¹ Id.

²¹⁹² Id.

²¹⁹³ Id.

pollutes the atmosphere.²¹⁹⁴ Eight-hundred scientists wrote to an adviser of the EU and emphasized that this allowance would accelerate climate change and prevent the goals of the EU's own directive from being realized.²¹⁹⁵ Unfortunately, the renewable energy directive that enables EU member states to harvest and burn wood for energy generation was still finalized.²¹⁹⁶ The EU may have justified this rule because of the large quantity of wood located in Europe.²¹⁹⁷ Regardless, burning wood for clean energy both pollutes the environment and threatens the world's forests.²¹⁹⁸ For decades, wood makers have generated electricity and heat from wood process wastes, which still supply the bulk of Europe's forest-based bioenergy.²¹⁹⁹ Since 2008, the EU has only harvested more wood for energy.²²⁰⁰ Reportedly, 90% of these wood pellets come from the main stems of trees, mostly of pulpwood quality.²²⁰¹

From a GHG perspective, wood is an inefficient carbon-based fuel because of how it is harvested and used.²²⁰² Cutting trees releases CO₂ and harms the soil.²²⁰³ Moreover, it also decreases the planet's ability to store released CO₂ and keep it from entering the atmosphere.²²⁰⁴ Many studies have noted that harvested wood releases more CO₂ than many other energy sources, including 1.5 times the CO₂ of coal and 3 times the CO₂ of natural gas, because of

²¹⁹⁴ Timothy Searchinger, et al, Europe's renewable energy directive poised to harm global forests, 9 Nature Communications 1-4 (2018).

²¹⁹⁵ Id.

²¹⁹⁶ Id.

²¹⁹⁷ Id.

²¹⁹⁸ Id.

²¹⁹⁹ PricewaterhouseCoopers EU Services EESV's consortium. Sustainable and optimal use of biomass for energy in the EU beyond 2020 (2017).

²²⁰⁰ Searchinger, supra.

²²⁰¹ Id.

²²⁰² Jérôme Laganière et al, Range and uncertainties in estimating delays in greenhouse gas mitigation potential of forest bioenergy sourced from Canadian forests, 9 Gcb Bioenergy 358-369 (2017).

²²⁰³ Rajib Karmakar, Indranil Das, Debashis Dutta and Amitava Rakshit, Potential Effects of Climate Change on Soil Properties: A Review, 4 Science International, 51-73 (2016).

²²⁰⁴ Searchinger, supra.

wood's carbon bonds and water content.²²⁰⁵ Although regrowing forests would decrease the amount of CO₂, this would also absorb less carbon than if the forests were left unharvested.²²⁰⁶ This means that the world needs more time for forest regrowth to achieve substantial GHG reductions.²²⁰⁷

2.3. Stricter Norwegian renewable energy laws

Norway has taken a stricter approach than the EU to support its renewable energy sector while protecting the environment. In doing so, Norway has applied the EU's own 2018 directive to its unique economy.²²⁰⁸ Hence, Norway can support the use of renewable energy according to this directive and also refuse to burn wood as a clean energy source. This demonstrates the usefulness of Norway's position outside the EU as well as its government's active role in regulating the renewable energy market.

Another example of the government's active role can be seen in the Norwegian power grid, which is a monopoly regulated by the state.²²⁰⁹ The Norwegian Water Resources and Energy Directorate (NVE) regulates the system and grants licenses for the transmission and production of renewable energy.²²¹⁰ The NVE addresses the concerns of industry developers, especially data center developers, and it is responsible for providing licenses for the construction of operating electrical assets with voltage levels of 22 kV or less.²²¹¹ In essence, the electricity generation sector is overregulated by the Norwegian government, which might put more restrictions on the development of the renewable energy sector than the EU's 2018 directive.

²²⁰⁵ Id.

²²⁰⁶ Id.

²²⁰⁷ Id.

²²⁰⁸ Slevin, *supra*.

²²⁰⁹ Look at the official Norwegian database: The Norwegian power system. Grid connection and licensing. Available at: https://publikasjoner.nve.no/faktaark/2018/faktaark2018_03.pdf

²²¹⁰ Id.

²²¹¹ Id.

2.4. Swedish-Norwegian market for electricity certificates

Moreover, Norway created a Swedish-Norwegian market for electricity certificates in 2012, with the goal of increasing the use of renewable energy sources and providing incentives for investing in new renewable energy power production facilities.²²¹² This market has its origins in a 2003 treaty between Norway and Sweden.²²¹³ As a result of this treaty, Norway passed Directive 2009/28/EC to create its electricity certificates market.²²¹⁴ The Norwegian directive provides suppliers of preapproved new renewable electricity with one certificate per MWh produced.²²¹⁵ This certificate can be sold to electricity suppliers, as the government forces these suppliers to purchase clean energy certificates based on the proportion of electricity that they sell or use.²²¹⁶ Notably, the Norwegian government aimed to create a clean energy system in which the private sector would contribute 26.4 TWh of new renewable electricity to the grid by 2020.²²¹⁷ Swedish and Norwegian households have split the bill fifty-fifty, although it was not outlined which side of the border the power installations needed to be built on.²²¹⁸

Saudi Arabia can apply a similar arrangement with the cooperation of other Gulf region countries. Crucially, an electricity certificate market may motivate the private sector to share the burden of achieving Vision 2030's energy goals. However, many studies have pointed out that although these markets can help increase the use of clean energy, they do not stimulate the technological development of clean energy.²²¹⁹ This has led countries such as the U.K. to

²²¹² Odd-Harald B. Wasenden & Kristoffer B. Grimstad, Norway, 3 E&J 66 (2013).

²²¹³ *Id.*

²²¹⁴ *Id.*

²²¹⁵ Gard Hansen, New renewable energy and the Norwegian policy triangle, Fagbokforlaget 139-156 (2013).

²²¹⁶ *Id.*

²²¹⁷ *Id.*

²²¹⁸ *Id.*

²²¹⁹ Hansen, supra.

abandon their own clean energy certificate markets.²²²⁰ Instead, the U.K. has chosen a more targeted arrangement that provides politicians with more responsibility and favors technologies with advantages beyond their outputs in MWh.²²²¹ The U.K.'s arrangement does not rely on supply and demand to determine prices. Rather, the prices account for considerations such as creating jobs and promoting one of the world's fastest-growing energy sectors.²²²² Despite this criticism of the clean energy certificate market, it should be noted that Saudi Arabia's Vision 2030 only intends to reach a certain level of renewable energy production. Vision 2030 does not include a long-term development plan for renewable energy technology. Thus, the clean energy certificate market might be more appropriate for Saudi Arabia than the U.K.

2.5. Norwegian National Passive House Standard

Another example of successful energy efficiency development can be seen in the Norwegian National Passive House Standard (NS 3700) of 2012.²²²³ Before this standard was established, the Norwegian government debated the benefits of passive houses in reducing the energy required for each Norwegian household.²²²⁴ The evidence shows that a passive house can significantly reduce the amount of carbon released from electricity generation,²²²⁵ and this idea has recently spread in Norway.²²²⁶ A passive house has a maximum total net energy demand of 100 kWh/m²a, including all electricity consumed in the dwelling.²²²⁷ A passive house must also,

²²²⁰ Id.

²²²¹ Id.

²²²² Id.

²²²³ Hilde Nykamp, A transition to green buildings in Norway, 24 *Environmental Innovation and Societal Transitions* 83-93 (2017).

²²²⁴ Id.

²²²⁵ Id.

²²²⁶ Look at The Passive House Institute (PHI): The first certified Passive House in Norway (2008). Available at: http://biblioteket.husbanken.no/arkiv/presentasjoner/passivhuskonferanse_2008_artikkel_the_first_certified_passive_house_in_norway.pdf

²²²⁷ Id.

according to the Norwegian standard, have a space heating demand close to 30 kWh/m²a.²²²⁸ In contrast, the average Norwegian household consumes a total of 214 kWh/m²a end energy.²²²⁹ The national building code (1997) required a space heating demand of about 60–90 kWh/m²a, and it encouraged the emergence of passive houses in the Norwegian housing sector in 2007.²²³⁰ The years between 2004 and 2008 were called the “low energy” period because most housing projects were identified as “low energy.”²²³¹ Clearly, energy use is fundamental to green building.²²³² Still, it is unclear whether passive houses are beneficial if they do not use renewable energy sources in their building designs.²²³³

2.6. Possible solutions for developing the renewable energy sector in Saudi Arabia

While other entities can provide helpful renewable energy strategies for Saudi Arabia, it is crucial to acknowledge how the country’s current financial practices may influence its adoption and development of renewable energy. In particular, even if Saudi Arabia reduces its generation demand for fossil fuels, this will not significantly develop its renewable energy sector.²²³⁴ However, financial incentives can very effectively overcome market barriers for the renewable energy sector.²²³⁵ Many reports have shown that financial incentives will benefit the renewable energy sector more than limiting the use of fossil fuels in electricity generation.²²³⁶

²²²⁸ *Id.*

²²²⁹ *Id.*

²²³⁰ *Id.*

²²³¹ Nykamp, *supra*.

²²³² *Id.*

²²³³ *Id.*

²²³⁴ Richard L. Ottinger, UN Environment Guide for Energy Efficiency and Renewable Energy Laws, Pace Law Faculty Publications 1-370 (2016).

²²³⁵ Paolo Bertoldi, Rewarding energy savings rather than energy efficiency: Exploring the concept of a feed-in tariff for energy savings, 56 Energy Policy 526-535 (2013).

²²³⁶ *Id.*

These financial incentives are crucial for development due to the multibillion-dollar subsidies for the fossil fuel industry.²²³⁷

Renewable energy projects face many financial challenges, including those stemming from high up-front capital costs and perceived risk.²²³⁸ Although renewable energy is cheaper than fossil fuels in terms of its operating costs, leading to minimal lifetime energy costs for consumers, it is difficult to compensate for large fossil fuel subsidies and the unacknowledged external costs of fossil generation.²²³⁹ Hence, policymakers can struggle to manage the up-front capital costs and risk allocations while also considering the reduced operating costs and environmental advantages offered by renewable energy sources.²²⁴⁰

Saudi Arabia can adapt targeted financial policies to overcome such financial challenges. For instance, Saudi Arabia can directly invest in the renewable energy sector, aiming to decrease the up-front costs of projects.²²⁴¹ Moreover, it can subsidize the renewable energy sector to help it gain traction and develop thriving businesses capable of competing for a significant market share.²²⁴² In addition, Saudi Arabia can adopt a public-private ventures approach.²²⁴³ Joint ventures can provide renewable energy developers with more access to funding for their clean energy projects as well as more governmental support to offset capital project risk, which makes these investments more attractive for the private sector.²²⁴⁴ Furthermore, Saudi Arabia can encourage the use of public risk insurance.²²⁴⁵ This insurance can induce investments in projects

²²³⁷ Ottinger, *supra*.

²²³⁸ *Id.*

²²³⁹ *Id.*

²²⁴⁰ *Id.*

²²⁴¹ *Id.*

²²⁴² *Id.*

²²⁴³ *Id.*

²²⁴⁴ *Id.*

²²⁴⁵ *Id.*

by commercial lenders by decreasing their risk.²²⁴⁶ Further, this insurance can also reduce operating expenses for clean energy projects and raise their long-term financial viability.²²⁴⁷

2.7. Feed-in tariff regime

In particular, Saudi Arabia can take advantage of two famous regimes that many countries have adopted to build their renewable energy sectors. The first regime is the feed-in tariff (FIT), which allows a government to force electricity utility companies to buy clean energy from suppliers at a price determined by a long-term contract.²²⁴⁸ As a result, producers receive payments from entities in the energy market, such as utilities, rather than from the government.²²⁴⁹

The FIT regime has three main financial benefits.²²⁵⁰ The first is that the regime provides payment for all clean electricity produced, even if it is used by the producer itself.²²⁵¹ The second is that the regime gives bonus payments to producers who export their clean energy to the grid.²²⁵² The third is that the regime also reduces the producer's standard electricity bill.²²⁵³ If any clean energy producer exports energy to the utility while simultaneously receiving energy from the same utility, the utility may choose to just pay a check or bill for the possible energy difference.²²⁵⁴

²²⁴⁶ Id.

²²⁴⁷ Id.

²²⁴⁸ Ming-Chung Chang, Jin-Li Hu and Tsung-Fu Han, An analysis of a feed-in tariff in Taiwan's electricity market, 44 *International Journal of Electrical Power & Energy Systems* 916-920 (2013).

²²⁴⁹ Source 40

²²⁵⁰ Tesoro Huayllas, Dorel Ramos and Ricardo Vasquez-Arnez, Feed-in and net metering tariffs: An assessment for their application on microgrid systems IEEE 3-5 (2012).

²²⁵¹ Id.

²²⁵² Id.

²²⁵³ Id.

²²⁵⁴ Id.

The FIT regime has successfully developed renewable energy sectors and technologies around the world.²²⁵⁵ More than 20 countries in the EU have adopted the FIT regime.²²⁵⁶ For instance, France set a FIT price of €0.082/kWh for wind electricity, Portugal agreed on €0.0591/kWh for hydropower, and Ireland offered €0.056/kWh for wind energy.²²⁵⁷ In 2013, there were 98 FIT jurisdictions in the U.S.²²⁵⁸ The U.K. adopted the FIT regime in 2010, which added 1.06 GWp of PV capacity in two years.²²⁵⁹ Germany enacted the Renewable Energy Act, which allows the government to place a €0.1288/kWh rate on small PV systems.²²⁶⁰ Likewise, Spain adopted regulatory frameworks based on favorable FIT rates.²²⁶¹ The FIT regime has boosted PV installation in Spain, and the annual installation rate reached 2700 MWp in 2008, making the country the world leader in annual installation, with a total installed capacity of over 3.5 GWp.²²⁶² Furthermore, the FIT helped to add up to 100 kWp to the grid, which was 575% of the average electricity tariff for the first 25 years of operation.²²⁶³ Similarly, Japan implemented the FIT regime as well as a subsidy on the installation cost of renewable technologies.²²⁶⁴

Saudi Arabia can use the FIT regime to reduce its high consumption of electricity from fossil fuels, prioritize clean energy, and improve its use of its unique natural resources, which is of particular importance because it consumes more electricity than the global average.²²⁶⁵ Namely, it consumes four times more electricity than the U.S. and eight times more than

²²⁵⁵ Shaker Haji, Amal Durazi and Yasser Al-Alawi, Feed-in tariff structure development for photovoltaic electricity and the associated benefits for the Kingdom of Bahrain, 37 *International Journal of Sustainable Energy* 479-497 (2017).

²²⁵⁶ Chang, Hu and Han, *supra*.

²²⁵⁷ *Id.*

²²⁵⁸ Shaker, *supra*.

²²⁵⁹ *Id.*

²²⁶⁰ *Id.*

²²⁶¹ *Id.*

²²⁶² *Id.*

²²⁶³ *Id.*

²²⁶⁴ *Id.*

²²⁶⁵ Salam and Khan, *supra*.

Japan.²²⁶⁶ Saudi Arabia has the greatest potential for renewable energy in the Middle East and North Africa (MENA) region,²²⁶⁷ as the country lies in the middle of the “sunbelt.”²²⁶⁸ Globally, Saudi Arabia has the sixth-highest potential for solar energy production.²²⁶⁹ The country averages 8.9 h/day of sunshine and 5,600 Wh/m² of horizontal solar radiation.²²⁷⁰ The solar irradiation of Saudi Arabia is 250 W/m², whereas the average irradiation of high-potential solar areas is 100–200 W/m².²²⁷¹

Essentially, if Saudi Arabia can leverage its geographical advantage and apply a regulatory FIT regime, this may motivate the private sector to invest in renewable energy, which would benefit the renewable energy sector in the long term. This is vital because government projects can only benefit the sector in the short term.²²⁷² For instance, King Abdullah City for Atomic and Renewable Energy (KACARE) failed to achieve its goal of generating 41 GW by 2012.²²⁷³ Many reports noticed the missing regulations for cooperation between these entities, which led to this failure.²²⁷⁴ Other reports expressed that while different entities agreed on their goals, the means to achieve these goals were debated.²²⁷⁵

2.8. Renewable Portfolio Standard

The second regime that Saudi Arabia should consider is the Renewable Portfolio Standard (RPS).²²⁷⁶ The RPS requires renewable energy producers to generate a minimum

²²⁶⁶ The Saudi 2030 vision, supra.

²²⁶⁷ the Saudi 2030 vision, supra.

²²⁶⁸ the Saudi's Renewable energy plan 2030, supra.

²²⁶⁹ Id.

²²⁷⁰ Id.

²²⁷¹ Id.

²²⁷² Ratikainen, supra.

²²⁷³ Id.

²²⁷⁴ Id.

²²⁷⁵ Id.

²²⁷⁶ Huayllas, Ramos and Vasquez-Arnez, supra.

amount of clean energy sold or capacity installed and for utilities to ensure that the target is met.²²⁷⁷ Many countries have adopted this standard, including the U.S., Japan, the U.K., and Australia.²²⁷⁸ For each unit of power that a renewable energy producer generates, they are issued a certificate or credit.²²⁷⁹ These can then be sold either in conjunction with the underlying power or separately to energy supply companies.²²⁸⁰ Many U.S. states have actively adapted the RPS to increase their renewable energy generation and encourage economic development.²²⁸¹ Renewable energy policies helped drive the nation's \$64 billion market for wind, solar, and other renewable energy sources.²²⁸² The states differ in their RPS targets. Some states use the percentage of retail electric sales, whereas those such as Iowa measure RPS according to specific amounts of renewable energy capacity.²²⁸³ Most states' RPS targets are between 10% and 45%.²²⁸⁴ Evidently, this standard will bolster renewable energy sector development in the long term, as utilities must reach minimum clean energy production standards to compete in these regulated state markets.

The RPS has many proven benefits to renewable energy sector development.²²⁸⁵ Namely, it has been a policy driver for renewable-energy growth in the U.S.²²⁸⁶ The U.S. reportedly generates 58% of all non-hydroelectric renewable-energy capacity as a result of its RPS

²²⁷⁷ Id.

²²⁷⁸ Id.

²²⁷⁹ Id.

²²⁸⁰ Id.

²²⁸¹ National Conference of State Legislatures: State Renewable Portfolio Standards and Goals (2021). Available at: <https://www.ncsl.org/research/energy/renewable-portfolio-standards.aspx>

²²⁸² Id.

²²⁸³ Id.

²²⁸⁴ Id.

²²⁸⁵ Galen Barbose et al, A retrospective analysis of benefits and impacts of U.S. renewable portfolio standards, 96 Energy Policy 645-660 (2016).

²²⁸⁶ Id.

requirements.²²⁸⁷ The existing RPS policies in the U.S. are expected to increase its use of renewable energy to at least 8% of its total domestic generation supply, which is equivalent to roughly 106 GW of renewable generation capacity.²²⁸⁸

Additionally, the RPS also has societal benefits and impacts,²²⁸⁹ some of which might not be assessed effectively due to the risk-benefit analyses that the states use. These analyses cannot quantitatively measure benefits such as air quality.²²⁹⁰ For instance, a risk-benefit analysis may not account for environmental pollution as a cost of the fossil fuel industry, which could affect a comparison between this industry and the renewable energy sector. The Environmental Protection Agency (EPA) claimed that limiting climate change by using renewable energy offers many benefits to the U.S., and there is growing recognition of the desirability of near-term actions to limit emissions.²²⁹¹

The RPS requirements have reduced GHG emissions by an estimated 59 million MT of CO₂ equivalent.²²⁹² Specifically, they have prevented the burning of fossil fuels to generate electricity.²²⁹³ RPS programs have also displaced non-combustion fuel-cycle emissions from the fossil energy supply.²²⁹⁴ According to the U.S. Interagency Working Group (IWG's) central-value social cost of carbon (SCC), the RPS helped the world avoid future damages estimated at \$2.2–6.3 billion in 2013.²²⁹⁵ Critically, many epidemiological studies have reported that the air

²²⁸⁷ Galen Barbose, *Renewables portfolio standards in the United States: a status update*, Washington: Lawrence Berkeley National Laboratory (2012).

²²⁸⁸ Look at the National Renewable Energy Lab (NREL) report: 2010 Wind technologies market report. Available at: <https://www.nrel.gov/docs/fy11osti/51783.pdf>

²²⁸⁹ Barbose et al, *supra*.

²²⁹⁰ Jonathan J. Buonocore et al, Health and climate benefits of different energy-efficiency and renewable energy choices, 6 *Nature Climate Change* 100-105 (2016).

²²⁹¹ Ottmar Edenhofer, *Climate change 2014: mitigation of climate change* (Cambridge University Press, 2015).

²²⁹² Barbose et al, *supra*.

²²⁹³ *Id.*

²²⁹⁴ *Id.*

²²⁹⁵ *Id.*

pollution caused by climate change has a direct relation with increased mortality.²²⁹⁶ Lim et al. estimated that each year, there are more than three million premature deaths globally from outdoor particulate air pollution.²²⁹⁷ Therefore, any measures that reduce this pollution should be fully supported. The EPA estimated that the Clean Power Plan (CPP) would provide approximately \$34 billion in monetized health benefits in 2030, mostly centered on reduced premature mortality.²²⁹⁸ These benefits, which can result from RPS programs, must be considered in any risk-benefit analysis.

2.9. Prosumer system

In addition to these two global regimes, Saudi Arabia can adapt measures that have successfully developed the renewable energy sector in Norway. For instance, the Norwegian Energy Act established the concept of the “prosumer.”²²⁹⁹ A prosumer is a person who sells their surplus electricity.²³⁰⁰ A prosumer is also an end user, and both prosumers and consumers are connected to the grid.²³⁰¹ Regulations on network tariffs occur at “the point in the electric transport network where electricity is fed in or fed out, or where there is electricity exchange between grid companies.”²³⁰² Thus, a prosumer benefits from consuming their electricity when electricity prices are high.²³⁰³ Many consumers are expected to become prosumers due to the ongoing development of renewable energy technology. In other words, increased electricity

²²⁹⁶ Johanna Lepeule, Chronic Exposure to Fine Particles and Mortality: An Extended Follow-up of the Harvard Six Cities Study from 1974 to 2009, 120 *Environmental health perspectives* 965-970 (2012).

²²⁹⁷ Stephen Lim et al, A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010, 380 *The lancet* 2224-2260 (2012).

²²⁹⁸ Barbose et al, supra.

²²⁹⁹ Banet, supra.

²³⁰⁰ *Id.*

²³⁰¹ *Id.*

²³⁰² *Id.*

²³⁰³ *Id.*

prices and decreased renewable energy technology prices motivate many households and businesses to become prosumers. Even businesses can benefit from becoming prosumers, as prosumers do not have to pay value-added tax (VAT) for the surplus electricity that they sell.²³⁰⁴ This dynamic further develops the renewable energy sector, as the demand for its energy increases.

2.10. Other supportive policies for the renewable energy sector

Saudi Arabia can also indirectly support the renewable energy industry by targeting those sectors that rely on renewable energy. For instance, Saudi Arabia can adopt laws that support and give financial incentives to electric vehicles (EVs). Norway backs many policies to motivate Norwegian citizens to use EVs.²³⁰⁵ Citizens with EVs are exempted from the tax on CO₂ and gain a discount of 25% VAT; the free use of ferries, car parks, and public charging stations; and free movement on streets otherwise dedicated to buses and trams.²³⁰⁶ Many reports have stated that Norwegian policies that promote EVs will reduce CO₂ by 40% by 2030.²³⁰⁷ Moreover, as a result of Norwegian policies, many citizens will shift toward EVs for financial reasons.²³⁰⁸ A study conducted in Norway reported that 41% of EV owners bought their vehicles for financial reasons.²³⁰⁹ Internal combustion engine cars are relatively expensive in Norway, costing double the price in EU countries due to import taxes.²³¹⁰ The Norwegian government has also established many public charging stations, which addresses the issue of charging EVs in the country.²³¹¹ In 2015, more than 50,000 EVs were registered, meaning that EVs constituted

²³⁰⁴ *Id.*

²³⁰⁵ Viola and Longo, *supra*.

²³⁰⁶ *Id.*

²³⁰⁷ *Id.*

²³⁰⁸ *Id.*

²³⁰⁹ *Id.*

²³¹⁰ *Id.*

²³¹¹ Brenna, Foadelli, Longo and Zaninelli, *supra*.

33.1% of all cars in the country.²³¹² In 2016, the number increased to 100,000 EVs.²³¹³ Thus, the government's support for EVs has increased clean energy and reduced GHG emissions.

3. Low oil prices and new gas discoveries

Oil revenues are beneficial for all oil-producing countries.²³¹⁴ Given that most oil-producing countries rely on oil in their GDPs, oil prices significantly determine their oil revenues.²³¹⁵ Consequently, increased oil prices improve the welfare of oil-producing countries, whereas decreased prices harshly impacts these countries.²³¹⁶ Notably, high oil prices may boost investment and other economic activities, which may accelerate economic growth in these countries.²³¹⁷ Moreover, oil prices and employment are directly linked.²³¹⁸ Hence, these countries depend on oil revenues for their government funds, employment, and cash flow. Crucially, when oil prices decrease, this also decreases consumer purchasing power, which negatively affects non-oil sectors.

3.1. Oil crash (2014)

Saudi Arabia relies on exporting petroleum products to support its economy.²³¹⁹ Evidently, oil prices will continually decrease year by year due to uncontrollable, international factors.²³²⁰ One recent study on Saudi Arabia used data gathered from the Saudi Arabian

²³¹² Id.

²³¹³ Id.

²³¹⁴ Haider Mahmood and Muntasir Murshed, Oil Price and Economic Growth Nexus in Saudi Arabia: Asymmetry Analysis, 11 *International Journal of Energy Economics and Policy* 29-33 (2021).

²³¹⁵ Id.

²³¹⁶ Id.

²³¹⁷ Id.

²³¹⁸ Tarek Alkhateeb, Oil price and employment nexus in Saudi Arabia, 7 *International Journal of Energy Economics and Policy* 277-281 (2017).

²³¹⁹ Anis Ali, Volatility of Oil Prices and Public Spending in Saudi Arabia: Sensitivity and Trend Analysis, 11 *International Journal of Energy Economics and Policy* 165-172 (2021).

²³²⁰ Id.

Monetary Authority (SAMA), and it concluded that the Saudi government has enhanced its short-term public spending while oil prices have decreased annually.²³²¹ Nevertheless, the study asserted that long-term public spending, which covers important social services such as education and health care, will be negatively affected if oil prices continue to decrease.²³²²

3.2. International Monetary Fund report on the Gulf region's reserves

The IMF stated that the financial reserves of Gulf region countries will disappear due in part to a decreased demand for fossil fuels and an increase in gas extraction, which countries prefer to fossil fuels because it is less disruptive to the environment.²³²³ In addition, the IMF proposed that the development of renewable energy resources would decrease the demand for fossil fuels in energy generation and thus decrease the price of green energy.²³²⁴ Moreover, the IMF noted that the increased availability of oil threatens the long-term future of oil revenues.²³²⁵ Technological innovations in the oil industry have reshaped the market landscape. As a result, the U.S. is now the second-cheapest source of oil in the world, and its output has doubled, making it the largest oil producer and, soon to be, a net oil exporter.²³²⁶ According to the U.S. Energy Information Administration (EIA), oil technology is expected to rapidly develop in the next decade.²³²⁷ This would make current non-oil-producing countries, such as China, follow suit and increase their shale oil extraction.²³²⁸ Increased oil in the market would increase the future potential global oil supply, which would decrease prices even further.

²³²¹ Id.

²³²² Id.

²³²³ The IMF report, supra.

²³²⁴ Id.

²³²⁵ Id.

²³²⁶ Id.

²³²⁷ Id.

²³²⁸ Id.

Consequently, many oil-producing countries are determined to prioritize non-oil sources over fossil fuels. Declining oil prices represent an unprecedented challenge to the business models of oil-exporting countries as well as a powerful threat to their political, economic, and social stability.²³²⁹ Nowadays, Saudi Arabia is facing an economic downturn due to declining oil prices, with minor increases as well.²³³⁰ Significantly, these oil prices may prevent the government from financing the ambitious projects necessary to achieve its Vision 2030 goals. Further, any fluctuation in oil demand and price in the world market could disturb business activities, government revenues, and income levels in Saudi Arabia.²³³¹ Because oil has started to lose its unique scarcity premiums, producers now question the policies that intend to keep oil underground in the hopes of it commanding higher prices in the future.²³³²

3.3. Discovery of Gas in Saudi Arabia

Fortunately, Saudi Arabia can start to exploit gas to finance its Vision 2030. Natural gas is viewed as a necessary source of energy that countries tend to use in the transformation and decarbonization of their energy sectors.²³³³ So far, natural gas has been marginalized in comparison to oil in Saudi Arabia, since oil has remained more attractive to export.²³³⁴ The exploitation of gas can benefit export and revenue flows while diversifying the Saudi economy.²³³⁵ In summary, rather than using it as an alternative to oil, Saudi Arabia can exploit gas to temporarily support its public spending and finance its Vision 2030 projects.

²³²⁹ Nicolò Sartori, *The Gulf Cooperation Council's Shift to Gas.: Avoiding Another Fossil Fuel Trap*, Istituto Affari Internazionali 1-14 (2018).

²³³⁰ Mahmood and Murshed, *supra*.

²³³¹ *Id.*

²³³² Sartori, *supra*.

²³³³ *Id.*

²³³⁴ *Id.*

²³³⁵ *Id.*

Natural gas is a very significant energy source.²³³⁶ Starting in the 90s, the production of gas has increased annually by 2%, compared with oil at 1.3% and coal at a negligible 0.15%.²³³⁷ The most important feature of natural gas is that it is environmentally friendly relative to coal and oil.²³³⁸ In addition, gas is more efficient than oil and coal in terms of its thermal release.²³³⁹ It can also be transformed into sulfur-free liquids.²³⁴⁰ Non-associated gas, once discovered, is often cheaper to extract than oil, but its transport is more expensive.²³⁴¹ Because the world has more gas reserves than oil, this source is more sustainable in the long term.²³⁴²

Saudi Arabia has 219 trillion cubic feet of gas reserves, and it is ranked fourth among gas countries after Russia, Iran, and Qatar in reserve size.²³⁴³ Most importantly, Saudi Arabia discovered four new oil and gas fields in 2020.²³⁴⁴ Gas started flowing from the Hadabat Al-Hajara field at a rate of 16 million standard cubic feet per day.²³⁴⁵ Another site, the nearby Abraq at-Tulul field, has started producing 3,000 barrels per day of crude, 49 barrels of condensates, and 1.1 million cubic feet of gas.²³⁴⁶ These examples demonstrate that the country has the potential to exploit such resources to support its public spending and investments.

²³³⁶ Look at the report written by Robert Mabro in The Oxford Institute for Energy Studies: Saudi Arabia's Natural Gas: A Glimpse at Complex Issues. Available at: <https://www.oxfordenergy.org/publications/saudi-arabias-natural-gas-a-glimpse-at-complex-issues/>

²³³⁷ Id.

²³³⁸ Id.

²³³⁹ Id.

²³⁴⁰ Id.

²³⁴¹ Id.

²³⁴² Id.

²³⁴³ Id.

²³⁴⁴ Look at the CNBC news available at: <https://www.cnbc.com/2020/12/27/saudi-arabia-announces-four-oil-and-gas-discoveries-state-news.html>

²³⁴⁵ Look at the Bloomberg news: Saudi Aramco Discovers Two Oil, Gas Fields in Kingdom (2020). Available at: <https://www.bloomberg.com/news/articles/2020-08-30/saudi-aramco-said-it-has-discovered-two-new-oil-gas-fields>

²³⁴⁶ Id.

Overall, a shift to gas is needed for Gulf region countries to address the multitemporal challenges of an energy market in rapid transformation.²³⁴⁷ In Saudi Arabia, this source can be used to achieve its Vision 2030 goals. However, gas alone will not result in a sustainable energy transition, and the country must adopt key measures to avoid a new fossil fuels exports/revenues trap.²³⁴⁸ Three recommended measures are the phase-out of electricity subsidies, reform of natural gas prices, and increased penetration of renewables.²³⁴⁹ Decreasing electricity subsidies will increase the use of renewable energy in Saudi Arabia.²³⁵⁰ Renewable energy development decreases fossil fuel consumption, which leads to an increase in the demand for renewable energy.²³⁵¹

3.4. Lessons from Norway on investing natural resources

Furthermore, Saudi Arabia can apply the Norwegian doctrine to exploit its natural gas resources and create a sustainable economy. Norway created its sovereign wealth fund (SWF) in 1990, which is known as the Government Pension Fund Global (GPFPG).²³⁵² The GPFPG is the largest SWF in Europe and the second largest in the world.²³⁵³ The GPFPG aims to use oil revenues without affecting the general income flow to the government, thereby buffering the impact of volatile oil revenues on government spending.²³⁵⁴ Moreover, it intends to create financial savings that benefit the current generation and also future generations.²³⁵⁵

²³⁴⁷ Sartori, supra.

²³⁴⁸ Id.

²³⁴⁹ Id.

²³⁵⁰ Id.

²³⁵¹ Id.

²³⁵² The Government Pension Fund Act, supra.

²³⁵³ Anita M. Halvorsen, Norwegian Sovereign Wealth Fund's Ethical Guidelines: A Model for Investors, *The*, 8 *Eur. Company L.* 88 (2011).

²³⁵⁴ Halvorsen and Eldredge, supra.

²³⁵⁵ The Government Pension Fund Act (Article 1), supra.

The GPFG resulted from Norway's dangerous overreliance on oil in the 70s.²³⁵⁶ Thus, the government began depositing 90% of the total oil revenue into the fund to reinvest it, the first payment occurring in 1996.²³⁵⁷ The fund invests the royalties from natural resource developments to earn a return above the national rate of growth.²³⁵⁸ Article 6 of the act affirms that the GPFG is prohibited from investing in Norway because of concerns regarding the perverse impacts that this could have on the domestic economy.²³⁵⁹ Ultimately, Saudi Arabia can use the successful and sustainable Norwegian economic model to exploit its current gas discovery, which would prevent Saudi Arabia from making the old mistake of relying only on oil and not implementing sustainable economic reforms.

Conclusion

This chapter discussed solutions that the Saudi government can adopt to effectively lessen its economic reliance on oil. The first part focused on the importance of a competitive environment for the private sector to invest in, and it addressed possible conflicts between the market system and citizens' welfare and the extent to which the government should be active in the economy. The second part discussed the need for Saudi Arabia to enact comprehensive renewable energy laws that will develop its renewable energy sector. Moreover, this part also emphasized how renewable energy laws can develop this newly emerging sector in the long term. The third part examined the benefits of exploiting new gas discoveries to finance non-oil sectors, and it detailed the methods by which Saudi Arabia can more efficiently exploit its new gas discoveries, decrease its dependency on oil, and promote sustainable economic reforms.

²³⁵⁶ The Government Pension Fund Act (Article 4), supra.

²³⁵⁷ Hachigian, supra.

²³⁵⁸ Id.

²³⁵⁹ The Government Pension Fund Act (Article 6), supra.

Following the research, it seems as though Saudi Arabia can apply efficient projects from other countries to improve its own economy and energy use. In particular, Saudi Arabia can adapt the successful Norwegian model to regulate its market system and provide its citizens with the welfare required by the constitution. Because Norway is an oil-producing country and the diversity of its government was not harmed by its active role in the economy, its model can be applied to Saudi Arabia. Moreover, Saudi Arabia should enact comprehensive renewable energy laws to develop its renewable energy sector. While ongoing government projects can help the renewable energy sector in the short term, a legal environment for the private sector to invest in this sector will lead to its development in the long term. Finally, Saudi Arabia can use its newly discovered gas reserves to manage its government spending and finance the non-oil sectors listed in Vision 2030, such as the renewable energy sector. More specifically, Saudi Arabia can apply the Norwegian approach to invest its fossil fuel revenues and develop its non-oil sectors.

Chapter 8 Conclusion

The first chapter of this thesis discussed the serious impact of climate change on human existence and the earth. The danger has both long- and short-term effects on human lives, as the consequences of climate change are now being noticed around the world. Notably, climate change affects the political stability of many countries. The second chapter focused on the existence and development of renewable energy. In particular, this chapter emphasized the importance of deploying renewable energy to address climate change. Crucially, this chapter explored the potential of solar energy, which is abundant in Saudi Arabia. Finally, this chapter outlined some problems with solar energy, mainly its intermittency and energy storage issues.

The third chapter centered on Saudi Arabia, and it both contextualized and explored the country's Vision 2030 goals and shift from fossil fuels to non-oil energy sources, particularly renewable energy. First, the chapter covered the environmental norms under Islam as a religion and the extent to which Islam advocates for environmental protection. This chapter also analyzed the constitution of Saudi Arabia and the fundamental rights that it provides to the citizens. Specifically, the constitution makes the government responsible for providing a clean environment to its citizens. It emphasized that Saudi Arabia's reliance on fossil fuels will not lead to a sustainable economy.

The fourth chapter discussed the Norwegian economic approach, which may prove useful to Saudi Arabia. As Norway relies on a special group of democratic welfare-capitalist systems, its government is responsible for providing welfare to its citizens. Thus, the state is active in the economic system, and it aims to regulate the market in a way that ensures welfare. This chapter also examined the Norwegian sovereign fund, which invests oil revenues in non-oil sectors to create a sustainable economy. Since the discovery of oil, Norway has acknowledged that a

reliance on oil will lead to economic crisis. Lastly, this chapter outlined Norway's renewable energy laws and the effectiveness of these laws on the development of its renewable energy sector. The fifth chapter investigated the major challenges that Saudi Arabia faces as it shifts from relying on fossil fuels to its non-oil sectors, mainly the renewable energy sector. First, Saudi Arabia lacks a regulatory framework to provide a competitive market. Second, Saudi Arabia may struggle to achieve its Vision 2030 goals because of low oil prices. Third, Saudi Arabia suffers from complex and bureaucratic administrative laws, which may harm the private sector and discourage investment.

In response, the sixth chapter provided possible solutions to these three challenges while accounting for both the Saudi context and Norwegian insights. First, Saudi Arabia can apply the Norwegian economic model to regulate a successful competitive market economy and provide the welfare required by its constitution. Because Norway and Saudi Arabia have similar goals and oil resources, the Norwegian model should be attractive to Saudi Arabia. Second, Saudi Arabia must provide a legal environment for the private sector to invest in the renewable energy sector, thus leading to its long-term development. Crucially, Vision 2030 targets government projects to increase the use of renewable energy, which is only a short-term solution. Third, Saudi Arabia should use its new gas discoveries to finance its Vision 2030 projects and promote a more sustainable economy that incorporates renewable energy. Norway has successfully invested its oil revenues to diversify its economy and decrease its reliance on oil. Because Norway's economy is sustainable and did not collapse during the 2014 oil crisis, Saudi Arabia should apply its approach to these new gas discoveries. This thesis can provide a guide for Saudi Arabia to achieve the goals of the 2030 vision efficiently and have a more sustainable economy.

Recommendations

1- Saudi Arabia can apply the Norwegian doctrine in terms of the government's role in the economy. The economy must not rely completely on the government, but it also must not be open without any restrictions or regulations for the private sector that seeks only profits. Instead, the government must establish regulations, policies, and restrictions for the private sector that benefit citizens since the primary role of the government is to serve the people. In other words, if the private businesses do not have any restrictions, they will exploit citizens and harm the environment to seek short-term profits. Consequently, the government must regulate the private sector to control the motives of for-profit organizations and to benefit society.

2- Saudi Arabia must enable the private sector to be the main contributor to the GDP. The private sector has not been active in the Saudi economy because of the country's dependency on oil, resulting in a lack of skilled Saudi workers in the private sector. This is problematic because Saudi Arabia aims to shift toward a market-based economy. There are many reasons for the limited role of the private sector in the Saudi economy, including the lack of a legal environment that attracts investments. Many developed countries seek to create an environment that motivates entrepreneurs to achieve success. Easing investments in Saudi Arabia is needed if the country wants foreign investors to invest in Saudi Arabia. This means that the government must enact flexible laws to attract investors but still regulate the market in a way that protects its citizens from corporate exploitation.

3- Saudi Arabia should develop its education system to provide the market with qualified labor. Evidently, there is an imbalance between what the market demands and what the education system produces. Since Saudi Arabia aims to shift from fossil fuels to other sustainable sectors, the education system must meet the demand of these sectors, such as the renewable energy sector. Most importantly, workers in the new emerging sectors need technical and vocational training to meet the demand of the new sectors that the country aims to develop according to the 2030 vision.

4- Saudi Arabia must enact renewable energy laws for the renewable energy sector. The market for the new emerging sector must be attractive to private businesses. This means that incentives, soft policies, and government subsidies are needed to motivate the private sector to invest in the renewable energy sector. The government should not focus heavily on establishing clean energy projects but must establish a market that the private sector develops as part of the new emerging sector. Establishing a competitive market will allow the renewable energy sector to develop in the long term. The government can establish its own clean energy projects, but this should be separate from the private sector.

5- There are many successful renewable energy laws in Norway that can benefit Saudi Arabia in regulating the renewable energy sector. For instance, the Norwegian Energy Act introduced the prosumer system to motivate the public to rely more on renewable energy sources since it is beneficial for them. These laws and regulations support the government in regulating and motivating the private sector to invest in the renewable energy sector. This will develop the new

emerging sector in the long term and will make it more competitive and easier to access in the future.

6- Saudi Arabia can also apply feed-in tariffs (FIT). The FIT regime has three main financial benefits. First, the regime provides payment for all clean electricity produced, even if used by the producer itself. Second, the regime provides bonus payments to producers who export their clean energy to the grid. Finally, the regime also reduces the producer's standard electricity bill. Saudi Arabia can use the FIT regime to reduce its high consumption of electricity generated from fossil fuels and prioritize clean energy.

7- Another regime that Saudi Arabia can use in regulating the renewable energy sector is the renewable portfolio standard (RPS). The RPS requires renewable energy producers to generate a minimum amount of clean energy to sell or to install at a certain capacity and to ensure that the target is met. A certificate or credit is issued for each unit of power that a renewable energy producer generates. These certificates or credits can then be sold to energy supply companies either in conjunction with or separately from the underlying power. This system has had a positive effect on the development of the renewable energy sector in many countries. These standards, along with other renewable energy laws and policies, can develop the Saudi renewable energy sector in the long term.

8- Saudi Arabia can replicate the Swedish-Norwegian market for electricity certificates. The country can create this market with the other Gulf region countries since they have the same

challenges and goals in shifting to clean energy. This system will increase the renewable energy market, which will make it more attractive to investors.

9- Saudi Arabia can support the renewable energy sector in other ways, such as by offering government subsidies. It is important to note that fossil fuels developed after governments offered huge subsidies. Thus, it will be helpful to provide government subsidies and tax cuts for the renewable energy sector to achieve the goal of replacing fossil fuels in the future.

10- Saudi Arabia should provide sufficient protection for intellectual property rights, such as safeguarding trade secrets. The concept of trade secrets and other intellectual property rights should be defined clearly to protect the rights of investors. More importantly, Saudi Arabia must provide methods for equitable recovery if trade secrets are violated.

11- Saudi Arabia can apply the Norwegian doctrine to exploit its natural gas resources and create a sustainable economy. This exploitation can be applied by creating a sovereign wealth fund that uses gas revenues without affecting the general income flow to the government, thereby buffering the impact of volatile gas revenues on government spending and creating financial savings that benefit current and future generations.

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