The Mediating Effect of Climate Change on the Relationship between Energy Resources and Cost - Saving Sustainability and Energy Security in Sabah, Malaysia

By

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Research Project Submitted in Partial Fulfillment of the Requirements

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DECLARATION

I hereby declare that the case study is based on my original work except for quotations and citations that have been duly acknowledged. I also declare it has not been previously on concurrently submitted for any other degree at Universiti Tun Abdul Razak (UNIRAZAK) or other institution.

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Abstract of the project paper submitted to the Senate of Universiti Tun Abdul Razak in partial fulfillment of the requirements for the Master of Business Administration

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With a current projected nameplate capacity of 900 MW and a peak demand of about 700 MW, Sabah has a 28% reserve margin, Sabah's capacity is largely made up of outdated, pricey, and more unreliable diesel plants, and the demand for energy is expanding at a rate of over 7% annually. Driven by the expansion of both the commercial and household sectors, unexpected breakdowns in Sabah result in costly service interruptions, especially on the east coast, which is almost totally dependent on diesel plants. In addition, Sabah and Sarawak, two states in East Malaysia (also known as Malaysian Borneo), only have rates of 77.00% and 67.00%, respectively, while Peninsular Malaysia has a high electrical access rate of 99.72%. Nearly 0.8 million Malaysians, the majority of whom live in East Malaysia's rural areas, lack access to electricity. Sabah even had the highest average monthly number of electric outages among all the states in Malaysia in 2009, with 1,759 disruptions. This research adopts quantitative research in which a public survey was performed in between 28 April 2023 to 10 May 2023 emphasizing on the Sabah public sentiment on perception, awareness, knowledge, acceptance and attitudes on how Sabah's energy resources, including nuclear, fossil, and renewable fuels, relate to Sabah's cost-effective sustainability and energy security. A total 100 questionnaires have been distributed to various geographic or regional regions, who are likely to differ due to their beliefs or perceptions, educational backgrounds, income levels, and occupations participated in this survey but only 80 usable questionnaires are taken as sample size as required in this paper. The response rate was 86.96%. A smaller sample was chosen in the study rather than a more thorough census due to the magnitude of the population. The sample strategy used in the present research was non-probability sampling. The hypothesis results indicated that most Sabah's people had a poor understanding of, and lack of acceptance of, the need for energy. This study found that the Protection Motivation, Theory Consistency Theory and Behavioral Reasoning Theory (BRT), play an important theory of planned behavior in looking at practical, long-term solutions to the problems of cost-effective sustainability, energy security, and climate change as a mediating factor. The study suggests that policy on conceptual framework on environmental literacy and pro-environmental be adopted and review the country existing energy policy especially renewable energy (RE) policy (RE Act 2011) and legal framework.

CHAPTER 1

INTRODUCTION

1.1 Background of the Study

Energy is recognized as one of the key factors in economic development, and a country's ability to maintain its economic growth depends on the security of its energy supply. Due to Malaysia's relentless energy demand and depleting domestic energy resources, energy industry players and policy makers have recently become more concerned about the country's energy supply security. For developing countries, finding affordable energy resources with secure supply and minimal environmental impact has always been the primary objective. According to Kumary and Tewary (2021), the world is currently working to achieve energy security (ES), which is frequently disrupted by population growth and unprecedented urban development. For developing countries, Dincer and Acar (2015) have highlighted energy security (ES) as a challenging task to meet rising energy demands in a long-term, environmentally sustainable manner.

Energy supply is anticipated to increase by an average of 4.7% annually to 11,400,000 MW by 2030 to meet this constantly growing demand by industrial and commercial sectors. Natural gas, coal, and oil make up the majority of Malaysia's conventional power generation system and the total national primary energy supply (TPES). According to Ludin et al. (2018), Malaysia's main challenges include climate change, fossil fuel extraction, resource depletion, and a lack of renewable energy sources. Malaysia must develop ways to provide a sustainable and reasonably priced power supply in the future because it is expected that energy demand would rise proportionally to GDP and economic growth.

Coal and natural gas are the main fuels used in Malaysia's power sector, which is dependent on fossil-based energy sources. The difficult problem is figuring out how to accomplish sustainability, or how to guarantee the security and dependability of the energy supply while taking the effects of energy production on the environment into account. On the path to a sustainable future, the energy sector's two primary problems are securing energy supply and reducing energy's role to climate change (Abbasi and Abbasi, 2010; Kaygusuz, 2012). It is staggering to learn that 1.4 billion people in the world today lack access to electricity, with 85% of them living in rural regions. As a result, it is anticipated that from 2.7 billion now to 2.8 billion in 2030, there will be more rural populations reliant on the traditional use of biomass (Kaygusuz, 2012).

Since the population has been expanding at an exponential rate over the past few decades, energy production using fossil fuels (coal, oil, and gas) has dominated the energy market, creating issues for the entire world due to the rapid increase in emissions of carbon dioxide (CO2) (Asumadu-Sarkodie and Owusu, 2016a). One of the biggest issues in the 21st century is a dramatic evolution in the climate. If attempts are taken to change the way current energy systems operate, its severe effects might still be avoided.

World Bank classifications stated that the country's target is to grow its GDP by an average of 6% per year until 2020 to attain both development and economic prosperity (Dharmender, 2009). The difficulties that growing nations face are unique in that they must meet the rising energy needs for their economic expansions at a competitive price without endangering the environment. Because of this, the GDP growth and energy demand are always positively and significantly associated, as Malaysia has demonstrated (Abdul Hamid et al., 2008).

In the context of Sabah, climate change needs to be address towards the cost saving and energy sustainability using cleaner energy resources availability i.e., renewable energy and nuclear energy apart from the fossil fuel usage. To reduce emissions of greenhouse gases from the burning of fossil fuels and combat global warming, renewable energy sources hold the greatest possibilities (Edenhofer et al., 2011). In Sabah, one of Malaysia's 13 states has frequently experience a severe power shortage. In addition, Sabah's power network is not connected to any other power networks in most part of Sabah's area.

Therefore, the case study will focus on the Malaysian state of Sabah. This study seeks to examine the mediating effect of climate change to address energy resources to achieve cost – saving sustainability and energy security in Sabah, Malaysia. Following that, the findings are provided together with a sensitivity analysis and a conclusion.

1.2 Problem Statement

Malaysia's energy sector has been guided by the four-fuel diversification strategy since 1980. Malaysia is currently implementing the 1999 Five-Fuel Diversification Strategy energy mix. The energy mix in Malaysia is contributed by five major sources in this strategy: natural gas, coal, oil, hydro, and renewable energy (RE). With a well-balanced energy mix, the economy and the power sector are less vulnerable to changes in the fuel supply. Oil and natural gas prices rose dramatically in the 1970s, which raised concerns about supply security. The National Renewable Energy and Action Plan of 2009 and the Fifth Fuel Diversification Strategy of 2001 both feature

RE targets that Malaysia has been entirely ineffective in meeting due to RE's excessive price and a lack of private investment (Bujang et al., 2016).

Renewable energy sources are plentiful, many of them are still underutilized, environmentally responsible, and have a great deal of potential to satisfy the energy needs of both established and emerging nations (Oh et al., 2010). Although the announcement of Malaysia's fifth fuel policy a decade ago, the country's rate of RE development is still slow and in its early stages. Currently, the proportion of RE in the nation's whole energy mix is only approximately 1%. (Oh et al., 2010; Saidur et al., 2010). They have a high potential to help meet the energy needs of both established and developing nations (Oh et al., 2010). These renewable energy sources include geothermal, hydropower, biomass, sun, and wind. The choice of the most effective, efficient, and dependable source to suit Malaysia's needs presents a problem for the government and policy makers. Apart from a change to the tariff and the addition of the geothermal energy tariff in 2015, the RE Act 2011 has not undergone any significant amendments since it was first implemented. According to studies, wind (Albani, 2013) and tidal energies (Sarawak Energy, n.d.; Samo et al., 2017) both have the potential to be used, which will help increase the proportion of renewable energy sources (RE) in the energy mix. Renewable energy sources still make up a small percentage of the electricity that is produced today. Prior to the implementation of this policy, the government had a goal of producing at least 5% of the country's electricity from renewable sources, but this target had never been reached (Bujang et al., 2016).

The rise of both the business and residential sectors is responsible for Sabah's daily electricity demand rising by about 4.2 percent, from 14.2 GWh in 2009 to 14.8 GWh in 2010. Peninsular Malaysia has a high electrical access rate of 99.72%, while Sabah and Sarawak, two states in East Malaysia (sometimes referred to as Malaysian Borneo), only have rates of 77.00% and 67.00%, respectively. The statistic showed that almost 0.8 million Malaysians possess no access to power access. Most of them reside in East Malaysia's rural districts (Tian Shen Liang, 2016). Despite federal budget increases every year for the previous decades, East Malaysia's electrification programs have made modest progress towards catching up to Peninsular Malaysia. Sabah even had the highest average monthly number of electric outages among all the states in Malaysia in 2009, with 1,759 disruptions (Koh and Lim, 2010). These civil efforts resort to stand-alone power generation systems, e.g., diesel generators systems and micro- or pico-hydropower systems for electricity (Murni, Whale, Urmee, Davis and Harries, 2013; Anyi, Kirke, and Ali, 2010).

First, it is a free source from the sun and has infinite potential (Jaafar et al., 2002). Moreover, it creates power at the site of use, reducing electricity transmission losses, and it does not require additional land (Ali et al., 2012). The growth of solar energy benefits from the tropical climate in Malaysia. Only the lowest solar capacity can meet about 20% of the nation's electricity consumption (Ali et al., 2012). The way in which energy sources are used has evolved with each industrial revolution. To meet the demands of the industrial system and human life, a significant amount of coal, electricity, oil, natural gas, nuclear, biogas, solar, wind, and hydrogen energy is produced and consumed annually all over the world (Ping He and Xiaoting Ni,2022). As a result, there is a critical need to examine the related obstacles to the deployment of renewable energy in each nation and region separately. Government-funded expenses such as direct aid, tax breaks, indirect aid to the energy sector (such as the price of securing fuel supplies), and support for R&D expenses are not considered external expenditures. Significant obstacles include those related to the market, economy, finances, institutions, and technology, social, cultural, and behavioral impediments. The investigation helps us to have a better grasp of public perceptions awareness, knowledge, acceptance and attitudes towards long-term, economically sound, and practical ways to address climate change to achieve the cost and energy sustainability in Sabah, a state in Malaysia.

A revolutionary suggestion in their seminal paper on unburnable fossil fuels that "globally, a third of oil reserves, half of gas reserves, and over 80% of current coal reserves should remain unused from 2010 to 2050 in order to meet the target of 2°C" set by the Paris Agreement (McGlade and Ekins (2015). Yet, there has not been a comprehensive look at supply-side measures implemented to limit the output of fossil fuels yet. As the enormous excess in anticipated fossil fuel output and its effects on climate change become increasingly apparent (Weitza, Carlsena, Skånberga, Dzeboa and Viaudb, (2019). Limiting the use of fossil fuels can prevent a "carbon lock-in" by lowering investments in future manufacturing (Bauer, McGlade, Hilaire, and Ekins, 2018).

The challenging issue is how to achieve sustainability while taking the environmental impacts of energy production into account to guarantee the security and dependability of the energy supply (Tian Shen Liang, 2016). Due to the dependence of most of the electricity producing facilities on coal and oil, the power industry has been identified as a major contributor to greenhouse gas (GHG) emissions globally.

The use of nuclear energy as a way to decrease greenhouse gas emissions was first suggested in 2000 (Sailor, 2000), although discussion has continued ever since. Nuclear power may or may not be a low-carbon technology, so they strictly support a non-nuclear future (Mez, 2012). However, they could be the main source of electricity production in a low-carbon future with ten times the installed capacity up to 2050, or they could at least completely replace coal-fired power plants (Knapp and Pevec, 2018). The Paris Agreement's climate goals cannot be met without nuclear energy (Parsons et al. 2019). As Sovacool et al. (2020) demonstrate by comparing the CO2 emissions and energy generation of 123 nations over a 25-year period, large-scale national nuclear initiatives do not appear to result in considerably lower carbon emissions.

Electricity generation now has a significant option in the form of nuclear energy (WNA 2016). Nuclear energy generates more than a third (31.5%) of the world's electricity, according to IEA (2017a). This amounts to 31.5% of the energy produced by low-carbon fuels and the world's most environmentally friendly energy sources. Such an energy source may offer basic electricity in a secure manner, produces electricity without emitting carbon dioxide, and is regarded as an efficient solution for reducing long-term climate change (IAEA 2017a). Many nations still rely on nuclear power generation, despite the recent disaster in Fukushima in 2011 which rocked the world. Many nations have opted to generate electricity from nuclear power in accordance with the United Nations Framework Convention on Climate Change (UNFCCC) and other international climate change conferences because it is a clean energy source with no emissions that will indirectly help reduce emissions of greenhouse gases (GHG) and addressing world warming (Pongsoi and Wongwises, 2013).

Nuclear energy was ranked as Malaysia's sixth fuel in the country's energy mix for power generation, according to Ali, Daut, and Taib (2012). The Malaysian Nuclear Power Corporation was established in 2010 as part of the government's National Nuclear Strategy, which was introduced in response to the growing popularity of nuclear energy, even though the technology faced strong early opposition and criticism. As nuclear power was incorporated into the 11th Malaysia Plan 2016-2020, the Malaysian government has expressed interest in building them. The goal of building a nuclear reactor has been postponed multiple times since it is difficult for a growing nation like Malaysia. Only with the assistance of a nuclear-rich nation to construct and maintain nuclear reactors can Malaysia successfully develop a nuclear plant. Even though nuclear power plants are already safe to run, the subject of how to handle radioactive wastes continues to be complex (Ghazali and Ansari, 2018).

In contrast, Malaysia must adhere to worldwide standards by having a capable a strong institutional and legal foundation backed by a skilled technical and administrative personnel before having a nuclear power plant and being subject to the International Atomic Energy Agency's (IAEA) scrutiny, the atomic energy industry watchdog. With an effective institutional and legal framework, Malaysia has already begun moving in that direction (Ghazali and Ansari, 2018). A nuclear power plant development project led to the establishment of the Malaysian Institute for Nuclear Technology Research (MINT) in 1994. While working on alternative types of energy, it regrettably did not address any issues relating to nuclear energy (Farahdilah Ghazali, Abdul Haseeb Ansari, Maizatun Mustafa and Wan Mohd Zulhafiz Wan Zahari, 2019). The organization was formally renamed the Malaysian Nuclear Agency (Nuclear Malaysia) in 2006. The objectives of Nuclear Malaysia are to carry out research and development, promote the use of nuclear technology, transfer it, and make it commercially viable, as well as to coordinate and manage nuclear matters on a national and international level.

The topic of social costs and advantages of nuclear power has not received enough attention, despite economic and financial expenses for nuclear utilities receiving a lot of attention. Economic costs include capital costs, operational costs, and fuel cycle costs that the utility must incur. Regular environmental effects like air pollution, public safety risks from nuclear accidents or sabotage, and subsidies to private utilities are only a few of the social costs connected with each plant and the fuel cycle that powers it (Srinivasan, Gopi Rethinaraj, 2013). The institutional strength and political stability are also necessary for a country to successfully manage its nuclear power programmed, garner international support, and pull necessary private investment, Kristiansen, Bonfadelli and Kovic, (2018).

With a projected nameplate capacity of 900 MW and a peak demand of 700 MW, Sabah currently has a 28% reserve margin. Unfortunately, Sabah's capacity is largely made up of outdated, pricey, and more unreliable diesel plants, which are driving up energy demand at a rate of over 7% annually. The east coast of Sabah, which is nearly entirely dependent on diesel plants, is particularly affected by unplanned outages that result in expensive service interruptions (McNish, Kammen and Gutierrez, (2010).

1.3 Research Objectives

The objectives of this research are to ascertain how Sabah's energy resources relate to climate change, cost-effective sustainability, and energy security as follows:

RO1: To examine the relationship between renewable energy (RE) and cost saving sustainability (CSS) in Sabah.

RO2: To examine the relationship between fossil fuel energy (FFE) and cost saving sustainability (CSS) in Sabah.

RO3: To examine the relationship between nuclear energy (NE) and cost saving sustainability (CSS) in Sabah.

RO4: To examine the relationship between renewable energy (RE) and energy security (ES) in Sabah.

RO5: To examine the relationship between fossil fuel energy (FFE) and energy security (ES) in Sabah.

RO6: To examine the relationship between nuclear energy (NE) and energy security (ES) in Sabah.

RO7: To examine the relationship between renewable energy (RE) and climate change (CC) in Sabah.

RO8: To examine the relationship between fossil fuel energy (FFE) and climate change (CC) in Sabah.

RO9: To examine the relationship between nuclear energy (NE) and climate change (CC) in Sabah.

RO10: To examine the relationship between climate change (CC) and cost saving sustainability (CSS) in Sabah.

RO11: To examine the relationship between climate change (CC) and energy security (ES) in Sabah.

RO12: To examine the mediating effect of climate change (CC) in the relationship between renewable energy (RE) and cost saving sustainability (CSS) in Sabah.

RO13: To examine the mediating effect of climate change (CC) in the relationship between fossil fuel energy (FFE) and cost saving sustainability (CSS) in Sabah.

RO14: To examine the mediating effect of climate change (CC) in the relationship between nuclear energy (NE) and cost saving sustainability (CSS) in Sabah.

RO15: To examine the mediating effect of climate change (CC) in the relationship between renewable energy (RE) and energy security (ES) in Sabah.

RO16: To examine the mediating effect of climate change (CC) in the relationship between fossil fuel energy (FFE) and energy security (ES) in Sabah.

RO17: To examine the mediating effect of climate change (CC) in the relationship between nuclear energy (NE) and energy security (ES) in Sabah.

1.4 Research Questions

RQ1: To what extent does renewable energy (RE) relate to cost saving sustainability (CCS) in Sabah?

RQ2: To what extent does fossil fuel energy (FFE) relate to cost saving sustainability (CCS) in Sabah?

RQ3: To what extent does nuclear energy (NE) relate to cost saving sustainability (CCS) in Sabah?

RQ4: To what extent does renewable energy (RE) relate to energy security (ES) in Sabah?

RQ5: To what extent does fossil fuel energy (FFE) relate to energy security (ES) in Sabah?

RQ6: To what extent does nuclear energy (NE) relate to energy security (ES) in Sabah?

RO7: To what extent does renewable energy (RE) relate to climate change (CC) in Sabah?

RQ8: To what extent does fossil fuel energy (FFE) relate to climate change (CC) in Sabah?

RQ9: To what extent does nuclear energy (NE) relate to climate change (CC) in Sabah?

RQ10: To what extent climate change (CC) relate to cost saving sustainability (CSS) in Sabah?

RQ11: To what extent does climate change (CC) relate to energy security (ES) in Sabah?

RQ12: To what extent does renewable energy (RE) relate to climate change (CC) towards cost saving sustainability (CSS) in Sabah?

RQ13: To what extent does fossil fuel energy (FFE) relate to climate change (CC) towards cost saving sustainability (CSS) in Sabah?

RQ14: To what extent does nuclear energy (NE) relate to climate change (CC) towards cost saving sustainability (CSS) in Sabah?

RQ15: To what extent renewable energy (RE) relate to climate change (CC) towards energy security (ES) in Sabah?

RQ16: To what extent does fossil fuel energy (FFE) relate to climate change (CC) towards energy security (ES) in Sabah?

RQ17: To what extent does nuclear energy (NE) relate to climate change (CC) towards energy security (ES) in Sabah?

1.5 Scope and the Limitation of the Study

This will involve the collection of data from a significant number of participants the effects of renewable, fossil fuel and nuclear energy on cost saving sustainability and energy security. This research will be conducted on the population in Sabah, Malaysia.

This study will be conducted within a duration of one week. This study will only involve a population of 700 peoples where a sample of participants will be used to collect data 6 analysis. A sample of 65 participants will be selected from the populal tion of 700 people to carry on with the research. From the selected sample of 65 participants, different categories of individuals will be selected in terms of gender, age distribution, work experience, and other related factors. The limitation of this study is that this study is only limited on the state of Sabah to study the factors that affect cost saving sustainability and energy security. The information collected from one surrounding can lead to biased information.

1.6 Significant of the Study

The significant of study are divided into two parts of category: -

1.6.1 Significant of Academia

In Malaysia, 95% of energy needs generated using fossil fuels like coal, oil, and gas, and they will continue to be the country's main energy source which is expected to cause the carbon emission profile to quadruple by 2030. Due to several scientific studies showing that conventional, CO_2

emitting power systems are not both economically and environmentally sustainable (Babatunde, Said, Nor and Begum, (2018), sustainable electricity generation and consumption are the subject of intense debate among climate change experts.

This article will provide an update on recent and ongoing key energy-related events, their effects on the nation's energy landscape, and how they connect to the overall goal of addressing the country's energy security and sustainability through non-renewable and renewable energy (RE) (Tick Hui Oh, Md Hasanuzzaman, Jeyraj Selvaraj, Siew Chein Teo and Shing Chyi Chua, 2018).

Furthermore, the study also important for future researchers in gauging the efficacy of the energy security implementation in Sabah. It is appropriate to broaden energy security in its broadest sense ensuring the chain of supply for energy is secure, which, currently, encompasses a variety of questions and issues (Goldthau, 2010). Even though the study in this section is not to assess and contrast all, even the majority perspectives on energy security, it does highlight several definitions and methods that seem pertinent to this theoretical study.

This substantially widens the range of indicators to be observed for the study of this phenomenon. Energy survival ought to be viewed as a risk management issue since the energy system cannot be completely protected (OECD/IEA, 2007). The theory of energy security has been the focus of extensive literature and debate, but researchers have not been able to agree on a single interpretation (Chester, 2010, Cherp and Jewell, 2011, 2014, Sovacool, 2011, Sovacool and Mukherjee, 2011, Ang et al., 2015, Dannreuther, 2017, Szulecki, 2018, Koulouri, and Mouraviev, 2019).

1.6.2 Significant of Industrial

Through this study, research will be conducted to find out how effective energy resources in mitigating climate change in the aspect of energy security and cost saving sustainability. The findings from this research will assist the government, the public, and the business community in understanding the effects of climate change on cost-effective sustainability and energy security in the Sabah environment. In Malaysia, the need for energy is steadily rising, regrettably, there is an inadequate supply. Climate change have significant effects that should not be dismissed. Therefore, it is important for all parties to treat these issues carefully to prevent any adverse consequences on the environment of humans. The public, non-governmental organizations (NGOs), and the government should take steps to increase public knowledge of the causes of climate change. Both directly and indirectly affecting human health impacted by global climate

change. Researchers have up until now primarily concentrated on the immediate effects of extreme weather events, such as temperature increases, severe droughts, cyclones, and tropical storms, for which empirical data are widely accessible and connections are easily verifiable. The deteriorating of ambient air quality and the impact on the spread of infectious diseases are secondary effects of climate change that are important for human health (Massimo Franchini and Pier Mannuccio Mannucci, 2015).

This study also sheds light on how national and international development strategies' perceptions of energy security frequently place a heavy emphasis on fossil fuels, which influences sustainability of the environment and energy equity (Moore, Mascarenhas, Bain and Straus, 2017). In the Malaysian context, potential effects of climate change include, among other things, rising sea levels, decreased yields of crops, increased disease rates among declining biodiversity, coastline erosion, and forest species, intensified floods, bleaching of coral reefs, increased disease cases, tidal inundation of coastal regions, dwindling water supplies, a decline in biodiversity, and an increase in droughts (Haliza Abdul Rahman,2018). The deterioration of the ecosystem, infrastructure, and human health are all directly impacted by climate change. Indirect damages are another factor, and they are also anticipated to be significant (Masud, Rahman, Al-Amin, Kari and Filho, (2014).

This study also aims to shed some insight on how to fulfil the nation's rising energy demand through additional research, development, and investment in the power sector. This paper's goal is to draw attention to some of the difficult problems with Malaysia's plan to expand its power industry, which intends to ensure the security, sustainability, and stability of the country's energy supply. This will hopefully encourage more conversation and study on the topic.

The study also emphasizes the importance of ensuring that all social groups have equitable access to safe energy sources and minimizing the harmful consequences of the energy sector on climate change and the environment (Danila Longo, Giulia Olivieri, Rossella Roversi, Giulia Turci and Beatrice Turillazzi ,2022). In this analysis, Sabah, the thirteenth state of Malaysia, serves as a case study because Sabah possesses all the previously described typical qualities. Sabah also has its own independent power system, with its own power plants providing the state's electricity. It does not exchange any electricity with the states or nations that are nearest door. As a result, without many uncertainties brought on by the trading of electricity, the predicted power plant installation and growth in GHG emissions may be determined with accuracy. Also, the utility company in Sabah can formally provide all the information required for this study, which can then

be used. As a result, a thorough study may be conducted to produce realistic results that are unquestionably significant and pertinent to many policy makers.

1.7 The Organization of the Study

There are three (5) chapters in this research. A summary of each chapter is provided below.

First Chapter provides the introduction of the study with the inclusion of subheadings background of the study, problem statement, research objectives, research question, scope, and limitations of study, significant of the study.

Second Chapter consists of a review of prior literature to comprehend the conclusions of previous studies supporting the variables. It presents the conceptual framework and hypothesis development.

Third Chapter covered in details the study's research design, which includes study population and sampling procedure, date collection method, dependent and independent variables, operationalization and data measurement, and data analysis technique.

Fourth Chapter shall present the descriptive analysis and results of the respondents, as well as various statistical tests and discussions of the findings.

Fifth Chapter shall present recap of major findings, implications of the study, limitations of the study and recommendations.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This section will review relevant literature and provide a theoretical framework for the study. An explanation of the energy security concept is given at the outset of the chapter.

The threats to today's energy security have significantly changed from those of the past. It is appropriate to broaden energy security in its broadest sense ensuring the chain of supply for energy is secure, which, currently, encompasses a variety of questions and issues (Goldthau, 2010).

The issue of energy security first surfaced in the early 20th century. However, the term "energy security" was first used during the two oil price increases in the 1970s (although it had been used earlier in some works of literature, such as Lubell, 1961). The theory of energy security has been the focus of extensive literature and debate, but researchers have not been able to agree on a single interpretation. Since the concept has not been fully defined, it can be challenging to gauge its effectiveness and balance it against a nation's other political objectives.

Although the global community has not been able to acknowledge on what energy security entails; generally acknowledged that risk and security are associated. Energy survival ought to be viewed as a risk management issue since the energy system cannot be completely protected (OECD/IEA, 2007; Birol, (2007).

2.2 Research Variables

2.2.1 Renewable Energy

Renewable energy sources are those that derive their power from the continuous and natural flow of energy that takes place in our immediate environment. bioenergy, direct solar energy, geothermal energy, hydropower, wind, and wave and tidal energy from the ocean.

2.2.1.1 Hydropower

Water that flows from higher elevations to lower elevations can be used as a vital energy source for turning turbines and producing electricity, or hydropower. The magnitude of hydropower projects varies and includes run-of-river, in-stream, and dam projects with reservoirs. Hydropower

projects utilize a resource that varies briefly and use technically advanced hydropower technologies. Hydropower reservoirs are used for a variety of purposes, including irrigation, drinking water, prevention of flooding and drought (Asumadu-Sarkodie, Owusu, and Jayaweera, 2015; Asumadu-Sarkodie, Owusu, and Rufangura, 2015), and navigation (Edenhofer et al., 2011). The main source of energy for the turbine both gravity and height at which the water descends. Hydropower can store energy for several hours, can be upgraded quickly, and emits almost no particulate pollution (Hamann, Hug and Rosinski, (2016).

The estimated total capacity potential for hydropower generation is 3,721 GW, with a technical yearly potential of 14,576 TWh. However, the installed capacity of hydropower around the world is now far lower than its potential. Global warming may have an effect on the hydropower resource potential. The predicted global the effects of worldwide warming on current hydropower production system is less than 0.1%, even if further study is required to make these less uncertain projections (Edenhofer et al., 2011). As the production of hydropower does not release greenhouse emissions, it is frequently referred to as a green form of energy. Moreover, water is drawn from reservoirs and waterways and transported over a great length using channels, pipelines, and turbines that are frequently visible (Frsund, 2015). Water may also go through mountains by being dug through their interiors. The hydropower stations in Malaysia serve more purposes than only producing energy.

Hydropower is one of the most affordable, dependable, predictable, and ecologically friendly options (Borhanazad, Mekhilef, Saidur and Boroumandjazi (2013). Due to its high temperatures, humidity levels, and rainfall throughout the year, Malaysia has a significant potential and a wide range of water resources. While small-scale facilities and even individuals operate "micro" hydropower plants to meet their personal energy needs or sell power to utility companies, large hydropower plants offer electricity to large numbers of people (Alam, Hashim, Rashid, Omar, Ahsan, and Ismail (2014).

2.2.1.2 Solar Energy

Direct solar energy is the term for the energy source used in renewable energy technologies that directly harness the power of the Sun. The photovoltaic (PV) technology used in solar energy is derived from the sun's irradiance (Asumadu-Sarkodie and Owusu, 2016d). It uses concentrated solar power (CSP) to generate thermal energy, meet immediate lighting needs, and possibly even produce fuels that might be used for transportation and other purposes (Edenhofer et al., 2011). The total energy from solar radiation falling on the globe in 2013 was more than 7,500 times

greater than the global annual primary energy consumption of 450 EJ, according to the World Energy Council (Urban and Mitchell, 2011).

Two benefits are combined by solar PV. On the one hand, manufacturing modules can be done in sizable facilities, which enables economies of scale. Meanwhile, PV is a relatively modular technology. By focusing direct-beam solar irradiance to heat a liquid, solid, or gas, concentrating solar power (CSP) technologies generate energy that is employed in a subsequent process for electricity generation. Large-scale CSP plants often focus sunlight by reflection rather than refraction using lenses. The trough systems are frequently used today as the CSP industry expands due to the positive experiences and lessons learned from these pioneering plants (Machinda, Chowdhury, Arscott, Chowdhury and Kibaara, 2011).

Renewable Energy (RE) capacity is expected to increase from its present level of 4430 MW to 10,944 MW, with solar energy having the greatest potential (Zainal Ariffin, Isa, Lokman, Ahmad Ludin, Jusoh, and Ibrahim, 2022).

2.2.1.3 Biomass Energy

The term "biomass" refers to all organic material derived from plants, trees, and crops. Photosynthesis is essentially how the sun's energy is captured and stored in biomass. The process of converting biomass into usable energy sources like heat, electricity, and liquid fuels is known as biomass energy (or bioenergy) (biofuels) (Srirangan, Akawi, Moo-Young, and Chou, 2012).

In addition to being able to be burned directly to provide energy, biomass can also be used as a feedstock to create a variety of liquid or gas fuels (biofuels). In an energy mix that relies heavily on sporadic sources like wind, the ability to transport and store biofuels is crucial for enabling on-demand generation of heat and power. Due to the wide availability of biomass worldwide, mainly because it can be obtained as a by-product of many industrial and agricultural processes, biomass represents a growing renewable energy source with high growth potential (Li, Rezgui, and Zhu, 2017).

There are 124 known palm oil mills in Sabah, and the potential for biomass generating there is thought to be 500 MW. Most Sabah's palm oil mills are situated on its eastern coast (Hashim, Khairuddin, and Ibrahim, 2015). These mills create a variety of by-products, including solid waste from empty fruit bunches (EFB), mesocarp fibers, palm kernel shells, and palm oil mill effluent, all of which can be utilized to generate biomass and biogas, respectively. Despite Sabah's significant

biomass potential, grid-connected renewable electricity generation is still only being realized at a terribly slow rate in Sabah. The main causes of the low penetration level are economic, financial, and technological limitations (Isa, Sivapathy and Kamarruddin, 2021).

2.2.1.4 Wind Energy

The definition of wind power is the process by which wind energy is transformed by wind turbines into a useful form, such as the production of electricity by wind turbines, mechanical power by windmills, water or drainage pumping by wind pumps, or propulsion of ships by sails. The rise of wind as a significant source of global energy has given it the upper hand among renewable sources. In some regions of the planet, wind has a significant energy density and is present everywhere (Manwell, McGowan and Rogers, (2010).

The kinetic energy of moving air is captured by wind energy. According to Asumadu-Sarkodie and Owusu (2016), the main way to use this importance in the mitigation of climate change is to generate energy from sizable turbines that are placed on land or offshore in bodies of freshwater or saltwater. The production and wide-scale use of onshore wind energy technologies has already begun (Edenhofer et al., 2011). Electricity is produced from wind energy using wind turbines.

Wind energy research is still in its infancy in Malaysia, with numerous locations addressing the lack of wind energy practicality. There is extremely limited research on the assessment of wind energy and wind farm potentiality in Malaysia. Earlier studies made use of secondary meteorological data that was primarily gathered by weather stations situated in airports. This wind data was gathered from the Malaysian Meteorological Department (MMD), which primarily provides weather forecasts for airports rather than energy-related reasons. (Noman, Alkawsi, Abbas, Alkahtani, Tiong, and Ekanyake, 2020). In Malaysia, Kudat is seen as a prospective location for the construction of wind farms (Albani et al. 2011).

2.2.1.5 Ocean Energy (tide and wave)

As wind blows across water, it produces surface waves (Ocean). The more persistent a breeze, the farther it travels, the higher the wave height, and the more energy it produces, the faster the wind speed (Jacobson and Delucchi, 2011). The energy that the ocean stores in the shape of waves., tide, currents, and heat is more than enough to supply the whole global need for electricity. Currently, there are four methods for harvesting energy derived from marine environments: wind, tides, waves, and temperature contrasts between deep and shallow sea water (Esteban and Leary, 2012).

The fundamental design of an ocean energy (OE) is a largely closed chamber that is open to the air and to the sea via one or more air turbines at the bottom. The Wells Turbine, which uses symmetrically curved airfoils placed at 90 degrees to the airflow, is the most widely used design (Shehata, Xiao, Saqr, and Alexander, 2017). However, alternative turbine models, like those with variable pitch, could also be used. Although the air turbine's flywheel motion accomplishes some energy storage, the overall output of an air turbine varies greatly depending on the designs. For the OE to be connected to the grid, a sizable amount of power will likely be needed. The OE investigations are a crucial first stage in Malaysia's wave energy harvesting process.

In Malaysia, wave energy could not be acceptable or commercially viable as tidal current energy. The average yearly wave power density must be greater than 50 kW/m2 for wave energy conversion technology. Unfortunately, Malaysia's ocean only has a wave power density of less than 50 kW/m2. As a result, Malaysia's ocean has limited potential for capturing wave energy. (Chong and Lam, 2013).

2.2.2 Fossil Fuel Energy

Economic development is fueled by conventional energy sources based on fossil fuels including coal, oil, and natural gas. According to studies like those by Zakaria et al. (2021) and Hannan, Begum, Abdolrasol, Lipu, Mohamed and Rashid (2018), all the participants in this research have agreed that fossil fuels such as natural gas, oil, and coal will be indispensable for total primary energy supply (TPES) in Malaysia and electricity generation. Due to the rapid depletion of old energy sources and rising energy demand, the primary energy usage in the world climbed by an astounding 1.8% in 2012. (BP, 2013). Every year, the world emits over 50 billion tons of GHGs. The energy sector is accountable for almost three-quarters of all global emissions of CO2. Fossil fuel combustion for power generation to meet residential, commercial, and industrial demand accounts for over 40% of it (Abdul Latif, Chiong, Rajoo, Takada, Chun, Tahara and Ikegami, 2021).

According to the Energy Commission of Malaysia's capacity data, fossil fuels made up 82.9% of the energy mix in Malaysia in 2017 (Suruhanjaya Tenaga Energy Commission, 2019). The percentages of coal, natural gas, and fuel oil/diesel in the fossil fuel input are 44.2%, 38.0%, and 0.6%, respectively. Due to the enormous increase in the industrial, transportation, and agricultural sectors, Malaysia has experienced steady rise in its energy needs as a growing nation. With the risk of a potential extended energy crisis, Malaysia continually assessed its fuel diversification policy to ensure that the nation was not overly dependent on one single source of energy, namely oil.

Due to Malaysia's promotion of fuel diversification in power generation, the use of natural gas in the energy mix has essentially plateaued since 2010. This action provided Malaysia with the opportunity to increase the amount of natural gas resources available for export and supported the recently announced government policy to try and lessen the country's disproportionately high reliance on natural gas for power generation (Ali, Daut, and Taib, 2012). In comparison to oil, natural gas has a more reliable yield.

The attractive cost of coal in 2010 is the primary factor driving its use in the energy mix. Yet, the inclusion of coal in the energy mix has sparked concern due to its unfavorable effects on the environment. Politics played a role in the decision to use coal as the principal energy source (De Oliveira, (2018). More than 90% of the energy mix still consists of fossil fuels, despite predictions that by the end of 2030 coal's contribution in power generation will fall from 37% in 2021 to 22% (Shadman, Chin, Yap, Sakundarini, and Velautham, 2021).

2.2.3 Nuclear Energy

Presently, nuclear energy produces around 6% of the world's energy. With more installed capacities and more nations constructing nuclear power plants, trends show that nuclear energy generation is rising (IEA, 2010). Base-load electricity can be produced reliably by nuclear power reactors without any emissions of carbon. Nuclear reactors have not advanced quickly or been widely accepted despite being a tested technology and a desirable choice for power generation to move towards a greener society due to several problems and constraints (Suman, 2018). As the country's oil and gas reserves run out, nuclear power plants can be employed as alternative sources of electricity generation, reducing the country's significant reliance on its energy mix includes fossil fuels. Additionally, nuclear power plants have lower operating costs despite having the highest initial investment costs (Dahlan, Ibrahim, Rajemi, Nawi, and Baharum, 2014).

Malaysia is now doing pre-feasibility studies, policy studies, regulation reviews, and probable site selection as part of the evaluation process. There are some serious concerns regarding Malaysia's readiness to use nuclear power. The primary issues have always been nuclear waste disposal, challenges with nuclear power plant (NPP) decommissioning, and potential risks and hazards of NPP. Some nations decided to put plans to develop nuclear power plants on hold or to completely abandon them in the wake of Japan's nuclear crisis in 2011 (Jaafar, 2012).

Extreme weather conditions, logistical snags, and mishaps can prevent uranium from getting to nuclear power plants that desperately need fuel. Additionally, the region's reliance on imported

uranium, which is subject to significant price fluctuations, increases because of new nuclear plants (Sovacool, 2010).

2.2.4 Climate Change

Currently, both scientific and political discourses around the world are quite interested in the term "climate change." Since the beginning of existence, the climate has changed, but the rate at which it has changed in the recent past is worrisome, and It might be among the threats to the planet. For the last 36 years, the growth rate of carbon dioxide has accelerated (1979–2014) (Asumadu-Sarkodie and Owusu, 2016c, 2016f).

The current climate change policy is substantially behind the available scientific evidence. One of the most urgent issues with climate change policy is this gap between research and policy. Long-term stock and flow links cause many of the detrimental effects of global warming to be delayed (Kerr, 2007; Malla, Mushtaq, Bandh, Qayoom and Hoang, 2022). in addition, slow institutional responses to climate change are a result of underlying causes and effects in the climate system (Munck af Rosenschöld, Rozema, and Frye-Levine, 2014).

Despite the more recent increase in scientific interest in climate change adaptation as a governance challenge requiring measures from civil society, business, and especially government, nation states have not universally adopted climate adaptation policies (Ford, and Berrang-Ford, 2011). Most of the literature on climate change adaptation governance (CCAG) expressly emphasizes the necessity for state intervention, which seems to be at conflict with this (Biesbroek, Klostermann, Termeer and Kabat, (2013). Adaption to global warming has been described to as a "wicked problem par excellence" by some (Rittel and Webber 1973; Lazarus 2008; Termeer, Dewulf, and Breeman, (2013)), one that cannot be accurately articulated or solved due to vested interests and widely divergent problem formulations.

Economic growth depends on the generation of electricity. Climate change, however, changes the catastrophic risks for electricity producers, and these factors have previously been ignored in energy research and policy (Urban and Mitchell, 2011). It is now known that a changing environment can affect how much energy is used by various industries. Corporate energy markets and operations are increasingly including climate change's impacts in their management and planning as they realize that managing risks involves managing the environment.

The likelihood that hotter temperatures, less precipitation, and frequent and severe droughts may cause water stress one of the key problems raised by climate change (Urban and Mitchell, 2011).

As sea water is corrosive, this affects the production of power plants that require fresh water for cooling. The prospect of a scarcity of fresh water might potentially result in a drop in power output and threaten the economy (Urban and Mitchell, (2011). With rising negative effects of climate change, a lack of freshwater supply for power generation may in such instances become a national and regional energy security risk (Urban and Mitchell, (2011).

2.2.5 Cost Saving Sustainability

Energy prices serve as a gauge of economic effects, a reflection of resource scarcity, and a representation of supply versus demand in well-functioning markets. In the event of an increase in energy prices, countries with a high energy intensity will be forced to use a bigger portion of their resources for energy and will experience a greater loss in welfare than economies with a low energy intensity (Böhringer and Keller, 2011). Oil prices are regarded as a key indication of energy security (ES), but they are greatly impacted by a variety of variables (short-term shortages, speculation, etc.) and are challenging to adequately model in scenario analysis (Kruyt, Van Vuuren, de Vries and Groenenberg, (2009). As a basic metric, the proportion of nuclear and renewable energy in the total supply of primary energy is employed (Sharifuddin, 2014). "The share of geothermal, solar, wind, hydropower, tidal, wave, biomass, municipal waste and biofuel-based energy in total primary energy supply" is used as an indicator by Sovacool et al. (2011).

Energy or fuel consumption per capita, energy or fuel (oil) expenditures, and price elasticity of demand for energy or a particular fuel are all examples of demand-side indicators. The resilience of the energy system to unforeseen energy price increases of foreign origin would be improved by an increase in energy security, for instance through greater energy efficiency in supply and demand as well as through demand response or demand side flexibility. By reducing the dampening effect of price shocks on macroeconomic growth, increased energy security may be achieved (Couder, 2015).

For the natural resource-rich countries, one of the measures to be taken to ensure that the abundance of natural resources positively affects economic growth is to strengthen the financial system of the country. When the financial system is strengthened, revenues from natural resources are transferred to the real sector through the financial system. Besides, a low level of corruption in natural resource-rich countries, a transparent management approach, strong institutionalization, and transferring natural resource revenues to productive investments contribute to a stable and strong economic growth performance (Hemmati, Hooshmand and Khodabakhshian, (2013).

2.2.6 Energy Security

Global issues including energy security and climate change issues that are regularly discussed in public policy debates around the world (Toke and Vezirgiannidou, 2013). Significant research has been conducted to examine international politics related to the global climate change (Helm and Hepburn 2009, Giddens 2011). However, there hasn't been as much research done despite the fact that this issue has garnered attention recently, little research has been done on the connection between the two policy domains of energy security and climate change. For two reasons, this is an important area of research. First, reducing energy-related emissions will thus be critical for climate mitigation. Furthermore, many governments regard energy as a priority policy subject because it is a key generator of economic growth and prosperity. It is not only vital locally, but access to energy supplies is frequently a strategic foreign policy problem (Giddens, 2011). Second, this problem is because Climate change's effects and the need to move away from military security as the primary form of security are both getting attention as well as towards human security, concerns how environmental deterioration and sustainability affect human security (Dalby 2002: Peoples and Vaughan-Williams, 2020).

As a result, there are issues over whether the idea of energy security must be altered to account for the climate damage produced by traditional energy sources. Some suggest that the idea of energy security, which generally refers to the availability of resources at reasonable rates, should be expanded to include concerns about sustainability (Pascual and Elkind., 2010). The International Energy Agency (2011) has attempted to incorporate these issues into its definition of energy security: "the uninterrupted physical availability at an affordable price while respecting environmental concerns."

Energy is acknowledged as one of the main drivers of economic growth is a nation's capacity to maintain its economic growth depends on the security of its energy supply. Due to Malaysia's relentless energy demand and depleting domestic energy resources, the security of Malaysia's energy supply has recently come to the attention of energy sector players and policy makers (Sahid, Siang, Peng, 2013).

Three fundamental questions are typically left out of the literature on energy security strategies, which is relatively weak (Labandeira and Manzano, 2012). Energy security's cost-benefit evaluation is discussed in the first query. Finding an "operational" definition of energy security is the subject of the second query. The third and last question highlights the frequently ignored

linkages and synergies between energy security policies and other policies (such as energy efficiency, renewable energy sources, or climate change).

The 4A- framework was first introduced by APERC (2007) to organize their study on energy security in Asia. It incorporates the conventional concepts of availability, affordability, acceptability, and accessibility. The paper did not offer any evidence to support using the four using previous research, empirical findings, or logical reasoning (Cherp and Jewell, 2014).

2.3 Literature Gaps

Research on utilizing both non-renewable and renewable energy sources in Malaysia for energy safety and reducing climate change have been undertaken (Ghazali, Ansari, Mustafa, Mohd, and Zahari (2019). However, several authors point out that the term “energy security" seem to be very vague and is not clearly defined (Lochel et.al, 2010). In scholarly and policy literature, there are an overwhelming number of fragmented and incoherent interpretations of energy security (Cherp and Jewell, 2014). The ambiguity suggests that the lack of an operational definition of energy security hinders the public and scientific discourse. Lack of clarity directly translates into a lack of distinct indicators for energy security. It is challenging to fix a problem that cannot be accurately measured (Bohringer and Keller, 2011). Consequently, greater study is required to address the issues of energy security and cost-effective sustainability in combating climate change using both renewable and non-renewable energy sources.

2.4 Underpinning Theories

2.4.1 Climate Change Theory

Fourier (1827), (Lucazeau, 2019) may have made the first theory to the greenhouse effect when he contrasted how the atmosphere affected the temperature. Other scholar (Tyndall 1859, cited in Jackson (2020): Eunice (1856) cited in Ruiz, Martín, and Prados-Castillo, (2023), attributes the idea that "the interception of terrestrial rays [by the atmosphere] exercises" the "most important influence on climate" to Fourier (1827) and others. This theory was the first to make the revolutionary discovery that carbon dioxide and water vapor can absorb radiant heat. Eunice (1956) asserted that variations in the atmospheric concentrations of carbon dioxide and water vapor may affect climate. In 1896, Svante Arrhenius, a Swedish physicist (1860–1927), made the first assertion that the burning of fossil fuels would eventually lead to increased global warming. Temperatures and calculated that human activities may warm the world by increasing atmospheric carbon dioxide.

The Climate Change Theory is relevant in relation to availability and abundance resources of fossil fuels on the earth and dominant primary energy sources since there is now broad agreement that human activity is what is causing the observed rise in atmospheric concentrations of carbon dioxide and other infrared-absorbing trace gases, which are warming the universe (Whyte, 2021). The rise in atmospheric carbon dioxide caused by burning fossil fuels, as well as other trace gases produced by our expanding industrial and agricultural activities, is the human influence on the climate that is currently garnering the most attention. Publications by Revelle (1985): Ausubel (1983) cited by Derbyshire and Morgan, (2022), provide excellent y attempts to define the role of carbon dioxide in the atmosphere from the perspectives of both our use up of the earth's fossil fuel reserves and the role of carbon dioxide in sustaining plant life and controlling the surface temperature.

The terms "climate change" and "global warming" commonly used that perhaps utilized synonymously in order to explain the climatic phenomenon brought on by variations in greenhouse gas concentrations in the atmosphere in recent years (Lorenzoni and Pidgeon 2006). They are often used in conjunction with one another as though they are describing the same thing. (Boykoff and Boykoff 2007; Lineman, Do, Kim and Joo, (2015); Penz and Polsa, (2018); Schuldt, Konrath and Schwarz (2011); Whitmarsh 2009). Some scholars favor the phrase "climate change" (Jaworska 2018; Koteyko, N., Jaspal and Nerlich, (2013); Leiserowitz 2006), while "global warming" is preferred by some (McCright and Dunlap 2000; Olausson 2010; Ytterstad 2015). In certain research (Dayrell and Urry 2015; Knox and Jacques 2016; Schmid-Petri, Adam, Schmucki and Häussler (2017) both phrases are used as search terms to find papers for the study of climate change. The two phrases may elicit similar affective reactions in the US, the UK, and other countries, according to earlier research (Lorenzoni and Pidgeon 2006; Villar and Krosnick 2011).

Plass (1956) first used the term "climate change," previously known as "climatic change," when he investigated the remarkable correlation between carbon dioxide and historical variations in Earth's surface temperatures and climate. Following that, as Broecker (1975) created a model to forecast the increasing temperature levels brought on by the rise in atmospheric CO2, the term "global warming" came into prominence. In some scientific papers (such as The Intergovernmental Panel on Climate Change report) and some scholarly study, the two phrases are clearly distinguishable due to their differing historical contexts. The concept of climate change is all types of variability in climate and weather, including warmer summers, chilly winters, more rain, and more droughts (Lorenzoni and Pidgeon 2006; Schuldt et al. 2011; Whitmarsh 2009). According to Lineman, Do, Kim and Joo (2015); Shi, Dong, Yan, Zhao, Li, Liu, and Xi, (2020),

"global warming" is described as a continuous an increase in the planet's average temperature. Further research has shown that individuals' political views (Akerlof and Maibach 2011), gender identification (Greenhill et al. 2014), information and expertise (Benjamin et al. 2017), and knowledge and experience (Villar and Krosnick 2011) may all influence how the two terms are interpreted.

Although some academics contend that there is still a lack of evidence to support a causal relationship between conspiracy theory belief and behavior, others have claimed that conspiracy theories about climate change hamper pro-environment action (Biddlestone, Azevedo and van der Linden, (2022). Even though the most recent assessment from the Intergovernmental Panel on Climate Change 2022 shows how climate change brought on by human activity already severely harmed societies all over the world, (Pörtner, Roberts, Adams, Adler, Aldunce, Ali and Ibrahim, 2022). Conspiracy theories challenging the reality of climate change's occurrence, causes, and effects are still prevalent (Ibbetson, 2021; Inhofe, 2012). Recent findings addressing global warming, often known as anthropogenic (man-made) global warming (AGW), support the hypothesis that the greenhouse effect, which humans have exacerbated, is what causing the globe to warm up particularly since the Industrial Revolution (Dincer, Colpan, and Kadioglu, Eds, 2013). Human cultures will be severely impacted by the political, economic, social, and health climate change effects. These societies have never had to deal with an environmental issue of this magnitude and complexity in such a short period of time.

The climate change or global warming theory is significant remedy in understanding to tackle serious problem not only to human beings but animals and plants and should embark some remedial steps which include but are not limited to using renewable energy sources and stopping deforestation. Innovative solutions must be brought forward to end this hazard once and forever. Melting of polar ice caps will lead to floods which can cause mayhem everywhere. Rise of sea levels will devastate agricultural and fishing activities. According to (Dincer, Colpan, and Kadioglu, Eds, 2013), global warming poses enormous risks due to the over usage of fossil fuels like coal, natural gas, and oil and the usage needs to end by the utilization of alternative energy sources is the most important way to stop this calamity. These include renewable energy sources including hydropower, geothermal heat, wind, and solar power. The most beneficial aspect about using these sources is their purity. These include renewable energy sources including hydropower, geothermal heat, wind, and solar power. The best thing about using these sources is their purity. They do not generate any pollutants or dangerous gases that can contribute to global warming. They are not endangering the natural equilibrium and are environmentally benign. Most

significantly, fossil fuels will eventually run out, and we will eventually need to produce energy from renewable sources. Thus, using alternative energy sources will ultimately help to stop global warming. Nuclear power, in addition to renewable energy, might be the cornerstone of a future powered by clean energy. Nuclear energy emits substantially less carbon dioxide than fossil fuels even though it cannot be referred to as "Carbon Neutral". Nuclear electricity generation produces relatively less greenhouse gas compared to other energy sources (Sadekin, Zaman, Mahfuz and Sarkar, 2019).

2.4.2. Consistency Theory

The 1950s saw the appearance of consistency theories in the psychological literature, whereas Kuhn (1959) notes that a dozen different energy conservation principles were developed in the 1940s (McGuire, (1966): Gawronski & Brannon (2019). These theories, which went by several different names (balance, congruity, symmetry, dissonance, etc.), all shared the idea that people tend to act in ways that minimize internal inconsistencies in their interpersonal interactions, interpersonal cognitions, or their beliefs, feelings, and actions. The various theories varied from one another in many ways, such as how consistency is defined, additional assumptions that were made, and the behavioral domains that the derived predictions are applied to, even though they shared this fundamental predictive postulate. The assessment of straightforward attitude-behavior and attitude-belief consistency is made possible by the current consistency hypothesis. According to Marks, Trafimow, and Rice (2014), definitions of attitude and conduct are comparable to those put forth by Insko and Schopler in 1972.

The Consistency theory states explicitly or implicitly, on the rational actor model of human behavior. It is assumed that behavior is self-centered, preferences are constant, and decisions are unaffected by social context or frames of reference. The linked disciplines of behavioral economics, game theory, and neuroscience have confirmed that human behavior is unconventional and that, contrary to the conventional behavioral model, humans engage in systematic patterns of decision-making (Grilli and Curtis, 2021). The stance that these "irrational" patterns of behavior are fundamental to human decision-making and that, as a result, economic policy should be based on these behaviors to be successful. It is said that the typical economic approach to addressing climate change policy, with its nearly sole concentration on individuals' logical reactions to financial incentives.

Protection Motivation Theory provides a helpful framework to explain pro-environmental decisions by considering a wide range of predictors, such as the costs and rewards of both current

(maladaptive) behavior and anticipated adaptive behavior (Bockarjova and Steg, 2014). Therefore, the Protection Motivation Theory may improve our comprehension of the driving forces behind pro-environmental attitudes and behavior, which may then be used to encourage pro-environmental choices to lower environmental hazards, particularly the use of fossil fuels in combating climate change (Singh, Singh and Vaibhav, 2020).

Behavioral Reasoning Theory (BRT) are best applied to mediating constructs, such as (i) reasons for adoption, (ii) reasons against adoption, and (iii) attitudes towards a technology, to understand how consumers think about the implementing renewable energy sources (Claudy, Peterson and O'driscoll, 2013). A significant step towards less carbon-intensive and more sustainable energy systems is consumer adoption of renewable energy sources (Prothero, Dobscha, Freund, Kilbourne, Luchs, Ozanne and Thøgersen, (2011). Although growing environmental awareness and professed preferences for eco-friendly products, the consumer markets for renewable energies are expanding at only moderate rates. This can be explained by consumers' positive perceptions of products that lessen their impact on the environment (Claudy, Peterson and O'driscoll, 2013). It is possible that customers today are more environmentally sensitive than they were at the turn of the millennium given the mainstreaming of the green commodity argumentation in industrialized countries. More importantly, the ongoing conversation among societal actors (such as the media, decision-makers, non-governmental organizations, and corporations) has given people various justifications for living a "greener" lifestyle (Prothero and Fitchett 2000; Prothero et al., 2011). This has helped citizens recognize their individual responsibility in the ecological crisis.

According to the Theory of Planned Behavior, people's support of nuclear power facilities being reopened was largely influenced by their awareness of them (Ong, Prasetyo, Salazar, Erfe, Abella, Young and Redi, 2022). Additionally, being aware of the advantages would result in a favorable perception of behavioral control (PBC) and attitude towards intention. The unfavorable acceptance of the NPP reopening may result if a person's information tends to favor the perceived danger. On the other hand, positive acceptance will result if a person's knowledge leans towards the perceived benefits. The model derived from the study would be incredibly helpful for researchers, governments, and even business sectors globally.

2.5 Conceptual Framework

A one-stage normative model was created based on the literature already in existence, and it served as the foundation for the research goals of this study (Bigerna, D'Errico and Polinori, 2021).

The conceptual framework (Figure 1) shows the relationship between the independent and dependent variables and the intervening variables. The conceptual framework is made up of three independent factors, two dependent variables, and one mediating variable that give an overview of the important interaction between nuclear energy, fossil fuels, and renewable energy in terms of cost effectiveness, sustainability, and energy security (Razmjoo, Kaigutha, Rad, Marzband, Davarpanah and Denai, 2021).

The topic of cost-saving sustainability and energy security in the Malaysian state of Sabah will be included in the study's dependent variable because it has become a major worry to address through environmental awareness (Surianshah, 2021). Meanwhile, climate change has a pivotal role in mediating the cost saving sustainability (Koh, Lim, and Morris, 2011). The independent variables will involve renewable energy, fossil fuel and nuclear energy of this study (Voumik, Islam, Ray, Mohamed Yusop, and Ridzuan, 2023).

The consistency literature can also be utilized to establish a connection between renewable and non-renewable energy resources to contend with the consequences of climate change on cost-effective sustainability and energy security (Voumik, Islam, Ray, Mohamed Yusof, and Rizwan, 2023). Hence, the conceptual framework (Figure 1) over the effects of both renewable and conventional energy sources can be represented using the diagram shown below:

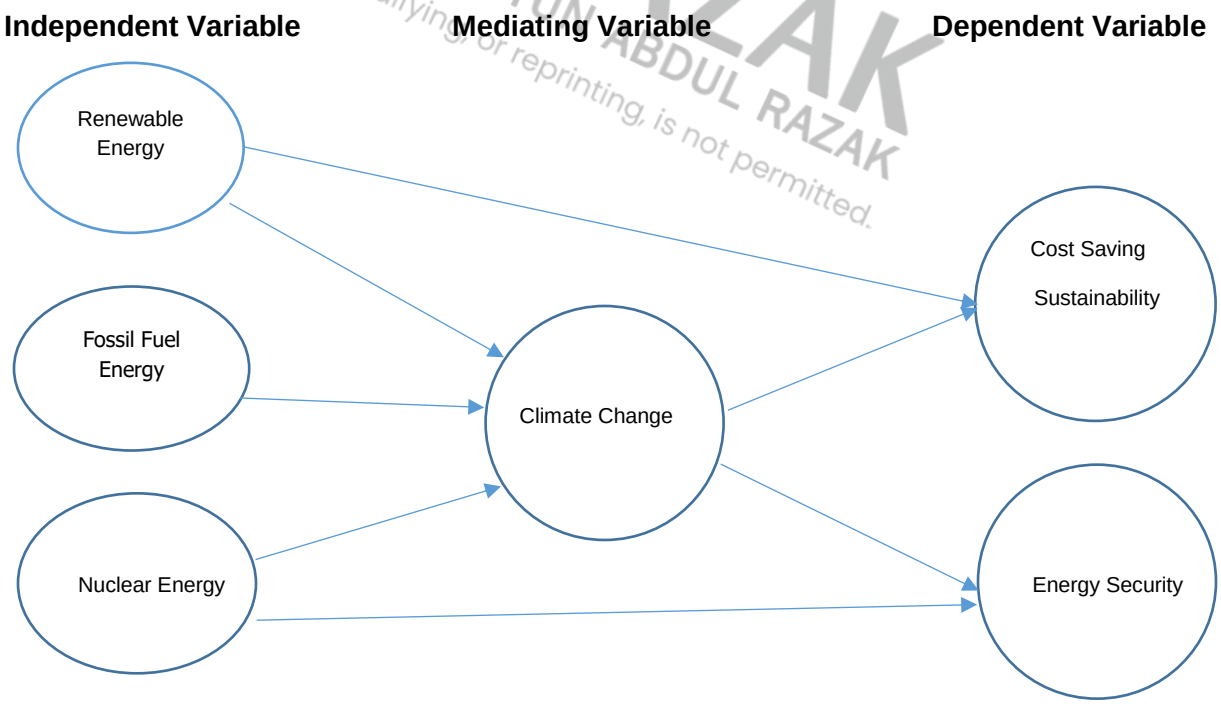

Figure 1: The mediating effect of Climate change on the relationship between energy resources towards cost saving sustainability and energy security in Sabah, Malaysia.

2.6 Hypothesis Development

The following are the research hypotheses on the investigation of the impact of climate change on the independent and dependent variables in the perspective of Sabah: -

H1: There is a significant relationship between renewable energy (RE) relate to cost saving sustainability (CCS) in Sabah.

Badsar and Karami (2021) conducted the study in Zanjan County, Iran investigated into direct and indirect effects of knowledge on farmers' willingness to employ renewable energies (REs). Results showed a significant correlation between farmers' motivation to employ renewable energy sources. The findings also showed that farmers' motivation to employ renewable energies was significantly influenced by their knowledge, both directly and indirectly. Moreover, the study's findings identified reaction cost and internal rewards as the two variables that contributed most significantly. Although internal rewards were a significant and positive factor in encouraging respondents to utilize renewable energy. The association between public acceptance of or willingness to pay (WTP) for renewable energy was also corroborated by earlier research Bang, Ellinger, Hadjimarcou and Traichal, (2000); Claudy, Peterson and O'driscoll, (2013) and Hartmann and Apaolaza-Ibáñez, (2012) all found the same thing in their studies, as well as the prediction of intention (Badsar and Karami, (2021).

H2: There is a significant relationship between fossil fuel energy (FFE) relate to cost saving sustainability (CCS) in Sabah.

According to Dahlan, Aris, and Nawi (2017), the findings of the generation mix in 2030 when the petrol price is varied show a correlation between fossil fuel and cost-saving sustainability. From the existing subsidy price to the market price, raising petrol prices causes the dependence on petrol to drop from 38% (with subsidy) to 22%. (Market price). By increasing coal's share of the generating mix from 40% (with subsidies) to 48% under this scenario, coal is given the option to be chosen (market price). The usage of fossil fuel is interrelated to GDP per capita of the country. The earlier studies by Begum, Sohag, Abdullah, and Jaafar (2015) further corroborated that while population growth rate has no discernible effects on per capita CO2 emission, per usage of energy and GDP per capita have long-term beneficial implications with respect to per capita carbon emissions.

H3: There is a significant relationship between nuclear energy (NE) relate to cost saving sustainability (CCS) in Sabah.

Findings from a study conducted by Dahlan, Ibrahim, Rajemi, Nawi, and Baharum (2014) in Malaysia reveal that generation mixes comprising nuclear power plants offer improved system reliability, fewer CO2 emissions, and lower operating and investment costs. According to the study by Lovering, Yip, and Nordhaus (2016), costs trends have varied greatly by era, country, and experience due to factors like utility structure, reactor size, regulatory framework, and international cooperation may have a greater impact. The findings, however, indicated that while some countries' costs have been rising over time, others have had more stable costs over the long run and have seen cost drops over specific eras in their technical histories.

H4: There is a significant relationship between renewable energy (RE) and energy security (ES) in Sabah.

In Malaysia context, according to Qazi, Bhowmik, Hussain, Yang, Naseem, Adebayo, and Al-Rakhami, (2021), the two crucial factors, namely awareness and public opinions, are concentrated on as a desire to adopt RE. Due to the abundance of renewable energy sources (RES) in Malaysia, including wind energy, landfill gas, landfill waste, biomass waste from the palm oil industry, and solar energy, people are becoming more aware of the most recent technology and its advantages and disadvantages. Other research finding has also indicated that awareness has a positive and significant direct impact on behavior intention, which is similar with the findings of (Saleh, Haris and Bint Ahmad, (2014).): Alam, Hashim, Rashid, Omar, Ahsan and Ismail (2014).

H5: There is a significant relationship between fossil fuel energy (FFE) and energy security (ES) in Sabah.

The underlying basis of energy security theories is the assumption of adequate and consistent fossil fuel supply at competitive pricing in centralised supply chains (resource availability, control, and transit routes) (Proskuryakova, 2018). According to Ediger, (2019), even though fossil fuels have a declining part of the global economy, their production will likely continue to increase for several decades. He concluded by saying that it is also evident that decarbonization will be required to make the switch to a low-carbon economy. The similar conclusion was made by Covert, Greenstone, and Knittel (2016), who claimed that the world economy will probably continue to rely on fossil fuels as its main source of energy in the absence of significant greenhouse gas legislation.

H6: There is a significant relationship between nuclear energy (NE) and energy security (ES) in Sabah.

When Hosan, Dewan, Sahadath, Roy, and Roy, (2023) evaluated how the Bangladeshi public understood, perceived, and accepted nuclear power. According to the studies they discovered that there were several misconceptions about the technology because of major knowledge gaps surrounding nuclear energy and power in Bangladesh, which is evident from the strong correlation between their responses. This is due to the information not being available and the improper method of information dissemination. Additionally, responses revealed that respondents have truly little faith in the current political and economic climates, as well as the norms and regulations that apply to nuclear power programs. In Malaysia context, according to a study by Misnon, Hu, Rahman and Yasir, (2017), knowledge, awareness, and perception all play significant roles in the spread of information about nuclear energy. The survey also amply demonstrated that the government's information is regarded as one of the least reliable sources of information when it concerns energy.

H7: There is a significant relationship between renewable energy (RE) and climate change (CC) in Sabah.

Afroz, Masud, Akhtar, Islam and Duasa, (2015), investigate the significance of associations between consumer purchase intentions (PI) and the purchase behavior of environmentally friendly vehicles (EFVs) and subjective norms (SNs), perceived behavioral control (PBC), and attitudes towards electric vehicles (ATEVs). According to the study, Malaysian car owners either pay little attention to or are generally oblivious of the greenhouse impacts on the environment, which is seen in their PI towards EFVs.

According to Secinaro, Calandra, Lanzalonga, and Ferraris, (2022), high levels of environmental awareness reflect high levels of EFV purchasing intention. It is obvious that one's inclination to utilize environmentally friendly cars is directly influenced by their awareness of environmental issues. This shows that respondents' awareness of environmental issues was higher than their knowledge of them. This demonstrates that respondents' awareness of environmental concerns motivated them to buy EFCs. Another possibility is that a person's perception of how important environmental issues are may affect their propensity to buy sustainable products (Cheah and Phau, 2011).

H8: There is a significant relationship between fossil fuel energy (FFE) and climate change (CC) in Sabah.

The results of the study conducted by Rahman, Mohamad, and bin Abu Zarim (2014) revealed that the media can have a substantial impact on how well people comprehend climate change and its impacts on human health. Each country must cope with these complicated and grave consequences on its own. The increase in atmospheric greenhouse gases due to the widespread use of fossil fuels makes global warming a risk in addition to being detrimental to the ecosystem. The findings indicate that the male respondents gave the rising temperature and its potential effects on heat-related stress considerable thought, and that female respondents were particularly intrigued in these implications. Opoku, Filho, Hubert, and Adejumo (2021) study also reveal that the health climate change effects have been significant, to a greater or at least to some extent. Most of the respondents also said that climate-induced diseases may worsen in the future if are not addressed. In the upcoming years, health systems, governments, and health professionals will face challenges associated with the consequences of climate change on humans' health, the environment, and society.

H9: There is a significant relationship between nuclear energy (NE) and climate change (CC) in Sabah.

The public's opinions on nuclear power in the UK have historically been very divided, but as concerns about climate change and energy security have taken prominence in British energy policy, nuclear power has been reframed as a low-carbon technology, according to a study by Corner, Venables, Spence, Poortinga, Demski, and Pidgeon (2011). The findings demonstrate that, in climate change comparison, energy security has gained more focus in the national energy discourse. Concern over the rising cost of electricity was particularly acute. Likewise, as noted by Teräväinen, Lehtonen and Martiskainen, (2011), the recent drop in citizens' trust in the anthropogenic cause of climate change may potentially weaken the carbon-reduction argument for nuclear power and underline that of energy security instead. These findings had similar result and from others research (Poortinga, Spence, Whitmarsh, Capstick and Pidgeon, (2011); Leiserowitz, Maibach, Roser-Renouf, and Smith, (2010) imply that nuclear power is more advantageous in terms of energy security.

H10: There is a significant relationship between climate change (CC) and cost saving sustainability (CSS) in Sabah.

Consumption patterns of individuals have a negative impact on the environment, contributing to resource waste and climate change. More businesses are manufacturing goods that are environmentally friendly to mitigate the negative consequences, and governments have

encouraged consumers to adopt energy-saving products (Hua and Wang, 2019). Results by Bhutto, Liu, Soomro, Ertz, and Baeshen (2020) show that attitudes towards energy-efficient appliances (EEAs) are highly influenced by utilitarian environmental benefits and warm glow benefits. The results also demonstrate a beneficial influence of normative views on subjective norms. With identical outcomes for subjective norms and purchase intention, eco-literacy's interaction effect has a favorable influence on the causal relationship between attitude and intention to purchase.

H11: There is a significant relationship between climate change (CC) and energy security (ES) in Sabah.

There has been a lot of research on the politics of energy security and climate change as separate topics, but significantly fewer studies on how these two challenges are correlated (Toke and Vezirgiannidou, 2013). It appears that climate change issues are designed to advance elitist various interpretations of energy security that are specific to certain interests. It is concluded that initiatives at the regionally, internationally, and locally levels ought to focus on pushing climate change objectives to encompass energy policy. However, Nyman, (2018) argues that comprehending the complex interplay between energy, climate, and security is essential for both the study of international relations and for ensuring the future survival of human civilization in a world where environmental change is becoming a more serious threat. He asserted that the combustion of fossil fuels for energy is a major contributor to climate change, but that discussions concerning energy security typically ignore climate change while climate discussions take energy into perspective.

H12: There is a significant relationship between renewable energy (RE) relates to climate change (CC) towards cost saving sustainability (CSS) in Sabah.

Consumer reactions to increased volumetric energy prices and additional demand charges in the United States were examined by Liang, Ghosh and Oe, (2017). The findings indicated that homeowners tended to be more adamant about charging renters than tenants. Consumers' perceptions of the cost reductions brought on by energy efficiency initiatives or solar panel installation are influenced by demographic and behavioral factors. They also influence consumers' perceptions of whether it is reasonable for utilities to recover lost revenue by raising the price of volumetric energy. There is some evidence that people can internalize extrinsic reasons, especially if they feel supported and autonomous while performing out the action (Deci, Eghari, Patrick and Leone, 1994; Weinstein, Przybylski and Ryan, 2013).

H13: There is a significant relationship between fossil fuel energy (FFE) relate to climate change (CC) towards cost saving sustainability (CSS) in Sabah.

According to Shahbazi, and Nasab, (2016), a series of CO2-limiting regulations will be required to reduce the increase of greenhouse gases and its effects caused by fossil fuels, which release a significant amount of carbon dioxide and nitric acid into the atmosphere. One of the most significant technologies in the world that is regarded as one of the possibilities for lowering CO2 emissions and slowing global warming is carbon capture and storage (CCS) technology. According to Leung, Caramanna, and Maroto-Valer (2014), the type of plant and fuel used greatly influences the choice of CO2 collection method. It has been established that post-combustion capture technology is the most effective choice for gas-fired power plants due to its lower cost. Absorption, with its great efficiency and cheap cost, is the most cutting-edge method of CO2 purification.

H14: There is a significant relationship between nuclear energy (NE) relates to climate change (CC) towards cost saving sustainability (CSS) in Sabah.

According to Iwai and Shishido (2015), the Fukushima nuclear accident has altered the public's perception of disaster risks, fear of nuclear accidents, heightened awareness of pollution issues, and attitudes towards nuclear energy policy. It was also discovered that because to the closure of nuclear power facilities, Japanese people changed not only their consciousness but also their behaviors and sought cost – energy - saving measures. According to Van der Linden, (2017), risk perceptions and willingness to address climate change have a correlation. Although people may accurately detect some changes in long-term climate conditions, research across the social and behavioral sciences has demonstrated that psychological factors are frequently significantly more important in shaping how the public perceives the risk of climate change. Indeed, decades of research have demonstrated that the public's perception of risk is significantly influenced by cognitive, affective, social, and cultural factors, and that these elements frequently interact with one another in intricate ways.

H15: There is a significant relationship between renewable energy (RE) relate to climate change (CC) towards energy security (ES) in Sabah.

Researchers Wang, Wang, Wei and Li, (2018) investigated the factors influencing the development of renewable energy in China, including supply mix, energy security, and carbon emission, and discovered that renewables will become increasingly important in supplying the

enormous energy demand and producing significantly fewer carbon emissions and environmental pollutants, which helps to mitigate climate change and reduce environmental pollution. The findings also indicate that increased use of renewable energy is favorably correlated with energy security, carbon productivity, and carbon emission.

According to several studies (Afroz, Masud, Akhtar, Islam and Duasa, (2015); Schmeltz 2012), customers demand that businesses make their goods in a way that is environmentally friendly. The adoption of environmentally friendly cars by consumers was found to be significantly influenced by social preferences for environmental quality and energy security, according to Gallagher and Muehlegger's (2011) research.

H16: There is a significant relationship between fossil fuel energy (FFE) relate to climate change (CC) towards energy security (ES) in Sabah?

Findings by (Florin and Fennell, 2010) show that carbon capture and storage (CCS) from the combustion of fossil fuels is a potentially significant transitional technology that offers a near-term method of reducing climate change while advancing towards the establishment of a truly sustainable energy security in the medium to longer period. If CCS is not included in future low carbon energy technology portfolios in the future, the costs of mitigation are anticipated to increase. Carbon capture and storage (CCS) facilities connected to coal-fired power stations offer a climate change mitigation technique that may allow the continuing use of fossil fuels, according to study by Hammond, and Spargo, (2014). Fossil fuels will remain the main means of generating electricity as a means of ensuring the nation's energy security despite their detrimental impacts on the environment (Sifat and Haseli, 2019).

H17: There is a significant relationship between nuclear energy (NE) relate to climate change (CC) towards energy security (ES) in Sabah?

According to a study by Dahlan, Ibrahim, Rajemi, Nawi, and Baharum (2014), the public's acceptance of nuclear power is notably poor since the Fukushima tragedy and previous nuclear disasters have had a significant impact on it and because the media has further dramatized these occurrences. Social and economic restrictions have delayed Malaysia's progress in producing nuclear electricity. Public acceptance has been a major factor in a developing country's decision to implement nuclear energy. More crucially, people perceive the relationship between nuclear knowledge and their support for nuclear energy by applying trust, risk, and benefit judgements as perceptual filters. For instance, when the mining company Lynas Corporation opened a facility in

Gebeng, it sparked a contentious political debate and widespread public outcry over the radioactive chemicals found in the waste products left over from the extraction of rare earth elements. Indonesia has the highest level of public acceptance for nuclear power in Southeast Asia, according to Putra, (2017).

2.7 Chapter Summary

This study will make it easier to investigate three separate factors that influence the cost-saving, sustainability, and energy security aspects of climate change impacts. These three components include nuclear and fossil fuel energy as well as renewable energy. The outcome and effect could make Sabah's future energy usage and efficiency more dependable. The availability, acceptability, accessibility, and affordability aspects of the Four A's concept would be greatly beneficial to the public, commercial, and industrial sectors, luring foreign investors to Sabah due to its dependable and economical infrastructure and gauging the energy security efficacy.

CHAPTER 3

RESEARCH MEDTHODOLOGY

3.1 Introduction

The study will examine how the effects of climate change will affect Sabah, Malaysia's population in terms of energy resources (renewable, fossil fuel and nuclear energy), cost-saving sustainability, and energy security by utilizing quantitative technique. This study's section will provide a platform for discussion about the population's size and the method of non-probability sampling. Non-probability sampling is a way of selecting units from a population that is not random. Non-probability sampling is a quick, convenient, and low-cost approach to collect data because it does not require a full survey frame (Vehovar, Toepoel and Steinmetz, (2016). This section of the study will also discuss the method which will be used to collect the required information on the impact of the climate change on the dimensions of energy resources and cost saving sustainability and energy security within the Sabahan, Malaysian. There are varieties of methods that can be used to collect the required set of information from the participants such as the use of observation method, questionnaire, interview, and many others. A clear discussion will be made over the instruments used to collect data and data analysis using SMART PLS4. The methods of data analysis to be applied to the collected data over the impact of the climate change on the energy resources and cost saving sustainability and energy security within the Sabah's citizen also discussed intensively.

3.2 Research Design

The study examines how the effects of climate change would affect Sabahan people in terms of energy resources, cost-saving sustainability, and energy security by utilizing quantitative methodologies. The explanatory research design used to study climate change's impacts on the dimensions of energy resources and cost-saving sustainability, as well as energy security, among Sabahan citizen's (Rahi, 2017). In views of this, quantitative method is a scientific method, and its grounds can be identified in positivist paradigm (Grinnell and Unrau, 2010). This approach focuses on gathering new data from a wide population in accordance with the issue at hand and analyzing the data without considering the emotions and sentiments of the individual or the context of their environment. The unbiased nature of the quantitative approach, which gauges it through actions and opinions, enables researchers to explain data rather than interpret it.

According to Cohen, Manion and Morrison (2013), explanatory research is beneficial for this kind of study since it may be used to determine the causes of a certain phenomenon. Explanatory research offers a casual explanation for a topic or issue, typically in the form of relationships. To develop, elaborate, extend, or test a hypothesis, this kind of research enables one to gain new perspective on a topic. Explanatory research's main goal is to pinpoint problems and important variables in a particular study challenge. This method is very applicable to quantitative.

Deductive approach, where theory is not derived from observation but rather is based on conceptual and theoretical frameworks, can also be used to describe research that is based on empirical observation and theory that has been developed through conceptual and theoretical frameworks (Collis and Hussey, 2013). The goal of a researcher is typically to test a theory by gathering new data from respondents and analyzing the results using various statistical tests. This approach is typically advised for unique studies in which researchers develop assumptions before testing them to investigate a particular concept. Accordingly, it can be inferred that research is used to investigate facts, confirm the findings of earlier tests, offer answers to problems that have already arisen or that have just begun, support current theories, and even develop new ones. Research also entails knowledge creation, conducting tests to determine a phenomenon's causes and effects, as well as laying the groundwork for more investigations (Apuke, 2017). The research's findings enable Sabah's people to comprehend how climate change affects cost-saving sustainability, energy security, and energy resources.

3.3 Population, Unit of Analysis and Time Horizon

The unit of analysis is the most crucial element in any study because it serves as the foundation for the entire research process. Individuals from various geographical or regional regions in this population was used as the unit of analysis. In this study, population is in the context of Sabah's citizen that shall be study in various geographical or regional regions that are likely to vary due to their belief or perception, background of education, income, and occupation of which are essential for conceptual development, idea empirical measurement or observation, and data analysis.

The study's purpose is to evaluate each individual response to establish how the independent variables of energy resources (renewable, fossil fuels, and nuclear energy) correspond to the dependent variable of cost savings - sustainability, as well as the mediating variable of climate change.

Finally, cross-sectional or prevalence studies are surveys that are conducted at one event in time or over a short period of time hence each of the participants of Sabah is given the survey only once for the sole purpose of gathering research data at a specific time. A cross-sectional study, according to Saunders et al. (2019), is a study of a specific circumstance at a certain period. As a result, this study corresponds to individuals in Sabah who were surveyed once to collect data for the study at that time.

This research has been conducted on Sabah's citizen based on geographical and regional region in Sabah, Malaysia involving 500 peoples. The sample strategy used in the current study was non-probability sampling.

3.4 Sampling Design

The sampling design or sampling strategy is the method by which the required sampling units from a sampling population for identifying your sample. There are numerous sampling procedures used in quantitative research (Kumar, 2018). A sampling process involves picking a few individuals (a sample) from a larger group (the sampling population) to serve as the foundation for estimating or forecasting the prevalence of an unknown piece of information, circumstance, or outcome pertaining to the larger group.

The sampling design process has five steps. The first step is to identify the target population. The sampling frame is established in the second stage, and the sampling method is chosen in the third. The fourth stage is to select the sample size, followed by the sampling technique. The sampling strategy is determined by the population being sampled. The above-mentioned target group is Sabah's citizens. Sampling is the process of selecting a few individuals (a sample) from a larger group (the sampling population) to serve as the foundation for estimating or predicting the prevalence of an unknown piece of information, circumstance, or outcome pertaining to the larger group (Kumar, 2018).

3.4.1 Sampling Plan

A smaller sample was chosen in the study rather than a more thorough census due to the magnitude of the population. The sample strategy used in the present research was non-probability sampling. Non-probability sampling is a sampling method that does not provide a basis for any judgement regarding the likelihood that something in the universe will have a chance of being included in the research sample (Etikan and Bala, 2017). Convenience sampling has been used in this study because it allows the researcher to include people who are simple to reach

through an instant text messaging mobile platform like WhatsApp (Taherdoost, 2016). Participants are chosen for convenience sampling because they are frequently quickly and simply accessible. Convenience sampling is frequently chosen as a sampling method because, in comparison to other sampling methods, it is affordable and simple. The limits of research are frequently circumvented with the aid of convenience sampling.

3.4.2 Sample Size

Exhibit 1.7 Sample Size Recommendation a in PLS-SEM for a Statistical Power of 80%

Maximum Number of Arrows Pointing at a Construct	Significance Level											
	1%				5%				10%			
	Minimum R^2				Minimum R^2				Minimum R^2			
	0.10	0.25	0.50	0.75	0.10	0.25	0.50	0.75	0.10	0.25	0.50	0.75
2	158	75	47	38	110	52	33	26	88	41	26	21
3	176	84	53	42	124	59	38	30	100	48	30	25
4	191	91	58	46	137	65	42	33	111	53	34	27
5	205	98	62	50	147	70	45	36	120	58	37	30
6	217	103	66	53	157	75	48	39	128	62	40	32
7	228	109	69	56	166	80	51	41	136	66	42	35
8	238	114	73	59	174	84	54	44	143	69	45	37
9	247	119	76	62	181	88	57	46	150	73	47	39
10	256	123	79	64	189	91	59	48	156	76	49	41

Source: Cohen, J. A power primer. *Psychological Bulletin*, 112, 155–519.

Figure 2: Sample Size Recommendation a in PLS-SEM for a Statistical Power of 80%

Figure 3, Cohen (1992) illustrates the minimum sample size needed to detect minimum R^2 values of 0.10, 0.25, 0.50, and 0.75 in any of the endogenous constructs in the structural model for significance levels of 1%, 5%, and 10%, considering the typically employed level of statistical power of 80% and a specific number of arrows pointing at a construct in the PLS path model.

In this conceptual framework model study, the maximum number of independent variables and mediating variables in the measurement and structural models is seven. That being the case, to reach 80% for detecting R^2 values at least 0.25 (with a 5% margin of error). With seven pointing arrows in the framework of this research, the recommended minimum sample size shall be 80 to reach a statistical power of 80% for detecting R^2 values of 0.25 with a 5% probability of error.

A total of 100 questionnaires has been presented to respondents throughout Sabah's east and west coasts, south, north, and interior region, with a minimum sample size of 80. Samples were collected over a two-week period in April 2023 with respondents were given checkboxes for informed consent, demographic questionnaires, and a list of questions.

3.5 Data Collection Method

Primary data collecting techniques and secondary data collection methods are the two basic categories into which data gathering methods are typically categorized. Primary data is unpublished material that was obtained directly from a source and has not been altered by anyone. In other words, researchers employ a variety of techniques to obtain and compile primary data for a certain objective. As a result, primary data has higher levels of validity, dependability, objectivity, and authenticity than secondary data categories. These characteristics are crucial in certain research methodologies, such statistical surveys, when the information used is unique to a topic and cannot be obtained from published references. Even if the research can be undertaken utilizing secondary data, it is impossible to produce a valid conclusion without also using primary data. Experiments, surveys, interviews, and questionnaires are just a few of the sources that can be utilized to obtain primary data (Kabir, 2016; Taherdoost, 2021).

The term "secondary data" refers to information that has been collected from published sources, which means that it has already been done so for a different purpose and may be used for other research reasons. Secondary data sources serve as the foundation for the literature review portion in every paper. There are several sources of secondary data, including documents, books, scholarly publications, and online content. In general, secondary data are less expensive and simpler to get than primary data, and since they are only stated in the study, there is no accountability for their quality. As it might not be trustworthy or accurate, it also has drawbacks (Hox and Boeije, 2005; Kabir, 2016).

3.6 Questionnaire Design

A typical tool for gathering data is the questionnaire, which is a form or instrument with a list of questions and safe responses that respondents (from a certain demographic) fill out to provide the researcher with the data they need for the study (Pandey and Pandey, 2021). Quantitative data can be collected using these forms. Although a questionnaire is frequently used to collect statistical data, it can be used for a variety of objectives. It can be made to measure several

independent variables, including facts, preferences, and behaviors (Kabir, 2016). Although a questionnaire is frequently used to collect statistical data, it can be used for a variety of objectives. It can be made to measure several independent variables, including facts, preferences, and behaviors (Kabir, 2016). When it is impossible to communicate with each participant individually, this form is typically employed (Pandey and Pandey, 2021). As a result, it makes it easier to collect data from various people, organizations, and businesses.

Closed-ended and open-ended questions fall under the same question type category. Respondents are given a limited number of options to choose from when answering closed-ended questions, but when answering open-ended questions, they are required to supply predetermined responses (Taherdoost, 2021). Closed-ended questions are therefore pre-coded in contrast to open-ended ones to speed up implementation (Smyth, Olson and Kasabian, (2014).

The closed-ended questionnaire will be used in this study to collect data. A self-administered online survey served as the primary mode of data collection for the purpose of this study. Respondents receive them via mobile messaging apps like WhatsApp along with a link to the online survey made available by Google Forms. The questionnaires are distributed to the targeted population using a convenience sampling technique through an instant text messaging mobile platform like WhatsApp, and there is a high degree of confidence that the right person has responded, so there is a low risk of response contamination or distortion (Taherdoost, 2021).

In this study, the respondent's reaction is noted using a scale tool. In the survey, which uses the Likert style of rating, respondents are asked how strongly they agree or disagree with a series of statements on a scale of 1 to 5, where 1 denotes strongly disagree and 5 denotes strongly agree. When evaluating an intrinsically negative statement, the presence of a neutral point enables the respondent to choose the middle "neutral or not sure" category (Böckenholt, 2017).

There are six sections total, numbered A through G, in the survey. Section A covers all relevant information regarding the respondents' gender, age, job title, and race. Sharma, Minh Duc, Luu Lam Thang, Nam, Ng, Abbas and Karamouzian (2021) assert that demographic profiles are significant since they offer essential details about the population of the study.

Sections B, C, and D each contain a question that relates to an independent variable. Respondents are asked to rate the level of satisfaction they are overall with the following statement, which most accurately and completely expresses their opinion, by selecting the radio option next to the pertinent response.

Respondents are quizzed on their opinions on the statements in Section E in relation to the mediating variable, and climate change.

The questions in Sections F and G correspond to cost-saving sustainability, and energy security, which are two of the dependent variables, respectively.

The information gathered from the questionnaire survey has been arranged and summarized in accordance with the categories of awareness, acceptance, and energy sustainability factors that were mentioned earlier. The information provided by the informants is then examined and interpreted considering the study's goals.

The following Table 1 shows a summary of the questionnaire design.

Section	Variables	Sources	Item	Adoption / Adaptation
A	Demographic Profiles	Sharma, Minh Duc, Luu Lam Thang, Nam, Ng, Abbas and Karamouzian (2021)	5	-
B	Renewable Energy i) Hydropower ii) Solar Energy iii) Biomass Energy iv) Wind Energy v) Ocean Energy (Tide & Wave)	Badsar and Karami (2021); (Qazi, Bhowmik, Hussain, Yang, Naseem, Adebayo, and Al-Rakhami, 2021); Covert, Greenstone, and Knittel (2016); Masud, Akhtar, Islam, and Duasa (2015);	5	Adaptation
C	Fossil Fuels Energy (Natural Gas, Coal & Oil)	Opoku, Filho, Hubert, and Adejumo (2021); Shahbazi, and Nasab, (2016); Caramanna, and Maroto-Valer (2014)	5	Adaptation
D	Nuclear Energy	Misnon, Hu, Rahman and Yasir, (2017); Poortinga, Demski, and Pidgeon (2011); Teravainen et al. (2011).	5	Adaptation
E	Climate Change		5	Adaptation

		Hua and Wang, (2019); Toke and Vezirgiannidou, (2013); Nyman, (2018)		
F	Cost – Saving Sustainability	Bhutto, Liu, Soomro, Ertz, and Baeshen (2020); Lovering, Yip, and Nordhaus (2016).	5	Adaptation
G	Energy Security	Toke and Vezirgiannidou, (2013); Nyman, (2018); Cherp and Jewell, (2014)	5	Adaptation

Table 1: Summary of the questionnaire design

3.7 Pilot Study

When a clinical trial is being developed, sample size is a crucial factor to take into account, both for the main study and any preliminary pilot trials. (Whitehead, Julious, Cooper and Campbell, (2016). In order to be able to answer the research issue being examined, the sample size calculation is used to establish the bare minimum of participants required in a clinical experiment. An estimate of the standard deviation can be obtained from a pilot study, which can then be used to predict potential trial results.

In this pilot test, Kieser and Wassmer (1996), 80% Upper Confidence Limit (UCL) is best applied by using Cronbach Alpa also known as coefficient alpha method to the sample size computation and discovered that a pilot trial sample size between 20 and 40 will minimize the overall sample size for a main study sample size of 80–250 corresponding to standardized effect sizes of 0.4 and 0.7 interval (Whitehead, Julious, Cooper and Campbell, (2016) :Viechtbauer, Smits, Kotz, Budé, Spigt, Serroyen and Crutzen, (2015). The range of numbers above and below the point estimate that a 95% confidence level indicates the true value in the population will most likely fall within is known as the 95% confidence interval. The other 5% is the possibility that the true value is not within the confidence interval (Bonett and Wright, (2015).

Therefore, this pilot study was conducted with a sample size of 50 from the respondents from the 100 questionnaire that being distributed to establish whether the construct statements have an acceptable level of internal agreement. This was done to see if the measurement instruments were trustworthy and valid. The Cronbach alpha was utilized to test whether the constructs were credible to evaluate the internal consistency and reliability of items. A larger value implies a strong association between test items, while a lower value suggests a weaker relationship between test items. The Kuder Richardson 20 (KR-20) was used in this study to measure reliability in the

0.001.00 range. An alpha of 0.65 - 0.80 is commonly deemed "adequate" for a scale used (Vaske, Beaman and Sponarski, 2017).

In Table 2, all the Cronbach alpha values were greater than 0.70, indicating a high level of internal agreement. This indicates that the construct's level was acceptable. The figure is acceptable because it is more than 0.6. Whatever figure more than 0.6 is acceptable. Meaning all the question in the questionnaire are reliable by asking the right question. The question is consistent to measure the independent, dependent, and mediating variables.

Table 2: Reflective Measurement Model Results Pilot test

Construct	Measurement Items	Outer Loading	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
RE	RE1	0.703	0.788	0.842	0.851	0.546
	RE2	0.863				
	RE3	0.415				
	RE4	0.776				
	RE5	0.848				
FFE	FFE1	0.684	0.819	0.849	0.873	0.584
	FFE2	0.858				
	FFE3	0.596				
	FFE4	0.821				
	FFE5	0.827				
NE	NE1	0.35	0.756	0.877	0.811	0.497
	NE2	0.346				
	NE3	0.792				
	NE4	0.887				
	NE5	0.91				
CC	CC1	0.926	0.906	0.931	0.932	0.736
	CC2	0.627				
	CC3	0.946				
	CC4	0.882				
	CC5	0.869				
	CSS1	0.544				
	CSS2	0.862				

CCS	CSS3	0.788	0.857	0.893	0.9	0.649
	CSS4	0.9				
	CSS5	0.88				
ES	ES1	0.286	0.783	0.871	0.857	0.569
	ES2	0.792				
	ES3	0.731				
	ES4	0.914				
	ES5	0.876				

3.8 Research Instrument

Likert scales are frequently utilized in survey questionnaires to gauge respondents' views and attitudes (Rahi, 2017). In this study, the method is used to collect the required facts on how climate change is affecting the world on the energy resources (renewable, fossil fuels and nuclear energy) and cost – saving sustainability and energy security on Sabah's population. The well-structured questionnaire's questions are extremely pertinent in addressing the study concerns. The SMART PLS program has been used to conduct data analysis after the participants' pertinent information has been gathered. The SMART PLS tool was chosen because it is a very potent statistical tool that can be used to do a range of quantitative data studies.

The Questionnaire measure items include: 1: Strongly Disagree, 2: Disagree, 3: Neutral, 4: Agree, and 5: Strongly Agree. The actual items that were used to provide measurement on questionnaire include the aspects of 3 independent variable i.e., renewable, fossil fuels and nuclear energy, climate change as mediating variable and 2 dependent variables i.e., cost sustainability and energy security.

3.9 Measurement Item

Table 3: Summary of Measurement Items

Section	Variables /	Items	Sources	Likert Scale
	(Independent Variable) Renewable Energy (RE) i) Hydropower ii) Solar Energy	1. I have knowledge, awareness, and information on RE implementation. 2. I tend to agree that renewable energy is the	Badsar and Karami (2021); (Qazi, Bhowmik, Hussain, Yang, Naseem, Adebayo, and Al-	5 Likert Scale

B	iii)Biomass Energy iv) Wind Energy vi) Ocean Energy (Tide & Wave)	alternative for future power generations. 3. I am willing to pay (WTP) for an additional utility cost and technology purchases. 4. Lack of awareness and education causes implementation of renewable energy progressing slowly. 5. Lack of policy, subsidies, incentives, etc. in implementing renewable energy.	Rakhami, 2021); Covert, Greenstone, and Knittel (2016); Masud, Akhtar, Islam, and Duasa (2015);	
C	Fossil Fuel Energy (FFE) (Natural Gas, Coal & Oil)	1. I tend to agree that FFE sources is "the mother of global warming. 2. I tend to agree that FFE sources is still the dominant for power generations. 3. I tend to agree that FFE sources shall be banned or controlled. 4. I tend to agree that Transportation, Commercial business, and Industrial sectors is a major contributor to FFE demand for energy. 5. I tend to agree Carbon Capture & Storage (CCS) is the solution to our environment and atmosphere.	Opoku, Filho, Hubert, and Adejumo (2021); Shahbazi, and Nasab, (2016); Caramanna, and Maroto-Valer (2014)	5 Likert Scale
D	Nuclear Energy (NE)	1. I tend to believe that the country ready for nuclear	Misnon, Hu, Rahman and Yasir, (2017); Poortinga, Demski,	5 Likert Scale

		energy to increase energy demand. 2. I tend to believe that NE is a clean, affordable energy and solution to climate change and environment. 3. I tend to believe that NE would increase in risks of accidents related to nuclear waste and transport of nuclear waste. 4. I believe that lack of transparency on policy, information, awareness on NE and its waste management. 5. There is a concern on NE safety and its effects on humans, animal, ecology, environment, plants, and atmosphere.	and Pidgeon (2011); Teravainen et al. (2011),	
E	Climate Change (Mediating Variable)	1. I am aware that climate change is far too worst. 2. I am willing to contribute and participate in climate change program. 3. I am concerned about diseases, health, business, threatening food security, etc. and will affects my daily lifestyles. 4. I tend to agree on online and social media, expert, NGO on reliable information than the government and politician sources.	Hua and Wang, (2019); Toke and Vezirgiannidou, (2013)	5 Likert Scale

		5. Lack of government policy, awareness, education program and commitment to tackle climate change.		
F	(Dependent Variable) Cost-Saving Sustainability (CCS)	1. Environment Tax (ET) shall be introduced to curb environment pollution. 2. Corruption is hindering Cost Saving Sustainability (CCS) in implementing the future power generations. 3. Technology innovation and energy efficiency products is too expensive and costly. 4. Lack of financial capability hindered the implementation of future power generations. 5. Financial management and energy consumption will be able to ease cost – saving sustainability.	Bhutto, Liu, Soomro, Ertz, and Baeshen (2020);	5 Likert Scale
G	Energy Security (ES)	1. I have knowledge on the *Energy Security* issues. 2. Energy security and climate change are two different issues and policy to handle. 3. Energy Security shall be handled and considered as "Risk Management". 4. The lack of Energy Security policy hampered the country to progress and develop. 5. The lack of awareness, education and knowledge hindered the people from	OECD/IEA, (2007); Toke and Vezirgiannidou, (2013); Helm and Hepburn (2009), Giddens (2011), Held et al., 2011); (Giddens 2011); Elkind (2009); Pascual and Elkind (2010)	5 Likert Scale

		participating in curbing energy security issues.		

3.10 Summary of Chapter 3

In summary to this section, the population of individuals has been used to collect the necessary data on the effects of climate change on the energy resources (renewable, fossil fuels and nuclear energy and cost – saving sustainability and energy security in Sabah, Malaysia. Statistical software tool Smart PLS software is used to test the hypotheses through the structural model, after the reliability and validity of the constructs are verified through the measurement model. The research findings were discussed in depth in Chapter 4, henceforth the completion of data analysis by using PLS-SEM.

CHAPTER 4

RESEARCH FINDINGS

4.1 Introduction

This study is designed to assess how when climate change is mediated renewable energy, fossil fuels energy and nuclear energy affect the cost – saving sustainability and energy security in Sabah, Malaysia. Therefore, this chapter contains the data analysis results. The first section contains the demographical distribution of the randomly selected citizen of Sabah.

4.2 Response Rate

The response rate to a survey is a crucial indicator of the validity of a survey-based study and is also taken into account in deciding whether to publish a study (Holtom, Baruch, Aguinis and A Ballinger, (2022). One of the most widely used strategies for gathering data in educational research is online questionnaires (Saleh and Bista, 2017). The response rate to online surveys is positively impacted by sending surveys to a precisely defined and refined demographic (Holtom, Baruch, Aguinis, and Ballinger, 2022). The objective in this study not only to obtain the highest quality replies that result in a sample that is suitable for the purposes of a study, but also achieving the greatest response rate (Holtom, Baruch, Aguinis, and Ballinger (2022).

As shown in Table 4, of the 100 disseminated questionnaires, 92 were collected, and 80 of those were usable according to the sample size stated in the previous chapter. The response rate was 86.96% as a result.

Total Questionnaire Distributed	Total Questionnaire obtained	Sample Size	Usable Questionnaire	Unusable Questionnaire	Response Rate
100	92	80	80	0	86.96%

Table 4: Response rate

Given the above, failure to respond could result in a number of grave negative outcomes: A low response rate reduces confidence in probability-based inferential procedures and raises the possibility of nonresponse bias, which contributes to measurement error and biased estimations.

4.3 Demographical Respondents

Table 5: Demographical Respondents

Demographic	Category	Frequency	Percent (%)
Gender	Male	45	56.3%
	Female	35	43.8%
	Total	**80**	**100%**
Age	18 – 24 years	12	15.0%
	25 – 34 years	17	21.3%
	34 – 44 years	15	18.8%
	45 – 55 years	25	31.3%
	Above 55 years	11	13.8%
	Total	**80**	**100%**
Highest Education Level	High School	19	23.8%
	Diploma	26	32.5%
	Degree	23	28.7%
	Master / PHD	12	15.0%
	Total	**80**	**100%**
Income	RM0 – RM2,999	41	51.2%
	RM3,000 – RM5,999	15	18.8%
	RM6,000 – RM9,999	13	16.3%
	Above 10,000	11	13.8%
	Total	**80**	**100%**
Profession / Occupation	Non - Government Organization (NGO)	7	8.8%
	Public Sector	22	27.5%
	Private Sector	21	26.3%
	Self-employed/ Business owners	9	11.3%
	Unemployed/ Homemakers/Retired	17	21.3%
	Politician	4	5.0%
	Total	**80**	**100%**
Region/Location	West Coast Sabah	39	48.8%
	East Coast Sabah	14	17.5%
	Northern Sabah	4	5.0%

	Southern Sabah	3	3.8%
	Interior Sabah	8	10.0%
	West Malaysia	12	15.0%
	Total	**80**	**100%**

Table 5 exhibits the distribution of *(N=80)* people who were chosen at random from among those in different Sabah, Malaysian regions and geographical areas. Based to the above table, among the 80 participants, there were 45 male participants (56.25%) with 35 female participants (43.75%) in the study. The age groups of 25 to 34 years (21.3%) and 45 to 54 years (31.3%) generated the bulk of responses from the respondents. When it comes to education, those from tertiary education at least a diploma or degree responded scoring much higher of 32.5% and 28.7%, respectively. Public and private sectors responded with 27.5% and 26.3% respectively in the profession or occupation category, followed by the unemployed, homemakers and retirees with 21.3%. Geographically, the bulk of Sabah respondents were from the West Coast, where they made up 48.8%, and the East Coast, where they made up 17.5%. However, 15% of respondents were from West Malaysia.

4.4 Reflective Measurement Model Results

4.4.1 Reliability Analysis

This additional reliability test was carried out on the findings of an earlier pilot research, which determined that when the sample size increased to N=80, the data had an acceptable level of internal agreement between the statements assessing a given construct. Table 6, shows that by using Cronbach's alpha, the outcome reacted with the sample size increased to *N*=80 from the initial pilot study at N=50, indicates that the constructs have an acceptable level of agreement when the coefficient is more than 0.70. When the sample size is increased for the research study, the Cronbach Alpha score declines, according to the results of the pilot study conducted in Chapter 3. As an illustration, when N=50, the Cronbach Alpha for RE was 0.788, but when N=80, it dropped to 0.756. The findings establish that, aside from range, the number of variance and standard deviation of the data from the sample size or effect size had a significant impact on Cronbach Alpha's reliability. The growth in some areas demonstrates the stability of standard deviation and variance, which, other than range, exhibits an upward correlation with the Cronbach Alpha reliability coefficient (Amirrudin, Nasution and Supahar, (2021).

Table 6: Reflective Measurement Model Results

Construct	Measurement Items	Outer Loading	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
RE	RE1	0.659	0.756	0.810	0.833	0.511
	RE2	0.835				
	RE3	0.418				
	RE4	0.760				
	RE5	0.819				
FFE	FFE1	0.730	0.762	0.777	0.842	0.522
	FFE2	0.692				
	FFE3	0.516				
	FFE4	0.818				
	FFE5	0.813				
NE	NE1	0.366	0.725	0.820	0.800	0.472
	NE2	0.399				
	NE3	0.751				
	NE4	0.872				
	NE5	0.863				
CC	CC1	0.854	0.886	0.906	0.917	0.690
	CC2	0.661				
	CC3	0.892				
	CC4	0.878				
	CC5	0.846				
CSS	CSS1	0.519	0.810	0.837	0.870	0.579
	CSS2	0.802				
	CSS3	0.747				
	CSS4	0.867				
	CSS5	0.820				
ES	ES1	0.382	0.810	0.873	0.872	0.592
	ES2	0.807				
	ES3	0.740				
	ES4	0.921				
	ES5	0.876				

In accordance with the aforementioned formulation in comparing the result from the pilot study, the value of reliability is closely related to the simulation of variability. The coefficient of Cronbach Alpha reliability reacts together with the value of variability. The correlation between variance and standard deviation can, according to the findings of experiments or tests, more accurately represent the Cronbach Alpha reliability coefficient than range. The test items have a significant degree of correlation when the alpha level is high.

4.4.2 Construct Validity

This study uses construct validity to assess how effectively the construct is actually measured by the items chosen for it. Therefore, the ability of multiple indicators measuring the same concept through convergent validity to measure the underlying construct is evaluated. In addition, two types of validity, convergent validity and discriminant validity has been performed. In this study, Average Variance Extracted (AVE) is used to measure the amount of variance that is taken by a construct in relation to the amount of variance caused by measurement error. The average extracted variance as well as the composite reliability coefficients are indicators of a measure's quality. The capacity to absorb variance (AVE) of a construct is used to compare such variance to that caused by measurement error (Shrestha, 2021).

Table 6 presents an explanation of how the measurement model converged. A greater value denotes a higher level of reliability, and the values of AVE and CR range from 0 to 1. The convergence validity is confirmed when the AVE is greater than or equal to 0.5 (Shrestha, 2021). In the above case, the composite reliability is greater than 0.60 and all AVE values are higher than 0.50. RE has an AVE score of 0.511 and an FFE value of 0.522 except for NE record value of 0.472. Fornell and Larcker (1981) assert that the construct's convergent validity is still sufficient if AVE is less than 0.5 but composite reliability is higher than 0.6.

Table 7: Discriminant Validity – Fornell – Larcker Criterion

	CC	CSS	ES	FFE	NE	RE
CC	0.830					
CSS	0.667	0.761				
ES	0.410	0.605	0.769			
FFE	0.721	0.584	0.480	0.722		
NE	0.741	0.669	0.501	0.672	0.687	
RE	0.504	0.458	0.617	0.527	0.458	0.715

After construct validity has been properly verified, the Fornell-Larcker criterion and an evaluation of cross-loadings are used to determine the discriminant validity of correlations between latent variables and to assess the estimated strength of these correlations, particularly those between the latent variables. In other words, the square root of AVE for the construct shall be higher than its correlation with the other constructs in the study.

Table 7 demonstrates that FFE (0.722) is greater than the other correlation values underneath it, which are shown in the fourth column. In other words, the square root of AVE for the construct FFE (0.722) shall be higher than its correlation with the other constructs in the study. Additionally, the fifth column showed that NE (0.687) is higher than the other correlation value underneath it. As for RE (0.715) is the higher than the other correlations value thus indicating that the discriminant validity of the study was present.

The cross loading was evaluated in order to determine whether the assertions of a certain construct were loading towards other constructs. This is crucial because it enables us to ascertain if the remarks placed more emphasis on the targeted metric or another construct. The statements that are affected by cross-loading should be deleted in such a circumstance.

Table 8: Cross - Loading

Statements	CC	CSS	ES	FFE	NE	RE
CC1	0.854	0.520	0.326	0.603	0.609	0.397
CC2	0.661	0.391	0.275	0.413	0.348	0.327
CC3	0.892	0.564	0.215	0.645	0.624	0.500
CC4	0.878	0.568	0.409	0.676	0.692	0.397
CC5	0.846	0.677	0.447	0.617	0.720	0.459
CSS1	0.337	0.519	0.413	0.379	0.423	0.208
CSS2	0.513	0.802	0.480	0.387	0.483	0.343
CSS3	0.452	0.747	0.303	0.418	0.465	0.270
CSS4	0.609	0.867	0.495	0.524	0.602	0.453
CSS5	0.575	0.820	0.586	0.493	0.549	0.414
ES1	0.091	-0.022	0.382	0.155	0.047	0.266
ES2	0.225	0.430	0.807	0.310	0.310	0.468
ES3	0.338	0.472	0.740	0.365	0.443	0.451
ES4	0.400	0.604	0.921	0.458	0.520	0.512
ES5	0.415	0.600	0.876	0.466	0.446	0.610
FFE1	0.428	0.425	0.216	0.730	0.364	0.261

FFE2	0.515	0.451	0.413	0.692	0.514	0.570
FFE3	0.379	0.392	0.321	0.516	0.331	0.095
FFE4	0.629	0.422	0.276	0.818	0.659	0.339
FFE5	0.603	0.417	0.468	0.813	0.504	0.541
NE1	0.206	0.062	0.239	0.196	0.366	0.091
NE2	0.157	0.157	0.267	0.364	0.399	0.148
NE3	0.602	0.491	0.323	0.487	0.751	0.270
NE4	0.592	0.616	0.490	0.517	0.872	0.377
NE5	0.713	0.639	0.388	0.644	0.863	0.507
RE1	0.221	0.265	0.419	0.207	0.260	0.659
RE2	0.381	0.390	0.435	0.401	0.390	0.835
RE3	0.061	0.066	0.298	0.224	0.049	0.418
RE4	0.457	0.347	0.478	0.497	0.412	0.760
RE5	0.499	0.431	0.543	0.464	0.383	0.819

Table 8 illustrates the evaluation of cross-loadings, commonly known as "item-level discriminant validity," as a different method for proving discriminant validity. Gefen and Straub (2005) stated that "discriminant validity is shown when each measurement item correlates weakly with all other constructs except for the one to which it is theoretically associated," which is in line with Henseler, Ringle, and Sarstedt's (2015) findings. In other words, for example, the indicator (factor loading) of FFE construct must be higher from the other indicator in another construct, i.e., RE and NE *(shown in red font).* This demonstrates that the data utilized were discriminant valid.

4.5 Structural Model Results

A system that depicts the relationships between constructs is part of the structural equation modelling process. A meaningful relationship or effect between the dependent and independent variables, or even a mediating effect, must be established with such a model. The structural model's goodness of fit could be evaluated in a number of different ways. The relationship between nuclear energy, fossil fuel energy, and renewal energy with cost-saving sustainability and energy security as mediated by climate change was also tested using similar methodologies.

4.5.1 Collinearity Assessment

In this paper, a useful strategy for identifying common method bias is offered based on variance inflation factors (VIF) produced by a comprehensive collinearity test. According to Kock and Lynn

(2012), the occurrence of a VIF greater than 3.3 is proposed as an indication of pathological collinearity, and also as an indication that a model may be contaminated by common method bias.

Table 9: VIF Values for the Structural Model

	CC	CSS	ES	FFE	NE	RE
CC	0.000	2.841	2.841	0.000	0.000	0.000
CSS	0.000	0.000	0.000	0.000	0.000	0.000
ES	0.000	0.000	0.000	0.000	0.000	0.000
FFE	2.050	2.428	2.428	0.000	0.000	0.000
NE	1.874	2.440	2.440	0.000	0.000	0.000
RE	1.422	1.456	1.456	0.000	0.000	0.000

Table 9, reveals that the full collinearity test is effective in detecting common method bias with a model that, despite passing the usual convergent and discriminant validity evaluation standards based on a confirmation factor analysis, is nonetheless valid. Following to a thorough collinearity test, Table 9 displays the VIFs produced for all of the latent variables. Therefore, all VIFs from a full collinearity test are equal to or less than 3.3, the model is deemed to be free of common method bias.

4.5.2 Path Coefficients

The use of bootstrapping needed to be used to test the path coefficient hypothesis. This made it easier to assess the statistical significance of the coefficients. Table 10 demonstrates how the structural equation model validates each of the hypotheses.

The next stage is to evaluate the structural path coefficients (relationships between research constructs) and their statistical significances once the measurement model has been evaluated.

Further assessment, hypothesis was tested to ascertain the significance of the relationship.H1 evaluates whether or not there is a strong correlation between renewable energy (RE) relate to cost saving sustainability (CSS) in Sabah. The results revealed that renewable energy (RE) is insignificant correlated on cost saving sustainability (CSS) in Sabah (β = 0.107, t = 0.870, p > 0.05). Hence, H1 was therefore not validated.

Table 10: Path Coefficients

Hypothesis	Path Coefficients (β)	Sample mean (M)	Standard Deviation (STDEV)	T statistics (|O/STDEV|)	P Values
RE -> CSS	0.107	0.131	0.123	0.870	0.384
FFE -> CSS	0.078	0.085	0.130	0.603	0.546
NE -> CSS	0.344	0.334	0.145	2.377	0.018
RE -> ES	0.487	0.451	0.183	2.662	0.008
FFE -> ES	0.130	0.122	0.128	1.015	0.310
NE -> ES	0.306	0.335	0.177	1.725	0.085
RE -> CC	0.108	0.133	0.116	0.933	0.351
FFE -> CC	0.364	0.353	0.101	3.598	0.000
NE -> CC	0.446	0.435	0.104	4.287	0.000
CC -> CSS	0.302	0.292	0.139	2.163	0.031
CC -> ES	-0.155	0.130	0.161	0.965	0.335
RE -> CC -> CSS	0.033	0.035	0.037	0.895	0.371
FFE -> CC -> CSS	0.110	0.105	0.064	1.709	0.088
NE -> CC -> CSS	0.135	0.129	0.071	1.896	0.058
RE -> CC -> ES	-0.017	-0.011	0.029	0.578	0.563
FFE -> CC -> ES	-0.057	-0.047	0.061	0.928	0.354
NE -> CC -> ES	-0.069	-0.063	0.076	0.915	0.360

Table 10, results indicated that in order to have statistically significant of p-value less than the specified alpha 0.05, the very minimum for 2 -tail test, the T – statistics value should at least at ± 1.96 which shows that most of the indicator in latent variable having less than 1.96.

The results are least intriguing when it comes to statistical significance. The findings should specify the size of the effects of the treatment, not only whether or not they had any effect on the subjects (Sullivan and Feinn (2012). The p-value, however, does not provide the researcher to ascertain how strongly the relationships between the variables actually are, and it is not intended to do so. This is a good use for effect size measures. While the number of papers including statistical estimates of impact sizes determined using parametric tests is continuously rising, reporting effect sizes with non-parametric testing is still extremely uncommon (Tomczak and Tomczak (2014). In null hypothesis testing, an effect size estimate is a measure that should be reported alongside the p-value.

Neyman and Pearson (1933) define a Type I error as rejecting the null hypothesis (H0) when it is in fact true (also known as a "false positive" or "false alarm"). Researchers choose an adequately low alpha level in their analysis to minimize the possibility of discovering a difference that is not actually present in the data and to control for Type I error. Contrarily, a Type II error (also known as a "false negative") is when the null hypothesis (H0) is not rejected even though it is wrong and ought to be. Increasing the sample size in this case is an efficient strategy to lower the likelihood of obtaining a Type II error.

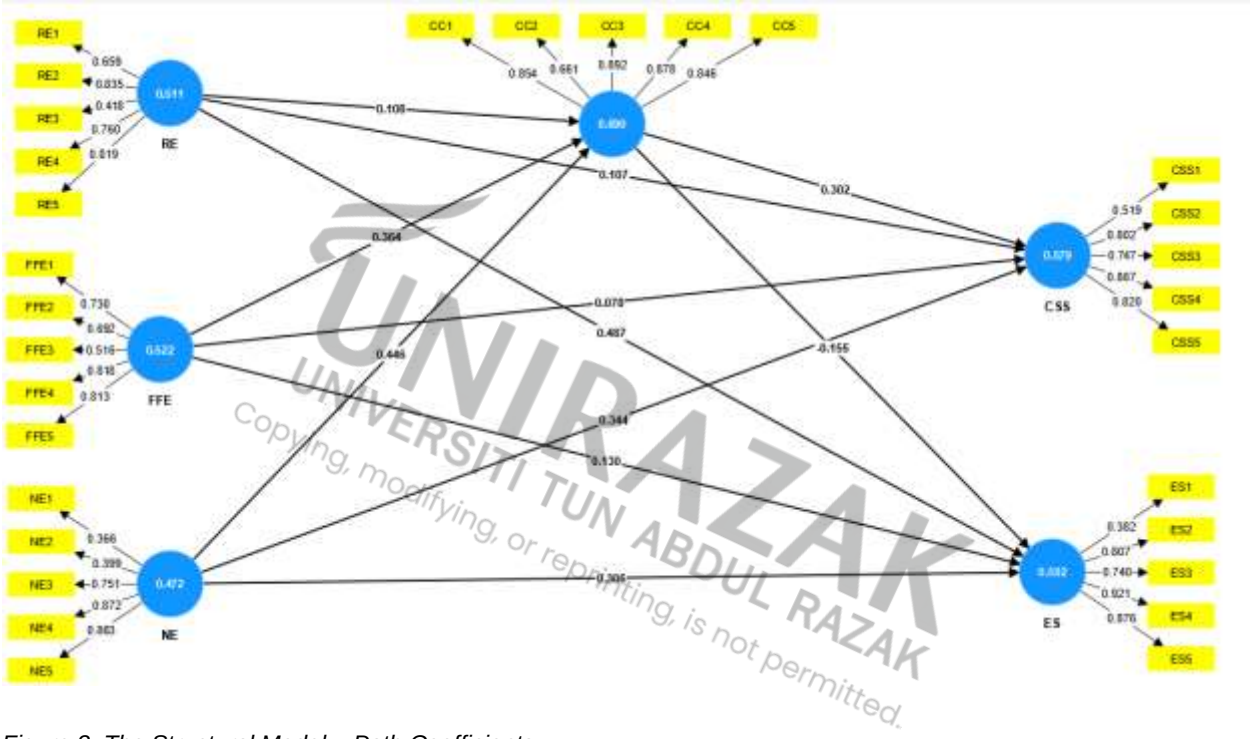

Figure 3: The Structural Model – Path Coefficients

4.5.3 R – Squared

The R-squared statistic is a is more informative and truthful commonly used metric to assess regression analysis and estimate the coefficients in comparison to other goodness of fit metrics. According to Chicco, Warrens and Jurman, (2021), regression models with a low R-squared are good models if some of the explanatory variables are statistically significant. So long as some or most of the predictors or explanatory variables are statistically significant, a low R-square of at least 0.1 (or 10%) is acceptable. If the model does not contain spurious causation and the explanatory variables do not exhibit multicollinearity, a high R-squared model is equally acceptable.

Ozili (2023) asserts that an R-squared of 0.50 to 0.99 is acceptable, particularly when the majority of the explanatory variables are statistically significant. The sole exception to this is that multi-collinearity among the explanatory variables or erroneous causation should not be the reason of the high R-squared.

Table 11: R - squared

	R - square	R – square adjusted
CC	0.648	0.634
CSS	0.526	0.501
ES	0.452	0.423

Table 11, shows that there is a strong effect of variables, i.e., cost – saving sustainability and energy security towards climate change. The figure shown in the table indicated that the R – squared above 0.50 to 0.99 is significantly acceptable.

In this case, 64.8% of the latent variable is accounted for by the model that is used to forecast the mediating influence of climate change (CC). This demonstrates a significant contribution of nuclear energy (NE), fossil fuel energy (FFE), and renewable energy (RE) to cost-effective sustainability and energy security. On the other hand, as the model explains 52.6% of the total variation, cost-saving sustainability performance is well suited. This exhibits a tremendous impact.

4.5.4 f- squared

In this research, the f-square was used to analyze how the deletion of specific predictor constructs affected the f - square value of endogenous constructs. This parameter, known as the f - square effect size, is rather redundant with the path coefficient's size (Purwanto, (2021). When evaluating the route coefficient size and the f - square effect size, the order of significance predictor constructs in explaining the dependent construct in a structural model is frequently the same. F - square is the change in R – square when an endogenous variable is removed from the model. Only when specifically asked by the editor or reviewer should f - square effect sizes be mentioned in this circumstance. Researchers can report f - square effect sizes if the path coefficient sizes and f - square effect sizes differ in the rank order of construct relevance when describing the dependent construct in the structural model Hair et al. (2019). As a result, whether f- square is

small, medium or large. According to Cohen (1988), small, medium, and large f effect sizes correspond to values higher than 0.02, 0.15, and 0.35.

In Table 11, shows the results that the effect of nuclear energy (0.302) is low and significant. Fossil fuels energy and renewable energy (RE) are (0.184) and 0.024 are also low and significant respectively. From these results, the whole f – square value is for effect size is relatively small.

Table 12: f - squared

	CC	CSS	ES	FFE	NE	RE
CC	0.000	0.068	0.016	0.000	0.000	0.000
CSS	0.000	0.000	0.000	0.000	0.000	0.000
ES	0.000	0.000	0.000	0.000	0.000	0.000
FFE	0.184	0.005	0.013	0.000	0.000	0.000
NE	0.302	0.102	0.070	0.000	0.000	0.000
RE	0.024	0.017	0.297	0.000	0.000	0.000

4.5.5 Model Fit

In this study, the SRMR (0.1) and NFI (>0.70) are used to evaluate the model fit. If the NFL is higher than 0.70 and the SRMR is less than 0.10, the model fitness is regarded as ideal. NFI values of >0.9 indicate satisfactory model fit (Byrne, 2010). Values of 0.06 and 0.08, respectively, for the SRMR indicate a well-fitting model (Sahoo, (2019).

In the table 13, shows that the fitness model is regarded as ideal even though the NFI are not achieving values of >0.90 to be indicated as well - fitting model.

Table 13: Model Fit

	Saturated Model	Estimated Model
SRMR	0.109	0.112
d_ULS	5.552	5.868
d_G	2.820	2.883
Chi – square	974.967	987.112
NFI	0.511	0.505

4.6 Summary of the findings

Table 14: Summary of the Findings

Item	Hypothesis	T statistics (|O/STDEV|)	P values	Decision
H1	There is a significant relationship between renewable energy (RE) relate to cost saving sustainability (CCS) in Sabah.	0.870	0.384	Not Accepted
H2	There is a significant relationship between fossil fuel energy (FFE) relate to cost saving sustainability (CCS) in Sabah.	0.603	0.546	Not Accepted
H3	There is a significant relationship between nuclear energy (NE) relate to cost saving sustainability (CCS) in Sabah.	2.377	0.018	Accepted
H4	There is a significant relationship between renewable energy (RE) and energy security (ES) in Sabah.	2.662	0.008	Accepted
H5	There is a significant relationship between fossil fuel energy (FFE) and energy security (ES) in Sabah.	1.015	0.310	Not Accepted
H6	There is a significant relationship between nuclear energy (NE) and energy security (ES) in Sabah.	1.725	0.085	Not Accepted
H7	There is a significant relationship between renewable energy (RE) and climate change (CC) in Sabah.	0.933	0.351	Not Accepted
H8	There is a significant relationship between fossil fuel energy (FFE)	3.598	0.000	Accepted

	and climate change (CC) in Sabah.			
H9	There is a significant relationship between nuclear energy (NE) and climate change (CC) in Sabah.	4.287	0.000	Accepted
H10	There is a significant relationship between climate change (CC) and cost saving sustainability (CSS) in Sabah.	2.163	0.031	Accepted
H11	There is a significant relationship between climate change (CC) and energy security (ES) in Sabah.	0.965	0.335	Not Accepted
H12	There is a significant relationship between renewable energy (RE) relates to climate change (CC) towards cost saving sustainability (CSS) in Sabah.	0.895	0.371	Not Accepted
H13	There is a significant relationship between fossil fuel energy (FFE) relate to climate change (CC) towards cost saving sustainability (CSS) in Sabah.	1.709	0.088	Not Accepted
H14	There is a significant relationship between nuclear energy (NE) relates to climate change (CC) towards cost saving sustainability (CSS) in Sabah.	1.896	0.058	Not Accepted
H15	There is a significant relationship between renewable energy (RE) relate to climate change (CC) towards energy security (ES) in Sabah.	0.578	0.563	Not Accepted
H16	There is a significant relationship between fossil fuel energy (FFE) relate to climate change (CC)	0.928	0.354	Not Accepted

	towards energy security (ES) in Sabah?			
H17	There is a significant relationship between nuclear energy (NE) relate to climate change (CC) towards energy security (ES) in Sabah?	0.915	0.360	Not Accepted

4.7 Conclusion

PLS-SEM, or partial least squares structural equation modelling, is one of the most used approaches for analyzing multivariate data. Its main use is the analysis of models with latent variables. PLS-SEM is widely used because of its user-friendly visual interface, which enables researchers to perform multiple robustness assessments (i.e., endogeneity tests) while taking into account the measurement error involved in the evaluation of abstract concepts. This visual interface is also one of the factors contributing to PLS-SEM's widespread acceptance.

As a result, it was determined that there was a significant correlation between fossil fuels, renewable energy, and energy security in relation to cost-saving sustainability and energy security, with the mediating influence of climate change also being found to be significant.

CHAPTER 5

DISCUSSION & CONCLUSION

5.1 Overview

The objective of this chapter is to put forth the data analysis's findings in a way that is informative. In addition to summarizing each hypothesis, the study's recommendations, inputs to policy, and suggestions for future research are presented as well.

5.2 Discussion of the Study

The research purpose was to assess the effect of mediation of climate change between energy resources (renewable energy, fossil fuels energy, nuclear energy) on the cost – saving sustainability and energy security in Sabah, Malaysia.

H1: There is an insignificant relationship between renewable energy (RE) relate to cost saving sustainability (CSS) in Sabah.

There is an insignificant relationship between renewable energy (RE) relate to cost-saving sustainability (CSS). Particularly, the data was sufficient to draw the conclusion that renewable energy and cost-saving sustainability were not related (β = 0.107, p > 0.05). The results revealed no relationship between renewable energy relate to cost saving sustainability. The Beta's (standardized coefficient) show how significant or insignificant each of the independent variables in clarifying the correlation between renewable energy and cost-saving sustainability. A lesser beta of 0.05 and 0.20 indicates a weaker connection in this hypothesis between the latent variables. The lowest Beta value, which is β = 0.107, indicates that renewable energy is an insignificant factor in the cost – saving sustainability. Therefore, the hypothesis is not accepted.

According to Alam, Hashim, Rashid, Omar, Ahsan & Ismail (2014), the cost of renewable energy takes into account both a comprehensive view of the initial expenditure necessary to set up the machines as well as their ongoing maintenance expenses. The lesser the value of a technology is to consumers, the lower its adoption rate, and the higher its cost. The lack of perceived value addition among customers is impeding the adoption of small-scale renewable energy. Desore and Narula (2018) found an inclusive managerial assessment of new technology and processes in a survey of the textile sector. According to Ahmad, Rashid, Omar, and Alam (2014), customers' intention to adopt renewable energy is positively correlated with their level of technical awareness.

The findings showed that people are more likely to convert to renewable energy sources when the benefit-cost ratio is higher.

Summary findings from studies by Alam, Hashim, Rashid, Omar, Ahsan, and Ismail (2014), Ahmad, Rashid, Omar, and Alam (2014), and others indicate that, on average, consumers are reluctant to pay more than a 5-percent increase above the price they are now paying for using renewable energy. This negative mindset may reduce users' intentions to switch to renewable energy sources.

H2: There is an insignificant relationship between fossil fuel energy (FFE) relate to cost saving sustainability (CSS) in Sabah.

There is an insignificant relationship between fossil fuel energy (FFE) relate to cost-saving sustainability (CSS). The information was particularly sufficient to reach the conclusion that fossil fuel energy and cost - saving sustainability were insignificant related (β = 0.078, p > 0.05). The findings showed that the energy from fossil fuels has no bearing on cost-saving sustainability. When examining the relationship between fossil fuel energy and economically viable sustainability, the Beta's (standardized coefficient) demonstrate that each of the independent variables is less significant tor insignificant than the others. The use of fossil fuels may be less influenced by cost-saving measures. The lowest Beta value, which is β = 0.078, indicates that fossil fuels energy is insignificant factor in cost – saving sustainability. Therefore, the hypothesis is not accepted. A lesser beta of 0.05 and 0.20 indicates a weaker connection in this hypothesis between the latent variables.

One of the primary causes of missing environmental goals is the weakening or non-implementation of environmental rules due to corruption (Leit ao, 2010; Chang and Hao, 2017; Balsalobre-Lorente et al., 2019). According to Lisciandra and Migliardo (2017) and Sekrafi and Sghaier (2018), corruption encourages the destruction of ecosystems and wildlife, which makes it easier to trade in extinct and endangered species and diverts monies intended for environmental policy for private gain.

According to Alves and Uturbey (2010), the production of electrical energy significantly worsens the environment. The quality of the air, water, and soil, as well as human health, may be influenced by the local or global consequences. Global warming linked to greenhouse gas emissions and air pollution from particulate matter emissions are two of the most significant adverse effects of energy generation. As a result of the costs that society must bear to prevent,

reduce, and/or compensate for these negative effects, there is a current global trend to consider environmental factors in the preliminary phases of venture evaluation. There are still expenses associated with degradation brought on by the lingering social and environmental effects of power generation even after control, mitigation, and compensating measures have been taken. These degradation costs are considered external expenses and are levied against third parties; however, they are not considered in cost/benefit analyses of projects or in energy pricing. It can be said that these external impacts have a big effect on the total cost of energy and are a significant burden to society as a whole, despite the challenges connected with the financial value of these effects and the uncertainty surrounding them.

H3: There is a significant relationship between nuclear energy (NE) relate to cost saving sustainability (CSS) in Sabah.

There is a significant relationship between nuclear energy (NE) relate to cost-saving sustainability (CSS). The information was particularly sufficient to reach the conclusion that nuclear energy and cost-saving sustainability were positively related ($\beta = 0.344$, $p < 0.05$). The findings are important because, according to Mahmood, Wang, and Zhang (2020), nuclear energy production has increased by more than 40%, accounting for 12% of worldwide power production and 5% of primary energy demands in 2018. The maximum beta values which indicate $\beta = 0.344$, which are acceptable and show a strong relationship between the latent variables. The hypothesis is accepted. Therefore, nuclear energy has a significant chance of quickly addressing difficulties with environmental degradation and meeting expanding energy demands.

According to research done in Malaysia by Dahlan, Ibrahim, Rajemi, Nawi, and Baharum (2014), generation mixes include nuclear power plants improve system dependability, produce less CO2, and have lower operating and investment costs. The utility structure, reactor size, regulatory environment, and international collaboration may have a higher impact on cost trends than other factors, according to the study by Lovering, Yip, and Nordhaus (2016), which found that costs trends have varied substantially by era, country, and experience. The results, however, showed that while costs have risen in certain countries over time, they have remained steadier in others over the long run and have decreased over particular periods in their technical histories.

An empirical study by Ozcan and Ulucak, (2021) showed that more nuclear energy generation in the Indian energy system would be helpful for mitigating climate change because it immediately reduces environmental pollutants. The outcomes show once again how the IPAT equation's general effect of population density stimulates carbon emissions. The empirical findings also show

that using nuclear energy improves air quality, which suggests a quicker uptake of nuclear energy in India's energy mix. The findings also show that India's deployment of nuclear energy during this prosperous period may enable a "tunnelling effect" for long-term sustainable economic growth (Bandyopadhyay and Rej, (2021).

H4: There is a significant relationship between renewable energy (RE) and energy security (ES) in Sabah.

There is a significant relationship between renewable energy (RE) and energy security (ES). The information was particularly sufficient to reach the conclusion that renewable energy and energy security were positively related ($\beta = 0.487$, $p < 0.05$). The findings are significant since they show that even the rise in the use of renewable energy has been much slower than expected because the new technology offers fewer comparative benefits than straightforward to use and manage energy alternatives (Stephenson and Loannou 2010). The highest Beta value, which is $\beta = 0.487$, indicates that the adoption of renewable energy grows at a pace of 48.7%. A strong correlation between the latent variables is this hypothesis indicated by a highest beta of 0.05 and 0.20. Therefore, the hypothesis is accepted. This relationship related a new technology's relative advantages include its cost, social impact, aesthetics, and other behavioral factors. According to Oluoch, Lal, Susaeta, and Vedwan (2020), the development of future energy portfolios must take into account the public's perception of various energy sources.

According to Milicevic, Djokic, Mirovic, Djokic and Kalas, (2022), the relationship between customers' intentions and green banking (GB) services on the importance of renewable energy in reducing carbon emissions as well as the problems of energy security and self-sufficiency was examined using the theory of planned behavior (TPB). The findings indicate that environmental awareness, attitude, and perceived behavior control have the biggest effects on consumers' intentions.

According to the findings of Mishal et al. (2017) and Taneja and Ali (2021), environmental consciousness has a favorable impact on attitude. It implies that customers who value the harmony of nature and the need for humans to coexist peacefully with it have a more positive attitude towards eco-friendly products and services; consequently, eco-conscious customers are more likely to consider embracing green banking services as preferred. Numerous studies on green purchase intention, like Bhutto et al. (2019) and Moon, (2021), indicated that perceived behavior control had a favorable and significant impact. Therefore, the desire to embrace green banking services will be higher if a consumer believes that they are simple to use.

H5: There is an insignificant relationship between fossil fuel energy (FFE) and energy security (ES) in Sabah.

There is an insignificant relationship between the fossil fuels energy (FFE) and energy security (ES), (β= 0.130, p > 0.05). The results demonstrated that energy security is unaffected by fossil fuels energy. A lesser beta of 0.05 and 0.20 indicates a weaker connection in this hypothesis between the latent variables. The lowest Beta value, which is β = 0.130, indicates that the fossil fuels grow lower at a pace of 13.0%. Therefore, the hypothesis is not accepted. In this instance, this relationship related the environment has undergone a dramatic transition and the scarcity of fossil fuels is no longer the main concern claimed, Blondeel, Bradshaw, Bridge and Kuzemko (2021).

Instead, given the abundance of fossil fuels, the focus is on the need to decarbonize the global energy system, limit the production of fossil fuels, and speed up the deployment of low-carbon energy technologies. Energy system transformation is seen as a two-pronged process, with a set of "high-carbon" energy transitions related to phasing out fossil fuel consumption, and "low-carbon" energy transitions related to the emergence of new renewable energy and other low-carbon sources. The primary indicators of the energy security vulnerability index are used to assess how sensitive and vulnerable the Malaysian economy is to disruptions in the energy supply and to further explore the potential effects of these indicators on important economic indices.

York and Bell (2019), study claimed that the amount of energy produced by different sources, such as in the 19th century when coal far exceeded biomass to form a significant portion of the global energy supply and in the 20th century, when petroleum overtook coal, could more accurately be described as energy additions rather than phases of transition. Analysis from current energy production trends also suggests that, as renewable energy sources make up a higher portion of total energy production, they are not displacing fossil fuels but rather increasing the total quantity of energy generated.

H6: There is an insignificant relationship between nuclear energy (NE) and energy security (ES) in Sabah.

There is an insignificant relationship between the nuclear energy (NE) and energy security (ES). (β= 0.306, p > 0.05). The results demonstrated that energy security is unaffected by nuclear energy. Even though, a strong Beta value, which is β = 0.306, however the p - value score above 0.05, a rule needed to be accepted in the hypothesis analysis and there is sufficient to reach the

conclusion to indicates that the nuclear energy and energy security is not related. Therefore, the hypothesis is not accepted. In this instance, this relationship related the energy environment and nuclear energy could have negative consequences on people, animals, the environment, and ecological systems, Liang (2021). According to the study's findings, people are aware of a number of difficulties associated to nuclear power development. Government policy, public outcries, and nuclear power plant accidents have all contributed to an increased public understanding of nuclear energy. However, while positive nuclear-related events are closely linked to increased discussion of nuclear policies and plans and employment opportunities in the industry, negative nuclear-related events are directly linked to increased awareness of radiation, risk and security, and government/corporate accountability. According to (Wu, 2017), mounting data suggests that public acceptability is just as important to the growth of nuclear energy as official support.

Through the years, concerns over global warming, air pollution, and security of energy have taken center stage on the energy policy agenda; these are issuing that nuclear energy has the potential to address (Mahmood, Wang, and Zhang, 2020). In contrast to other power generation methods, nuclear energy produces (under normal operating conditions) only small amounts of radioactive emissions, which power plant employees may be exposed to. Nuclear power plant radiation exposure to the general public and its possible health impacts are low in contrast to radiation and its effects from natural sources. Hayano, Tsubokura, Miyazaki, Ozaki, Shimada, Kambe, and Tokiwa (2015) asserted that the majority of the data gathered and released thus far have consistently demonstrated that the internal contamination for the majority of residents during the Fukushima Daiichi NPP accident was so low as to be undetectable.

H7: There is an insignificant relationship between renewable energy (RE) and climate change (CC) in Sabah.

There is an insignificant relationship between renewable energy (RE) relate to climate change (CC). Particularly, the data was sufficient to draw the conclusion that renewable energy and climate change were not related (β = 0.108, p > 0.05). The results revealed that renewable energy is insignificant relationship on climate change. The lowest Beta value, which is β = 0.108, indicates that renewable energy is an insignificant to climate change. Therefore, the hypothesis is not accepted. A lesser beta of 0.05 and 0.20 indicates a weaker connection in this hypothesis between the latent variables.

Yang, Bashiru Danwana, and Yassaanah (2021) found that the findings of the data analysis show that environmental awareness is the largest predictor of the intention to utilize renewable energy

in Ghana. In general, using renewable energy necessitates some amount of environmental consciousness on the part of the user. This is consistent with the findings of Karaolan and Durukan (2016): Karasmanaki and Tsantopoulos, 2019. According to Karasmanaki and Tsantopoulos, students increased environmental awareness and environmental concerns led them to support renewable energy sources. In a same context, Karaolan and Durukan emphasized that a consumer who cares about the environment would pick environmentally friendly products across a variety of categories, not simply in terms of energy use.

In the case of environmental sustainability in Peru, the outcomes showed a strong correlation between innovation uptake and circular economy readiness. This industry also greatly benefits from recent technical advancements including the capacity to produce energy from recycled materials. On the idea of recycling, the circular economy is built. According to Oláh et al., (2020), the circular economy has a strong focus on renewable energy. Due to excessive carbon emissions that are harming the environment, the world is embracing the circular economy model and switching to renewable energy sources (Iqbal, 2020). Recycling is the cornerstone of the circular economy, and renewable energy is produced from comparable resources like water and air without releasing harmful emissions.

H8: There is a significant relationship between fossil fuel energy (FFE) and climate change (CC) in Sabah.

There is a significant relationship between fossil fuels energy (FFE) and climate change (CC). Particularly, the information was sufficient to draw the conclusion that fossil fuel energy and climate change were related ($\beta = 0.364$ $p < 0.05$). Therefore, the hypothesis is accepted. According to Littlewood, Decelis, Hillenbrand, and Holt (2018), industry has a significant role in causing climate change. the strongest association between fossil fuel energy and climate change is indicated by the greatest Beta value, which is $\beta = 0.364$. A strong correlation between the latent variables is this hypothesis indicated by a highest beta of 0.05 and 0.20.

In the case of European nations (World Resources Institute, 2014), it was claimed that the relationships between commitment and actual corporate greenhouse gas (GHG) performance revealed that in European high emitting industries, business drivers and stakeholder pressure, but not sustainability drivers, enhance corporate commitment to climate change action, and that greater commitment results in improved GHG performances. Nevertheless, industry play a significant part in the fight against climate change. In fact, climate change is a crucial strategic problem for business, posing both risks and opportunities (Backman et al., 2015; Sullivan and

Gouldson, 2016). Institutional theory has been extensively used to describe how stakeholders may persuade businesses to engage in environmentally friendly conduct (Dögl and Behnam, 2015), and more specially to address climate change (Delmas and Montes-Sancho, 2010). This is reflected in the work of Boiral et al. (2012) who point out that institutional systems of governance in certain nations have an impact on the volume, nature, and channels via which pressure is applied to businesses to cut their GHG emissions.

Shafie, Mahlia, Masjuki, and Andriyana (2011) assert that energy is needed for practically every aspect of daily life, including industrial processes that affect economic growth as well as transportation, agriculture, and telecommunication. Gross domestic product (GDP), a key indicator of economic growth, and Malaysia's energy usage are almost perfectly correlated in Malaysia. Malaysia's economy must continue to grow for that country's progress to be possible. In Malaysia, air pollution has grown to be a significant environmental issue. The burning of coal, lignite, petroleum, natural gas, wood, and animal and agricultural waste causes air pollution in this country. Particularly since the 1990s, primary energy consumption has grown quickly, which has mostly contributed to an increase in CO2 emissions. The evidence also implies that environmental deterioration comes before economic development. Given the amount of energy inputs need to produce products to support heavy industry, it is not surprising that an increase in pollution levels causes economic growth in Malaysia (Shafie, Mahlia, Masjuki and Andriyana, (2011).

H9: There is a significant relationship between nuclear energy (NE) and climate change (CC) in Sabah.

The is a significant relationship between nuclear energy (NE) and climate change (CC). Particularly, the information was sufficient to draw the conclusion that nuclear energy and climate change were related ($\beta = 0.446$ $p < 0.05$). A Beta value $\beta = 0.446$. show a strong relationship between the latent variables. Therefore, the hypothesis is accepted. According to Hamid, Hassan, Ramanathan, Jumat, Jaafar and Abdullah (2015), public perceptions and Malaysia's acceptance of nuclear power are related and found that the findings indicated that more than 50% of the respondents were knowledgeable about nuclear power. Aside from that, only 39% of Malaysians believe their government will be able to develop a nuclear power plant, and 41% think nuclear energy is not the greatest choice for the country's energy needs in the future. The findings also showed a weak association between Malaysians' perceptions of nuclear energy as a source of power and their level of education, with greater levels of education being associated with a more

negative impression. Therefore, in order to change the public's perspective of nuclear power and foster positive acceptance of nuclear power plant (NPPs) in Malaysia, the government must provide the populace with nuclear education.

According to a study by Mahmood, Wang, and Zhang published in 2020, the majority of emissions from nuclear energy are linked to stages of the technology's full life cycle other than nuclear power station operation. Nuclear power's GHG footprint has lately been greatly reduced due to technological advancements, particularly in uranium enrichment, which can theoretically help to slow down global warming. The findings indicated that nuclear energy has significantly reduced its GHG emission intensity during the last few decades. The employment of more advanced technology for uranium enrichment, a crucial step in the nuclear fuel cycle, has been one of the key forces driving this advancement and is doing so more and more frequently. According to Rashid, Sali, Kadir, Zolkaffly, Kassim, Omar, and Bakar (2020), Malaysia is one of the nations that has included the Sustainable Development Goals (SDG) in its development strategy and is on track to accomplish the SDGs. In its Tenth Malaysia Plan (2010-2015), Malaysia highlighted nuclear energy as a prospective long-term choice to be investigated for the generation of power in Peninsular Malaysia, claim Jaafar, Nazaruddin, and Lye (2017).

H10: There is a significant relationship between climate change (CC) and cost saving sustainability (CSS) in Sabah.

There is a significant relationship between climate change (CC) and cost saving – sustainability (CSS). The data, in particular, were sufficient to make the conclusion that climate change and cost – saving sustainability were related ($\beta = 0.302$, $p < 0.05$). Therefore, the hypothesis is accepted. The highest beta value, $\beta = 0.302$, demonstrates that climate change and cost-saving sustainability are significantly positively related in relation to protection motivation theory. This theory uses a wide range of predictors, such as the costs and rewards associated with pro-environmental attitudes and behavior, to explain pro-environmental decisions. This theory may then be used to encourage pro-environmental choices to lower environmental hazards, particularly the use of energy resources in combating climate change (Singh, Singh and Vaibhav, 2020).

In a survey on Malaysian public employees done in 2013, Aini, Chan, and Syuhaily found that either the adoption of technical solutions or a change in behavior can help to conserve energy. I. In terms of gender, degree of education, income, understanding of climate change, and attitude, the results indicate that there were substantial differences in the relative acceptability of both

behavioral measures. Technical measures' acceptance was predicted by gender, understanding of climate change causes, and personal norms, but behavioral measures' acceptability was influenced by perceived efficacy and personal norms. The findings also suggested that when evaluating pro-environmental purpose activity, distinctions between technology adoption and behavior adjustments that call for lifestyle changes should be established.

According to Surianshah, S. (2021), descriptive statistics findings demonstrate that Sabah people have a high level of environmental awareness and green product consumption. They are particularly conscious of the need to conserve and maintain the environment of the tropical rainforest and to use eco-friendly items for the sake of future generations. However, it should be noted that awareness of the effects of resource depletion and the value of using green products in daily life is still low among Sabahans.

H11: There is an insignificant relationship between climate change (CC) and energy security (ES) in Sabah.

There is an insignificant relationship between climate change (CC) and energy security (ES). The data, in particular, were sufficient to make the conclusion that climate change and energy security were not related ($\beta = -0.155$, $p > 0.05$). Therefore, the hypothesis is not accepted. Beta values between 0.05 and 0.20 are less, indicating a lower relationship between the latent variables. The lowest beta value, $\beta = -0.155$, shows that behavioral control is considerably positively correlated with human awareness, knowledge, and attitudes towards the environment in regard to climate change and energy security (Sommer, (2011).

According to Toke and Vezirgiannidou, (2013), there isn't much of a correlation between studies of discourses and policies related to energy security and climate change and a comparison of media energy security is covered. It appears that the discussion of climate change is intended to enhance elitist and exclusive views of energy security. Given that the it is a significant factor in economic growth and prosperity, energy is frequently regarded as a key policy subject for many nations. According to (Giddens (2009); (Toke and Vezirgiannidou, (2013), the relationships between climate change and energy security are common knowledge in the elitist discussion of many significant nations. But a distinct facet of this relationship is shown in each of the country case studies. Despite the issues' relationships, these associations continue to treat them as separate issues in most situations.

The findings of a 2016 study by Gennaioli and Tavoni, indicate that the energy sector is both a target and a source of corruption due to the nature of the energy resources, the potential for rent-seeking, and the crucial role that the government involves in monitoring. According to Transparency International's Bribe Payers Index, the oil and gas industry, electricity generation and transmission, and these industries are among the most bribery-prone sectors. The need to minimize corruption has been acknowledged by international organizations like the World Bank, which has been involved in financing energy infrastructure in poor nations. These organizations frequently attempt to strengthen governance.

H12: There is an insignificant relationship between renewable energy (RE) relates to climate change (CC) towards cost saving sustainability (CSS) in Sabah.

There is an insignificant relationship between renewable energy (RE) and cost-saving sustainability (CSS) mediated by climate change (CC). Particularly, the data was sufficient to draw the conclusion that renewable energy and cost – saving sustainability mediated by climate change were not related (β = 0.033, p > 0.05). Therefore, the hypothesis is not accepted. A weaker correlation between the latent variables is indicated by a smaller beta of 0.05 and 0.20. The lowest Beta value, which is β = 0.033, indicates that renewable energy and cost-saving sustainability are insignificantly mediated by climate change, hence environmental awareness and concern have a favorable influence on attitudes and indirectly influence people' willingness to buy energy-efficient equipment (Li, Li, Jin, and Wang (2019). The findings of the study, Theory of Planned Behavior (TPB) applied in analyzing human behavior on environmental awareness, knowledge, attitude, and perceived behavioral control are all significantly positively connected with residents' propensity to buy energy-efficient appliances. In studies on consumers' attitudes towards buying green products, attitude has a better explanatory power.

A number of findings from earlier studies (Zainudin and Nordin, 2014) were consistent with the findings of this research. A person's attitude towards environmental issues will be positively correlated with their knowledge about energy-efficient products. Positivity has a big impact on a consumer's decision to buy an energy-efficient device. Greater understanding of energy conservation and environmentally friendly consumption practices is achieved through evaluating the impact of knowledge, among other factors, on energy-efficient products. In general, the government of Malaysia has made numerous policies and actions to maintain economic, energy, and environmental sustainability, recognizing the relevance and benefits of energy efficiency in the whole country. The product's price has traditionally been the primary consideration when

making a purchase. Government therefore has a responsibility to foster an environment where consumers have some purchasing power.

H13: There is an insignificant relationship between fossil fuel energy (FFE) relate to climate change (CC) towards cost saving sustainability (CSS) in Sabah.

There is an insignificant relationship between fossil fuels energy (FFE) and cost-saving sustainability (CSS) mediated by climate change (CC). Particularly, the data was sufficient to draw the conclusion that fossil fuels energy and cost – saving sustainability mediated climate change were not related (β = 0.110, p > 0.05). Therefore, the hypothesis is not accepted. According to Bui, Adjiman, Bardow, Anthony, Boston, Brown and Mac Dowell (2018), carbon capture and storage (CCS) is widely acknowledged as having the potential to play a critical role in achieving climate change targets, providing low carbon heat and power, decarbonizing industry, and, more recently, its ability to facilitate the net removal of CO_2 from the atmosphere. This is indicated by the lowest Beta value, which is β = 0.110. A weaker correlation between the latent variables is indicated by a smaller beta of 0.05 and 0.20.

Despite the fact that there is broad support for it and that it is technologically advanced, the aims for the implementation of CCS have not yet been met. The fact that all technical and commercial integration risks along the full CCS chain (capture, transport, and storage) must be managed by the private sector is a significant weakness in the CCS commercialization models that have been applied up to this time. There are no established business models for CCS, despite the fact that the private sector is capable of managing and competitively pricing a variety of risks. Due to the absence of a successful business model across the entire chain, the market will either accept it only at a premium price or not at all.

Carbon capture and storage was also related to how much it cost to build a plant. Shahbazi and Nasab (2016) assert that given that CCS reduces efficiency, increases costs, and reduces energy output, commercial fossil-fuel power and industrial facilities are unlikely to collect and store their CO2 emissions. These barriers can be partially removed with the help of the government's assistance in the form of tax credits and other related incentives. As CCS is increasingly widely used, such help will be required at all stages of project development. Okoh (2021) argues that it is critical to increase ambition in order to minimize the use of fossil fuels since the threat posed by climate change is hastening the depletion of natural resources.

H14: There is an insignificant relationship between nuclear energy (NE) relates to climate change (CC) towards cost saving sustainability (CSS) in Sabah.

There is an insignificant relationship between nuclear energy (NE) and cost-saving sustainability (CSS) mediated by climate change (CC). The information gathered was sufficient to make the conclusion that nuclear energy and cost-savings sustainability mediated by climate change were not related ($\beta = 0.135$, $p > 0.05$). Therefore, the hypothesis is not accepted. In this hypothesis, a lower correlation between the latent variables is shown by a smaller beta of 0.05 and 0.20. The data shows that a different element is mediating nuclear energy and cost-effective sustainability than mediated by climate change. When considering realistic, long-term solutions to the issues of cost-saving sustainability that are mediated by climate change as a factor, behavioral reasoning theory (BRT) is a key theory of planned behavior.

Rafaty's (2018) research found that weaker climate policies, particularly nonmarket regulations, are strongly and robustly associated with increased perceptions of corruption when controlled for relevant political and economic factors. In particular, they are strongly associated with the size of domestic energy-intensive, trade-exposed industries. The difficulties facing mitigation policy now are accompanied by a "global implosion of trust," seeing the largest-ever increase in public mistrust of business, government, media, and NGOs (Edelman 2018). In all of the nations surveyed, including many industrialized democracies, public perceptions of corruption have increased (Transparency International, 2017). The findings of the Sekrafi and Sghaier (2018) study confirm that controlling corruption has a positive direct impact on economic growth, but the overall effect is negative. In addition to its direct impact, corruption has an impact on growth through two other factors: the environment and the consumption of energy. According to Lyulyov, Pimonenko, Kwilinski, Dzwigol, Dzwigol-Barosz, Pavlyk and Barosz (2021), the public's perception of political stability has increased by 2.38 points, but perceptions of corruption have increased by 1.47 points. This has the potential to significantly speed up the recovery of the Ukrainian energy sector.

Research into the Fukushima nuclear power accident sequence, according to Tanter, (2013), indicated that the disaster was man-made and had its origins in regulatory capture brought about by a network of corruption, collusion, and nepotism. The Japanese experience is not unique, according to an examination of corruption cases in the global nuclear business from 2012 to 2013. Massive corruption is visible in a number of nuclear technologies importing nations as well as in nuclear technology exporting nations including the United States, China, and Russia. The

survey's findings demonstrate the inadequacy of national nuclear regulatory systems and the near-total failure of the international system. Public faith in businesses, governments, and institutions erodes when there is widespread corruption in the nuclear industry, which has serious social and political repercussions.

H15: There is an insignificant relationship between renewable energy (RE) relate to climate change (CC) towards energy security (ES) in Sabah.

There is an insignificant relationship between renewable energy (RE) and energy security (ES) mediated by climate change (CC). In particular, the data were sufficient to reach the conclusion that renewable energy and energy security mediated by climate change were not related (β = -0.017, p > 0.05). Therefore, the hypothesis is not accepted. The lowest Beta value, which is β = - 0.017, indicates that renewable energy and energy security mediated by climate change is a weak correlation. A weaker correlation between the latent variables is indicated in this hypothesis by a smaller beta of 0.05 and 0.20.

According to Chien, (2022), there is a good correlation between sustainability development growth (SDG) attainment and the sharing economy's benefits of appropriate energy resource use. Govindan et al.'s (2020) research, which demonstrates that in a sharing economy, two or more people or businesses use resources (natural, physical, and human) collaboratively or cooperatively, supports this conclusion. The SDGs in areas like health, social welfare, inequality reduction, and climate action can be achieved with the support of reasonable energy resource use. As a result, the sharing economy's efficient use of energy resources promotes sustainable development.

Leung, Xue, and Wen (2019) highlight the sharing economy reduces the need for energy resources since users share infrastructure, logistics, and technology. This decrease in the use of dirty energy lessens the damaging effects of home and commercial practices on the environment, such as oil deterioration, dirty water, air pollution, and livestock loss. This supports the nation's sustainable development. These findings are in line with those of Plewnia and Guenther (2018), who find that domestic economic activities in sharing economy nations use a socioecological paradigm and use less energy overall. Increased energy resource efficiency aids the nation in achieving its SDGs because energy is a major contributor to environmental degradation and a threat to sustainable development. Additionally, this outcome is consistent with other research, such as that of Boar et al. (2020), which shows that the sharing economy increases the efficiency of energy resources, which contributes to the achievement of SDGs.

H16: There is an insignificant relationship between fossil fuel energy (FFE) relate to climate change (CC) towards energy security (ES) in Sabah.

There is an insignificant relationship between fossil fuel energy (FFE) and energy security (ES) mediated by climate change (CC). Particularly, the information was sufficient to draw the conclusion that the relationship between fossil fuels energy and energy security mediated by climate change were not related ($\beta = -0.057$, $p > 0.05$). Therefore, the hypothesis is not accepted. The reason that the hypothesis is not accepted claimed by Piggot, Verkuijl, van Asselt, and Lazarus (2020) is that governments continue to make significant investments in and work to increase the production of fossil fuels for a number of reasons, including economic expansion, revenue generation, and geopolitical considerations as Beta represent negative value, $\beta = -0.057$. A weaker correlation between the latent variables is indicated by a smaller beta of 0.05 and 0.20.

The 2020 oil price collapse, which was caused by an excess of supply and collapsed demand as a result of the COVID-19 pandemic, however, serves as a stark reminder of the risks associated with assuming that demand for fossil fuels will continue to increase. Governments that largely depend on fossil fuel revenue streams may find themselves facing a problem when their budgets shrink, leaving workers and communities in those regions stuck when the industry collapses. While the sudden reduction in oil demand in 2020 is due to exceptional conditions and unique oil market dynamics, it also serves as a reminder that careful planning for a regulated decline in fossil fuel supply needs in respect to climate change to be discussed. Governments are implementing new types of "supply-side" climate policy to restrict the production of coal, oil, and gas as a small but growing number of them start to understand the necessity of balancing their plans for climate mitigation with those for energy production (Erickson et al.,2018; Gaulin and Le Billon, 2020; SEI et al., 2019; Tudela, 2020).

Lazarus and van Asselt, (2018), claimed that policymakers, investors, researchers, and members of civil society have started to examine the fossil fuel economy's supply side in order to address this weakness and explore the possibility of using supply-side solutions to support demand-side climate policies. The political and economic institutions and interests that support the production of fossil fuels contribute to the perpetuation and even the expansion of fossil fuel consumption, which is a critical concept underlying these new methodologies. From this newly available perspective, maintaining infrastructure for the exploration, production, and distribution of fossil fuels makes it far more difficult to accomplish the goals of global climate protection. According to (Lazarus and van Asselt, 2018), that this can manifest as prohibitions on exploration and

extraction, the elimination of subsidies for fossil fuel production, limitations on financing for fossil fuel projects, and transition planning for employees and communities. SEI et al., 2019 further stated that such initiatives are involving not only governments but also a variety of non-state actors, with investors divesting from fossil fuels, communities developing transition plans, and even some fossil fuel companies redefining themselves as 'energy' instead of oil or coal companies, to enable them to enter a post-fossil fuel era.

H17: There is an insignificant relationship between nuclear energy (NE) relate to climate change (CC) towards energy security (ES) in Sabah.

There is an insignificant relationship between nuclear energy (NE) and energy security (ES) that was mediated by climate change (CC). Particularly, the information was sufficient to draw the conclusion that the relationship between nuclear energy and energy security mediated by climate change was not related (β = - 0.069, $p > 0.05$). Therefore, the hypothesis is not accepted. The lowest Beta value, which is β = - 0.069, indicates that nuclear energy and energy security mediated by climate change is a weak correlation. In order to find realistic, long-term solutions to the issues of energy security caused by climate change as a factor, behavioral reasoning theory (BRT), which is a theory of planned behavior, is needed.

According to Kim and Kim, (2014), social media have grown in popularity and have the ability to spread quickly, making them an important channel for communicating public opinions because they serve as the primary virtual space for bringing up new public issues, having discussions about them, and forming opinions about them. Due to the prominence of social media, many businesses and governments are attempting to exploit these platforms for commercial purposes or to gauge public opinion.

According to Misnon, Hu, Rahman, and Yasir's (2017) research, Malaysians are more likely to believe the opinions of academics and scientists (67.90%) when seeking knowledge regarding energy-related topics. They also frequently place a high degree of trust (63.3%) in the information provided by the Malaysian Energy Commissions as well as (59.5%) by seminars, conferences, and other similar events. NGO and local authority, gas and other energy firms round up the top two, respectively, at 47.10% and 44.0%. Only 5.70% of respondents, on the other hand, have confidence in political organizations.

Studies (Ho et al., 2019; Mah et al., 2014; Du and Han, 2020) have found that public perception and attitudes towards nuclear power plants are influenced by trust in government. In many nations,

nuclear energy is an issue of politics at the national level. While some individuals emphasize the economic advantages of nuclear energy, others draw attention to its concerns. Governments must come to a nationwide consensus on the development of nuclear power plants and obtain support from the citizens of the communities around. Government officials must identify and monitor public sentiment towards nuclear energy in order to develop and implement long-term national nuclear energy policy. Without such initiatives, the cost to settle related disputes could skyrocket.

5.3 Recommendation

Online surveys face difficulties with sampling, response rates, non-respondent characteristics, confidentiality upkeep, and ethical concerns. In most questionnaire from the survey analysis result, it is found that the percentage of neutral view contributed the highest percentage in each question. It can be concluded that there is lack of public and media attention in disseminate information, broad geographic scope, small sample size, time constraint, lack of knowledge and awareness which contributed the most in the survey done. Latkovikj and Popovska (2019) study, recommended that more survey needed in term of public and media attention, easy access to information, broad geographic scope, larger sample size leading to greater statistical power, decreased cost of conducting empirical research, support from online search engines and data bases, open data sources, absence of the need for in-person interaction, and minimal waste of paper. The respondents' most frequently cited drawbacks include: biasness of providing respond, the need for Internet access, evaluation of the accuracy of online sources, restricted access to or high costs for some data bases, the contrast between fresh and redundant data available, irrelevant data, knowledge required for precise key phrase/question formulation, users' multiple accounts, involvement of AI, low motivation of the targeted respondents, unreliable answers, etc.

The possibility from the hypothesis results shows that a difference between two groups is just a result thought to be the result of sampling variability if the P value is higher than the set alpha level 0.05. Even if there is no change at all, that is, if the effect size is exactly zero, a statistical test with an adequate number of samples will nearly always show a significant difference; nevertheless, very small differences, even if significant, are frequently meaningless. Therefore, it is insufficient to describe an analysis' substantial P value alone in order for researcher to completely comprehend the findings (Sullivan and Feinn, (2012). It is recommended that an effect size estimate be included in the report along with the p-value when performing null hypothesis testing.

Absolute changes in human behavior are necessary for survival in the post-carbon age. Technology and behavioral change must be taken into account side by side to lessen and brace for Climate Change. It is important to determine whether or not there is a willingness to reduce consumption in the future in addition to identifying current behaviors (Hayles and Dean, 2015). The analysis outcome shows that the availability of energy supplies has a favorable impact on cost-effective sustainability and energy security, both directly via the mediation of human behavior, perception and acceptance. (Qazi, Bhowmik, Hussain, Yang, Naseem, Adebayo, and Al-Rakhami, (2021).

This research has come to the conclusion that total primary energy supply (TPES) in Malaysia and electricity generation will be completely dependent on fossil fuels including coal, oil, and natural gas meet residential, commercial, and industrial (Abdul Latif, Chiong, Rajoo, Takada, Chun, Tahara and Ikegami, 2021). Therefore, given that it has been proven that fossil fuels facilitate greater CO2 combustion into the atmosphere and consumption, strategies should be adopted to improve it. This is because the rapid depletion of traditional energy sources and rising energy demand for high-performance markets have an impact on sustainability and energy security.

This study recommended that the government help markets by passing stringent regulations that result in long-term emission reductions and persistently promoting new carbon emission-reducing technology. The government can enact legislation like high tariffs on carbon, carbon sequestration, storage, and trade programs to limit CO2 emissions caused by burning fossil fuels in industry and generation of electricity (Raihan, Muhtasim, Pavel, Faruk, and Rahman, (2022). Therefore, when these elements are implemented, the effect would be large towards cost-saving sustainability and energy security, even when climate change is regulated or mediated.

Integrated coal gasification combined cycles (IGCC), pulverized coal-fired simple cycles (PC), and natural gas-fired combined cycles (NGCC) power plants' costs for CO2 separation and capture using current technology must be thoroughly examined. Reduced capture costs may be possible to advances in power generating and capture technology. For example, efficiency at the reference plant could be improved while capital investment is reduced. Improved solvents and system elements are also anticipated to lower the capital and energy expenses for synthesis gas or flue gas treatment to separate and capture CO2 (Rubin, Davison and Herzog, (2015).

There are several options that could be suggested such as hydropower, solar and biomass energy to improve the quality of atmosphere and environment from the CO2 emissions. In Sabah,

biomass energy could be the potential energy sources due to large palm oil and factories available especially in the east coast of Sabah. Additionally, to reducing emitted carbon dioxide, renewable energy offers important economic advantages such as increased energy availability, enhanced energy security, and the use of locally available renewable resources. As a result of growing environmental consciousness worldwide, it is essential and advised to shift the energy balance to renewables in order to make it possible to employ sustainable energy sources and to create an ecosystem that is environmentally sustainable. The empirical result suggested that a rise in patent applications may result in a decrease in CO2 emissions. This implies that through reducing emissions, the use of clean technologies in industrial processes may contribute to improving environmental quality.

The findings were also crucial as they showed a strong connection between nuclear energy towards cost-saving sustainability and energy security, including both direct and indirect effects when climate change is taken into account. Nuclear power plants have several advantages over fossil fuel power plants, despite the need to maintain absolute nuclear safety. Nuclear power stations can run continuously for a long period of time and have lower levelized costs than coal and gas power plants. They also emit less CO2 emissions. Therefore, it is recommended that nuclear power plants be included in the generation mix due to their lower operating and investment costs, lower CO2 emissions, and improved system reliability given the limitations on the costs and supply of fossil fuels and renewable energy.

5.4 Contribution

This study was established to offer suggestions on how industrial and business entities could reduce costs while maintaining cost-effectiveness by applying or producing more resource-efficient technology and policies. Thus, the study comprised contributions from the academic community and industry.

5.4.1 Academic Contribution

The study is crucial for determining the success of Sabah's implementation of energy security for future scholars. Additionally, the body of research on the relationship that has been examined and has demonstrated a notable result. This study's major contribution is the conceptual model's construction and empirical testing, which shows how the utilization of energy resources (such as nuclear, fossil fuels, and renewable energy is mediated by climate change) for cost-saving sustainability and energy security. The hypothesis establishes that there is no direct correlation

between (a) renewable energy, (b) fossil fuel energy, (c) nuclear energy, (d) cost-saving sustainability, and (e) energy security on climate change. This conclusion is based on previous theories and research regarding climate change and its outcomes as well as the former model. This study's aim was to encourage the development of more models for use in climate change research. Based on a review of pertinent research, a model of the independent variables influencing climate change was created and verified using survey data. Experimental evaluations of every potential causal link in the proposed model were conducted, and the results mostly confirmed the study's findings. The Protection Motivation Theory, which offers a framework to explain pro-environmental decisions and may then be used to encourage pro-environmental choices to lower environmental hazards; the Consistency Theory; explicitly or implicitly on the rational actor model of human behavior; mediating constructs from the Behavioral Reasoning Theory (BRT), such as (i) reasons for adoption, (ii) reasons against adoption, and (iii) attitudes towards a technology; and theory of planned behavior influenced by their awareness had an effect on climate change. The proposed model in this study can be used as a place to start for future research to better understand the interactions between important variables and as a conceptual framework for researching the variables influencing climate change. The attention on the variables impacting climate change in the context of Sabah's cost-saving and energy security is another important addition of this study. The idea of climate change has grown in significance as technology and the business environment have changed.

Environmental issues nowadays are of a global nature, necessitating pro-environmental behavior from both young and old people in order to address existing issues and prevent the emergence of new ones. People who are environmentally literate have the information and abilities necessary to analyze environmental problems, which would enable them to act in an environmentally friendly way (Wong, Afandi, Ramachandran, Kunasekaran and Chan, (2018). Many academics have contended that the phrases "environmental literacy," "ecological literacy," and "eco literacy" have been used in so many diverse contexts and/or are so inclusive that they have very little meaningful meaning. Nevertheless, despite the sometimes-seeming arbitrariness and indiscriminate use of these terms, great efforts have been made to clearly define and outline the fundamental elements of environmental literacy, ecological literacy, and eco literacy, and to firmly anchor their characterizations in profound theoretical and philosophical foundations (McBride, Brewer, Berkowitz and Borrie, (2013).

The structural equation model revealed that a Sabah's people concern, attitudes, and sense of personal responsibility towards environmental protection are stimulated by poor levels of

environmental knowledge. More precisely, it was found that environmental awareness significantly predicted environmental concern, resourcefulness with regard to energy, cost-saving measures, attitudes, and responsibilities. Environmental attitudes and responsibility were significantly correlated indirectly with environmental knowledge. Furthermore, whereas views towards the environment were discovered to be a key factor of environmental responsibility, environmental concern had a substantial association between attitudes towards the environment and outdoor activities (Teksoz, Sahin and Tekkaya-Oztekin, (2012).

5.4.2 Industry Contribution

The government of Malaysia became extremely concerned about the rising energy consumption and worked to address it by encouraging end-use energy efficiency, which entails consuming less energy while providing the same level of service. One way to do this is to use less energy overall, whereas another is to use more energy while producing more. The best way to cut greenhouse gas emissions, however, is to increase energy efficiency. The finding from this study suggests that industry and commercial business could achieve a more efficient use of final energy by calculating the amount of energy used and energy losses by supplying various equipment and devices that use energy at varying levels of efficiency depending on the characteristics and working conditions.

The findings of this research are both theoretically sound and practically applicable. It is crucial for the commercial and industrial communities to comprehend how elements relating to energy demand and efficiency affect Sabah's development. Significant changes are being made in how energy, notably electricity, is produced, transferred, and used in Malaysia due to worries about energy security, the volatility of crude oil prices, and climate change. In 2009, fossil fuels such natural gas, coal, diesel and fuel oil were used to generate 94.5% of the country's electricity. The research has also pointed out some practical implications of our reliance on fossil fuels and recommended carbon capture and storage as one of the proposals to reduce CO2 emissions to the atmosphere in addition to transmitting electricity energy to the industrial and business community as a whole. An important factor in increasing overall efficiency and reducing energy waste is the urgent need to explore for alternative fuel options derived from renewable sources while simultaneously reducing reliance on fossil fuels (Shadman, Hanafiah, Chin, Yap and Sakundarini, (2021). This would increase Malaysia's access to and affordability of electricity. Energy use in Malaysia's industrial and commercial sectors has increased as a result of increased economic activity and population growth (from 28 million in 2010 to 32 million in 2019). This

resulted in an increase in energy demand of 5% to 7% each year for the following 20 years (Zakaria, Kamarudin and Wahid, (2021). Therefore, it is crucial to fulfil this rise in demand in a way that is ecologically benign, dependable in terms of supply security, sustainable for energy resources, and economical.

However, given the competitiveness of many renewable energy sources today, it will almost likely call for the development of a new generation of nuclear and "clean coal" technologies as well as the encouragement of a larger role for these sources. Investment in new technologies will also be necessary, from those that are now in use (like the conversion of natural gas into liquid fuel) to others that are in development (like biological engineering for energy supply). The amount of money being invested in technologies throughout the energy spectrum is skyrocketing right now, which will be good for both the environment and the future of energy (Yergin, (2006); Sovacool, (2011). Through this study also, assist the government, the public at large, and the business community in managing energy resources (renewable, fossil fuels, and nuclear energy) economically and protecting the environment and atmosphere from climate change's impacts with more of cost-effective and safeguarded energy security in Sabah.

5.5 Policy Implementation

In the upcoming years, the energy sector will need to focus on a number of important goals that are outlined in the National Energy Policy, 2022-2040 (DTN). The energy industry will be pushed by the DTN as a driver of socioeconomic growth (POVERA, (2022). The energy industry will also be able to fully capitalize on possibilities brought about by the energy transition attributable to the DTN's driven Low Carbon Nation Aspiration. The energy industry will need to align with domestic developments and be well-positioned to support the Wawasan Kemakmuran Bersama 2030 (WKB 2030) and Twelfth Malaysia Plan, 2021–2025 (Twelfth Plan), Abdullah, Zanudin and Marzukhi (2022). Energy transition describes a fundamental change in energy systems in favor of greener energy sources. This transition entails a change from a consumption pattern dominated by fossil fuels with high carbon emission intensity to one with a higher rate of renewable energy (RE) utilization and lower carbon emission intensity. Rapid technology advancement and aggressive climate change legislation are projected to accelerate the present energy transition.

In order to ensure that all Malaysians have a decent standard of living through development for all, address wealth and income disparities, and create a united, prosperous, and dignified Malaysia, WKB 2030 serves as the primary reference point for the country's progressive national socioeconomic goals development and growth priorities (Mujani, Ismail, Mohamad, Kashim,

Hussin, Kamaruzaman and Idris (2021). In order to achieve these goals, the energy sector must play a crucial role. The energy sector is directly impacted by five Key Economic Growth Activities (KEGAs), including the green economy, renewable energy, and sustainable mobility. Improving the resilience of the nation's fiscal and economic situation by fostering new energy-related industries would also help achieve the goal of decreasing reliance on petroleum-based revenue and commodity trade. According to Sustainable Development Goal 7 of the 2030 Agenda for Sustainable Development (2030 Agenda) and Aspirasi Keluarga Malaysia, the energy sector would improve everyone's access to reliable, economical, and environmentally friendly energy (Isa, Sivapathy and Kamarruddin (2021). By utilizing the nation's abundant energy resource resources, equitable regional development will be supported by prioritizing the distribution of energy-related costs and benefits across income groups, ethnicities, regions, and supply chains.

The DTN includes oil, natural gas, coal, hydropower, solar, photovoltaic, bioenergy, and other cutting-edge energy sources within its wide range of renewable and non-renewable energy sources. The final use of energy in every sphere of the economy, including transportation, industry, housing, and commerce, is likewise covered by DTN. The country will reap significant benefits from the prompt and efficient execution of the DTN programs. This includes improve social outcomes for Malaysians by fostering balanced regional development and securing future-proof jobs for workers. Protecting low-income households' access to affordable energy and advancing rural electrification will be priorities. Greater domestic energy independence and fuel diversification will promote a more robust energy industry and enable improved control over energy as a major strategic resource for the nation. Energy affordability has advantages such as improved energy access and reliability. In terms of the energy sector's environmental sustainability, significant gains are expected in the future. These advantages will be distributed equally to all parties involved, including the rakyat, industry, and government.

5.6 Future Research

Further research recommended investigations that examined at the relationship between performance and efficacy towards risk management in Malaysia, specifically in Sabah. It is challenging to comprehend the nature of acceptance and energy progress in Malaysia due to the lack of empirical studies and policies connected to both factors. A robustness analysis using other techniques or other instruments is recommended to be explored into as well. It may help the government to exclusively revise and achieve its environmental and energy supply aspiration to conserve biodiversity and as energy is central to economic development, ending energy poverty

is an inherently political process, which is the 2030 Agenda for Sustainable Development is at its core. in Sabah and access to power access (Tian Shen Liang, 2016).

5.7 Conclusion

The final chapter of the research is meant to provide an assessment of the research findings, clearly explained, suggestions, and the research's input. This study concluded that two primary issues with Sabah, Malaysia's energy supply security, namely an over reliance on fossil fuels and rising energy demand. This finding of this paper reveal that there is a need to emphasizes and re - examine the energy policies, the current trend in energy demand, energy security, and challenges, as well as pertinent strategic options, in order to accomplish economical and development of a sustainable energy supply that will improve not only the state's energy supply but also mitigate climate change. The results also concluded that the government must continue stepping up the implementation of its programs for energy efficiency and renewable energy in order to assure the sustainability and safeguard the State's energy supply and, by extension, its sustainable economic development. Therefore, government and non-government organizations should take more proactive measures to coordinate and promote energy generation based on renewable resources, such as inventorying renewable sources, identifying suitable and affordable technologies, developing incentives for appropriate practical application, and improving the State’s renewable energy policy to encourage greater participation from the government, non-government organizations, and the general public.

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APPENDIX 1: COVER LETTER

17 May 2023

Dear respondents,

Subject: The Mediating Effect of Climate Change on the Relationship Between Energy Resources & Cost – Saving Sustainability and Energy Security in Sabah, Malaysia.

Researcher: John Stephen Dionysius, Graduate School of Business, Master of Business Administration (Project Management)

This is John Stephen Dionysius, a Master candidate in the Graduate School of Business at Tun Abdul Razak University (UNIRAZAK), Malaysia. The title of my research project is The Mediating Effect of Climate Change on the Relationship Between Energy Resources & Cost – Saving Sustainability and Energy Security in Sabah, Malaysia.

The main objective of the study is to enlarge the definition of energy security to encompass maintaining the safety of the energy supply chain and to identify the remaining hindrance to alternative energy sources implemented to meet the power demand as a solution. The study specifically focuses on three independent variables, i.e., Renewable Energy, Fossil Fuels Energy and Nuclear Energy and the impact on Climate Change that may affect the cost – saving sustainability and energy security in Sabah, Malaysia.

Participation will involve completing this questionnaire by using Google Form. This set of the questionnaire consists of four (4) sections. Section A is related to contains questions related to respondent's demographics. Section B, C, D is related to the three (3) independent variables. Section E contain a question relates to Climate Change as mediating variable. Sections F and G correspond to Cost-Saving Sustainability and Energy Security. The questionnaire shall take around 15 minutes to complete.

I would appreciate it if you could give your cooperation by devoting your precious time to the survey. It must be stressed here that the data obtained from this survey will contribute to my thesis and appear in academic journals or may be presented at academic conferences, and all the information will be strictly confidential. By submitting the completed questionnaire, you consent to participate.

Should you have any queries or wish to know more about this study, feel free to contact me,

John Stephen Dionysius

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Your kind cooperation and contribution to my study is highly appreciated. Thank you

Thank you

APPENDIX 2: QUESTIONNAIRE

Section A: Demographic (Sharma, Minh Duc, Luu Lam Thang, Nam, Ng, Abbas and Karamouzian (2021)

Please select one (1) answer that best describe yourself.

1. Gender

□ Female

□ Male

2. Age

□ Under 18

□ 18-24

□ 25-34

□ 35-44

□ 45-54

□ 55-64

□ 65 or more

3. Highest Education Level

□ High School

□ Diploma

□ Degree

□ Master

□ PhD

4. Income

□ RM0 – RM2,999

□ RM3,000 – RM5,999

□ RM6,000 – RM9,999

□ Above RM10,000

4. Profession / Occupation

□ Human Right Activists (NGO)

□ Public Sector

□ Private Sector

□ Self-employed/ Business owners

□ Unemployed/ Homemakers/Retired

□ Politician

5. Region/Location

□ West Malaysia

□ Northern Sabah

□ Southern Sabah

□ East Coast Sabah

□ West Coast Sabah

□ Interior Sabah

APPENDIX 3: MEASUREMENT ITEMS

Please indicate your opinions on a 5-point scale to the following statements regarding factors influencing to the cost effectiveness and energy security sustainability.

(1–strongly disagree, 2–disagree, 3-neutral, 4-agree, 5-strongly agree)

Independent Variables	Strongly Disagree ← → Strongly Agree				
	1	2	3	4	5
Section B: Renewable Energy (RE) i) Hydropower ii) Solar Energy iii) Biomass Energy iv) Wind Energy v) Etc	Badsar and Karami (2021); (Qazi, Bhowmik, Hussain, Yang, Naseem, Adebayo, and Al-Rakhami, 2021); Covert, Greenstone, and Knittel (2016); Masud, Akhtar, Islam, and Duasa (2015);				
1. I have knowledge, awareness, and information on RE implementation.					
2. I tend to agree that renewable energy is the alternative for future power generations.					
3. I am willing to pay (WTP) for an additional utility cost and technology purchases.					
4. Lack of awareness and education causes implementation of renewable energy progressing slowly.					
5. Lack of policy, subsidies, incentives, etc. in implementing renewable energy.					

Section C: Fossil Fuel Energy (FFE) - (Natural Gas, Coal & Oil)	Opoku, Filho, Hubert, and Adejumo (2021); Shahbazi, and Nasab, (2016); Caramanna, and Maroto-Valer (2014)				
1. I tend to agree that FFE sources is "the mother of global warming.					
2. I tend to agree that FFE sources is still the dominant for power generations.					
3. I tend to agree that FFE sources should be banned or controlled.					
4. I tend to agree that Transportation, Commercial business, and Industrial sectors is a major contributor to FFE demand for energy.					
5. I tend to agree Carbon Capture & Storage (CCS) is the solution to our environment and atmosphere.					
Section D: Nuclear Energy (NE)	Misnon, Hu, Rahman and Yasir, (2017); Poortinga, Demski, and Pidgeon (2011); Teravainen et al. (2011).				
1. I tend to believe that the country ready for nuclear energy to increase energy demand.					
2. I tend to believe that NE is a clean, affordable energy and solution to climate change and environment.					
3. I tend to believe that NE would increase in risks of accidents related to nuclear waste and transport of nuclear waste.					

4. I believe that lack of transparency on policy, information, awareness on NE and its waste management.					
5. There is a concern on NE safety and its effects on humans, animal, ecology, environment, plants, and atmosphere.					

Mediating Variables	Strongly Disagree ← → Strongly Agree				
	1	2	3	4	5
Section E: Climate Change	Hua and Wang, (2019); Toke and Vezirgiannidou, (2013)				
1. I am aware that climate change is far too worst.					
2. I am willing to contribute and participate in climate change program.					
3. I am concerned about diseases, health, business, threatening food security, etc. and will affects my daily lifestyles.					
4. I tend to agree on online and social media, expert, NGO on reliable information than the government and politician sources.					
5. Lack of government policy, awareness, education program and commitment to tackle climate change.					

Section F & G: Dependent Variables

Please indicate your opinions on a 5-point scale to the following statements regarding energy resources.

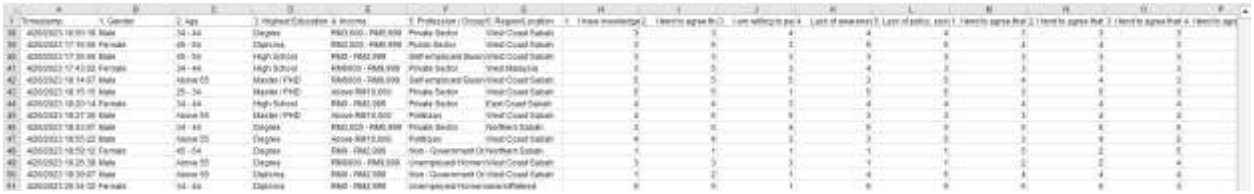
(1–strongly disagree, 2–disagree, 3-neutral, 4-agree, 5-strongly agree)

Dependent Variables	Strongly Disagree ← → Strongly Agree				
	1	2	3	4	5
Section F: Cost-Saving Sustainability (CSS)	Bhutto, Liu, Soomro, Ertz, and Baeshen (2020).				
1. Environment Tax (ET) should be introduced to curb environment pollution.					
2. Corruption is hindering Cost Saving Sustainability (CSS) in implementing the future power generations.					
3. Technology innovation and energy efficiency products is too expensive and costly.					
4. Lack of financial capability hindered the implementation of future power generations.					
5. Financial management and energy consumption will be able to ease cost – saving sustainability.					
Section G: Energy Security (ES)	OECD/IEA, (2007); Toke and Vezirgiannidou, (2013); Helm and Hepburn (2009), Giddens (2011), Held et al., 2011); (Giddens 2011); Elkind (2009); Pascual and Elkind (2010)				
1. I have knowledge on the Energy Security issues.					

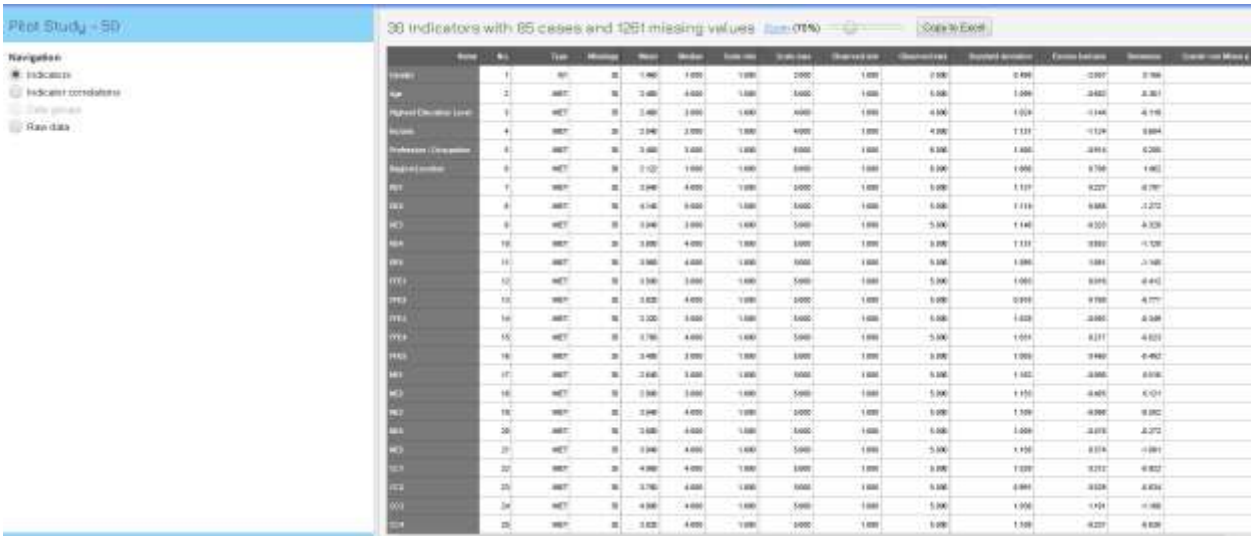
2. Energy security and climate change are two different issues and policy to handle.					
3. Energy Security should be handled and considered as “Risk Management”.					
4. The lack of Energy Security policy hampered the country to progress and develop.					
5. The lack of awareness, education and knowledge hindered the people from participating in curbing energy security issues.					

APPENDIX 4: PILOT STUDY ANALYSIS RESULTS (SMARTPLS4)

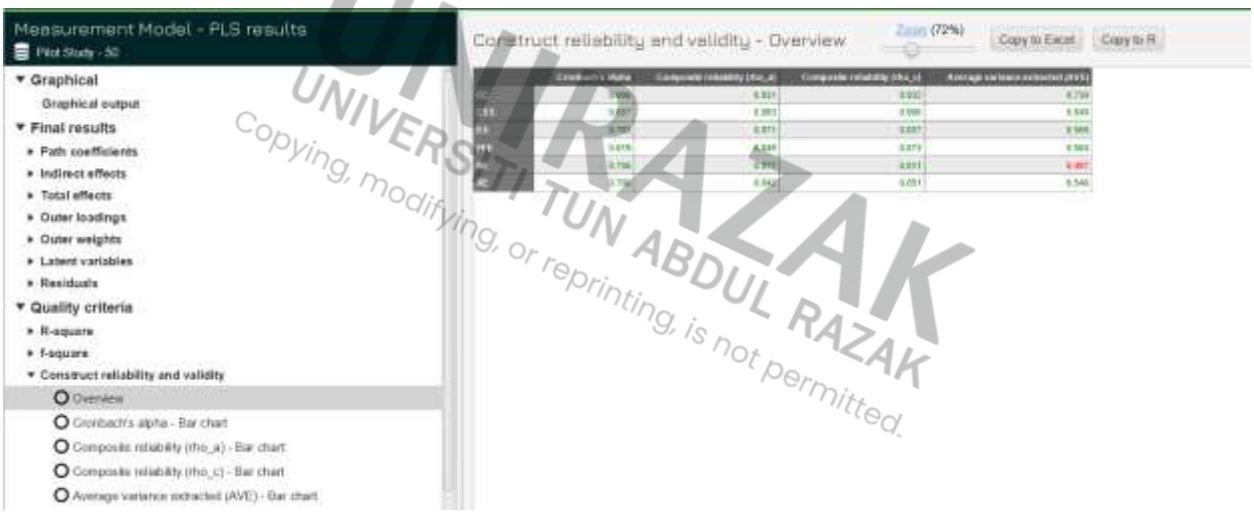
i) Responses



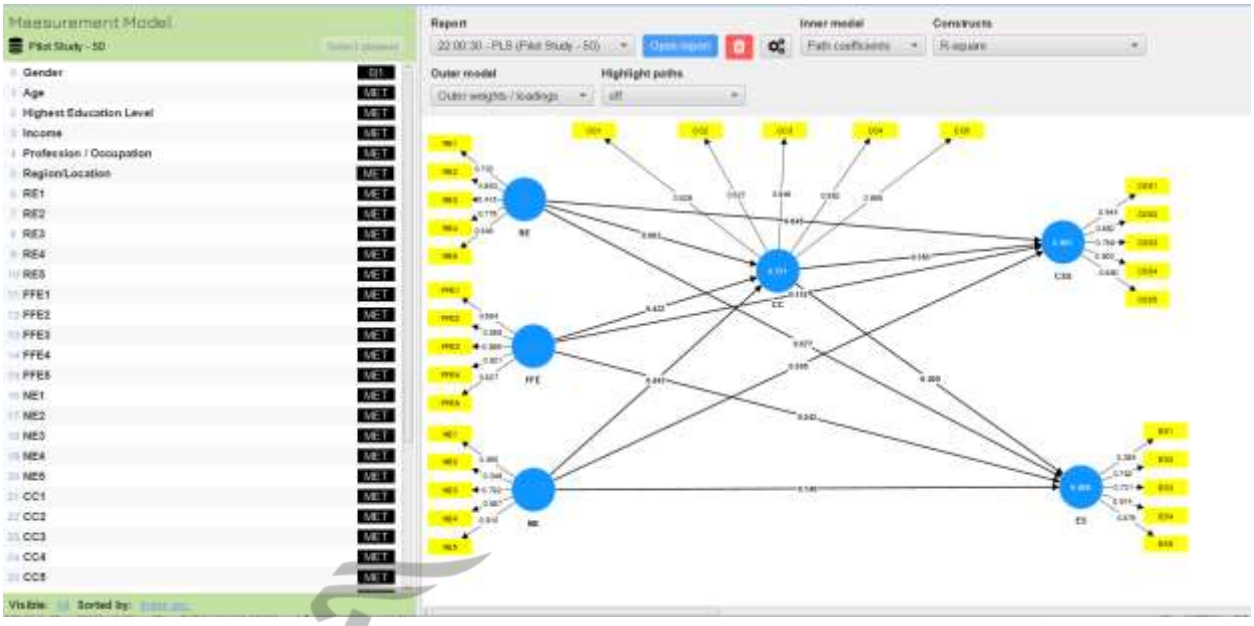
ii) Indicators



iii) Construct Reliability and Validity



iv) Measurement Model



APPENDIX 5: DEMOGRAPHIC FREQUENCY DISTRIBUTION (SPSS)

i) Frequency Distribution for Gender

Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	45	56.3	56.3	56.3
	2	35	43.8	43.8	100.0
	Total	80	100.0	100.0	

ii) Frequency Distribution for Age

Age

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	12	15.0	15.0	15.0
	2	17	21.3	21.3	36.3
	3	15	18.8	18.8	55.0
	4	25	31.3	31.3	86.3
	5	11	13.8	13.8	100.0
	Total	80	100.0	100.0	

iii) Frequency Distribution for Highest Education Level

Highest Education Level

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	19	23.8	23.8	23.8
	2	26	32.5	32.5	56.3
	3	23	28.7	28.7	85.0
	4	12	15.0	15.0	100.0
	Total	80	100.0	100.0	

iv) Frequency Distribution for Income

Income

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	41	51.2	51.2	51.2
	2	15	18.8	18.8	70.0
	3	13	16.3	16.3	86.3
	4	11	13.8	13.8	100.0
	Total	80	100.0	100.0	

v) Frequency Distribution for Income

Profession / Occupation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	7	8.8	8.8	8.8
	2	22	27.5	27.5	36.3
	3	21	26.3	26.3	62.5
	4	9	11.3	11.3	73.8
	5	17	21.3	21.3	95.0
	6	4	5.0	5.0	100.0
	Total	80	100.0	100.0	

vi) Frequency Distribution for Region / Location

Region/Location

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	39	48.8	48.8	48.8
	2	14	17.5	17.5	66.3
	3	4	5.0	5.0	71.3
	4	3	3.8	3.8	75.0
	5	8	10.0	10.0	85.0
	6	12	15.0	15.0	100.0
	Total	80	100.0	100.0	

APPROVAL PAGE

TITTLE OF PROJECT PAPER: THE MEDIATING EFFECT OF CLIMATE CHANGE ON THE RELATIONSHIP BETWEEN ENERGY RESOURCES AND COST - SAVING SUSTAINABILITY AND ENERGY SECURITY IN SABAH, MALAYSIA

NAME OF AUTHOR: JOHN STEPHEN DIONYSIUS

The undersigned certify that the above candidate has fulfilled the condition of the project paper prepared in partial fulfillment for the degree of Master of Business Administration.

SUPERVISOR

Signature :
Name :
Date :

ENDORSED BY:

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Dean

Graduate School of Business

Date: