CARBON TAXATION AND ITS ROLE IN PROMOTING RENEWABLE ENERGY ADOPTION

by

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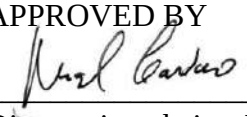

Dissertation chair – Dr. Gualdino Cardoso

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Admissions Director

Dedication

Dedicated to My parents

Late Mrs. Malleswari Rayaprolu &

Mr. Subrahmanyam Rayaprolu

ABSTRACT

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Dissertation Chair: Dr. Gualdino Cardoso
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The influence of carbon taxation in supporting renewable energy and sustainability is the focus of this research. The primary aim is thus to measure attitudes towards carbon taxation, regarding the efficiency of the instrument and its impact on behavior as well as on the advancement of renewable energies. Additionally, the study explores relationships between attitudes toward carbon taxation, perceived effectiveness, and adoption behaviors. The research utilizes a quantitative methodology, employing a structured survey to collect data from a diverse sample of respondents. The survey is designed to measure key constructs such as attitude towards carbon taxation, subjective norms regarding carbon taxation, perceived behavioral control over renewable energy adoption, behavioral intention to adopt renewable energy and perceived effectiveness of carbon taxation in achieving environmental goals. A survey of 100 participants assessed attitudes, behavioral intentions, and actual adoption patterns related to renewable energy. Statistical analyses, including Spearman's correlation and logistic regression, evaluated the relationships between key variables such as attitudes toward carbon, and renewable energy adoption. As

for the findings, they demonstrate rather positive attitudes towards carbon taxation as a tool to punish offenders and motivate green innovators as well as encourage sound practices. The level of perceived effectiveness of carbon taxation affects both behavioral intention and adoption behavior; behavioral intention was instrumental in increasing high levels of renewable energy adoption. Therefore, the study finds that carbon taxation is a suitable policy tool for decarbonizing energy and managing climate change. However, this success depends on fair implementation and other synergy activities like subsidizing "Renewable Energy Sources" (RES) and raising awareness. The implications of this research are important for policymakers, suggesting that carbon taxation has both economic and behavioral consequences to which appropriate attention should be paid when designing and implementing carbon taxation systems. It entails nurturing support from the public, how the taxes have been structured and better policies on RES. The findings contribute to growing body of literature advocating for carbon taxation as a critical tool in achieving environmental sustainability and transitioning toward a low-carbon economy.

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LIST OF ABBREVIATIONS

Abbreviations	Full Form
RES	Renewable Energy Sources
CO_2	Carbon Dioxide
RE	Renewable Energy
MNRE	Ministry of New and Renewable Energy
GPCL	Gujarat Power Corporation Ltd
WBREDA	West Bengal RE Development Agency
NIOT	National Institute of Ocean Technology
IFC	Information Flow and Communication
BEE	Bureau of Energy Efficiency
GHG	Greenhouse Gas
TPB	Theory of Planned Behavior
PBC	Perceived Behavioral Control
SEM	Structural Equation Modelling
SETs	Solar Energy Technologies
DPGs	Distance from Power Grids
EEAs	Energy-Efficient Appliances
NDC	Nationally Determined Contribution
SPSS	Statistical Package for the Social Sciences
RPTs	Renewable Power Generation Technologies
PEPB	Pro-Environmental Planned Behaviour
PAS	Perceived Authority Support
DEA	Data Envelopment Analysis

MIMO	Multi-Regional Input-Output model
CGE	Computable General Equilibrium
GTAP	Global Trade Analysis Project
SVAR	Structural Vector Autoregressive
IRF	Impulse Response Functions
EKCH	Environmental Kuznets Curve Hypothesis
IBR	Inclining Block Rates

CHAPTER I:
INTRODUCTION

1.1 Background

According to IPCC (2022); Stern (2006), "Fossil fuels" including oil, coal, and natural gas emit "carbon dioxide (CO2)" that causes economic growth, environmental change, and global warming. Wind, solar, wave, hydro, biomass, geothermal, and tidal power are “renewable energy” (RE) sources that may become more popular due to energy security and environmental concerns. In addition, rising energy prices have spurred interest in RE sources as fossil fuel alternatives. Thus, numerous companies and colleges worldwide are imagining a RE-powered future to find a long-term energy answer.

There has been tremendous growth in the worldwide RE industry. The global financial crisis of 2008 caused a growth in investments in new renewable capacity of US$120 billion, from US$104 billion two years before. Solar thermal power grew by 15% in 2008, wind power by 29%, and the total capacity of solar photovoltaic systems connected to the grid by 70%. During the same year, small hydro also experienced a considerable percentage increase. The Renewable Global Status Report rates leading nations in terms of “renewable energy” (RE) investment and capacity size up until 2008, and it further classifies them according to investor type within RE. Various RE sources are receiving large investments from growing economies like Turkey, Brazil, China, India, Indonesia, and the Philippines, according to this study.

Despite MacKenzie (2003) claims that LDCs should be allowed to use fossil fuels for a while so they might industrialize, several emerging economies have begun to invest heavily in RE. Sadorsky (2009) Studies examining the factors driving RE consumption in the G7 have shown that increasing levels of CO_2 per capita and real GDP per capita are long-term drivers of this trend. According to Sadorsky (2009b) who used panel cointegration techniques to delve deeper into the correlation between income and RE consumption in 22 developing nations, Although still in its infancy, the demand for RE consumption is rapidly increasing in emerging economies. Given how quickly RE sources

are being adopted in emerging economies, it's critical to comprehend the variables influencing their utilization.

Innovative RE capture systems are replacing coal, gas, and oil worldwide. Since they emit no carbon dioxide or greenhouse gases, RE sources are considered clean energy (Dato, 2018). RE has been around for a while, but RE technologies are new. People have historically used the sun to heat and light granaries (Sommerfeld, Buys and Vine, 2017). Increased human dependency on fossil fuels and other non-RE sources causes several negative effects, including accelerated global warming.

Modern energy harvesting technologies offer green electricity alternatives. Solar panels of various sizes can generate clean energy from solar energy (Reyes-Mercado and Rajagopal, 2017). Renewable technology can power cars, provide electricity, and heat.

Several RE sources can replace fossil fuel-based energy. Example: solar power (Oguntona *et al.*, 2021). Energy for heating and lighting can be harnessed from the sun by installing solar systems. Among the many RE options, solar panels are one example of a solar-powered technology (Sardianou and Genoudi, 2013). Solar power generated 2% of the world’s power in 2019. The use of wind turbines to generate electricity is another example of RE. As wind speeds up turbine blades, they feed energy into an electric generator, which in turn generates electricity (Makki and Mosly, 2020). Many countries have begun to rely on wind power; in Europe, for example, it generates fourteen percent of the continent's electricity.

Another RE source is hydropower. Hydropower converts water's mechanical energy into electricity. Electric power plants are usually near high-velocity water sources that move turbine blades and turn generators. Hydroelectric dams generate power based on water flow and velocity (Chel and Kaushik, 2018). With 36% of its power coming from hydropower, Europe is among the top regions in the globe. Organic resources derived from plants and animals are utilized in renewable energy technologies, such as biomass. You can burn plants or chemically transform them into liquid fuels because plants store chemical energy from sunlight. Among RE sources, biomass ranks high. Four percent of Europe's energy is biomass. Energy consumption is rising due to global economic growth.

Environmental repercussions from increasing economies have depleted natural resource supplies, calling conventional fossil fuels for energy generation into doubt.

Despite having one-seventh of the world's population, India uses less than four percent of the primary energy produced. Power from contemporary RE sources accounts for just a small percentage of the total. A specialized government department in India known as "Ministry of New and RENEWABLE ENERGY" (MNRE), previously known as "Ministry of Non-Conventional Energy Sources," (Pillai and Banerjee, 2009).

Conventional power-producing systems are unable to meet India's massive energy needs. The Great Indian Outage, from New Delhi to Kolkata, was the world's worst power outage. Over 700 million people—double the US population—were affected by the northern electrical system failure on July 30 and 31, 2012. Geothermal, wind, solar, biomass, and small-scale hydropower might power the world for years. These sources use natural, locally sourced resources, making them sustainable (Akella, Saini and Sharma, 2009). Renewable energy might bring clean energy to a big section of the world's population (Painuly, 2001). Renewable energy systems that are sustainable, economical, environmentally friendly, and able to meet the increasing energy demand generated by population development in emerging nations are crucial (Wilkins, 2010). According to S. Reddy & Painuly (2004), India's RE sources are abundant and distributed, with a potential that exceeds its energy consumption. If India wants to address environmental change and global warming, it must promptly develop and device programs to growth RE energy use. Doing so will benefit the economy and environment. If India wants to fulfil its future electricity needs, it must switch to clean RE sources, making these investments appealing.

1.2 Sustainability and Renewable Energy in India

Sustainable energy is defined as an ongoing supply of energy that satisfies current demands without jeopardizing the capacity of subsequent generations to accomplish the same. as opposed to RE, which derives its power from naturally occurring resources that are perpetually replenished by the elements (Chang et al., 2003; Ndimba et al., 2013). There are seven renewable and sustainable energy sources—solar power, hydropower, tidal

power, geothermal power, wind power, biomass, and wave power—that have been recognized from the literature and briefly described with their recent state in India.

- **Solar energy**

Solar power is the most prominent, universally accessible, and cost-free source of RE. Because of its advantageous position in the solar belt (401S to 401N), India is one of the top countries that get solar energy (Ramachandra, Jain and Krishnadas, 2011). Because of its proximity to the Equator, India has tremendous promise as a solar power destination. Nearly 3,000 hours of sunshine per year—or 5,000 trillion kWh—fall on India. India plans to develop 20,000 MW of grid-connected solar power by 2022, with an growth of 2208.36 MW in January 2014 (Khare, Nema and Baredar, 2013). India has a lot riding on its RE development—it might help with energy security, local environmental consequences, carbon intensity, regional development equity, and high-tech industry leadership.

- **Wind energy**

Wind power is an environmentally friendly and clean RES that can help us cut back on our use of fossil fuels (Leung and Yang, 2012). With an installed capacity of around 21,136.3 MW as of March 31, 2014, India ranked fifth among the world's wind energy producers, behind China, the US, Germany, and itself. Power generation from available wind has increased dramatically thanks to recent technological developments in wind energy architecture. Every year, 2.1 GW of new installations are added. India's wind sector is a dominating force in the global market. A total of 28% annual growth in installed capacity characterizes the wind markets around the world over the past decade. (Khare, Nema and Baredar, 2013).

- **Hydro energy**

Among the many RES, hydropower stands out for its use of the planet's "natural water cycle" to produce power. According to Sarkar et al. (2014). India is the sixth most hydro-potential-rich country in the world. This boon comes from the country's abundance of naturally occurring hydroelectric plants. However, according to Jain & Patel (2014) The country's overall hydro potential is 150,000 MW. With 39,788.40 MW of installed capacity as of September 30, 2013, India's total energy production was 17.39% (Kumar and Katoch,

2014). The potential for India to construct hydropower capacity exceeding 0.1 million MW remains. Using small rivers and canals for mini- and micro-hydro-power generation could be a smart move towards harnessing all of the water in our reservoirs and streams for RE. (Reddy, Kaushik and Panwar, 2013).

- **Geothermal energy**

Potential uses of geothermal energy include both on-grid and off-grid projects, in addition to its obvious immediate uses in cooking, swimming, heating, industrial process heat, bathing, drying crops, heating greenhouses, and powering open regions and rural areas. Based on their mapping, The geothermal resources in India have an estimated potential of around 10,600 MW, according to “Geological Survey of India” (Mahesh and Shoba Jasmin, 2013). The bulk of geothermal energy is now consumed directly by swimming pools and spas. In the food processing sector, geothermal energy could be used directly for low-grade heating.

- **Biomass energy**

Worldwide, biomass has had a renaissance in the last decade as a potential RE source. Biofuel can be utilized to describe fuels made from biomass, whether they are solid, liquid, or gas. According to Singh & Gu (2010). primary drivers behind biomass conversion to energy in India are reduced costs and improved conversion efficiency. The potential loss of natural habitats and cropland, increased food costs, and insufficient decrease in greenhouse gas emissions are some of the main arguments against biomass, especially when it comes to large-scale fuel production.(Ratha and Prasanna, 2012).

- **Tidal power**

India's 7,500 km coastline has adequate estuaries and gulfs to power turbines (Baba *et al.*, 2013). Nationwide, tidal energy can generate 8,000 MW. This potential is about 7,000 MW in the Gulf of Cambay, 1200 MW in Gujarat's Gulf of Kutch, and 100 MW in West Bengal's Gangetic Delta, part of the Sunderbans. In January 2011, Gujarat signed a "memorandum of understanding" to build a 250 MW Gulf of Kutch tidal power project. In May 2011, "Gujarat Power Corporation Ltd." (GPCL) became a Special Purpose Vehicle. In Kutch, this was for Mandavi's 50 MW tidal power plant's initial phase. The Ministry of

Power approved a 3.75 MW demonstration tidal power station in West Bengali Sunderbans. This is Durgaduani Creek. Kolkata's "West Bengal RE Development Agency" would manage it.

- **Wave energy**

Ocean power might meet some of the world's electrical demand and minimize our dependence on fossil fuels. (Alamian *et al.*, 2014). Ocean waves develop when wind energy is turned into wave energy. Wave quality varies year-round. A realistic formula approximates the entire wave energy potential. A thorough investigation of wave parameters suggests waves of up to 40,000 megawatts might impact the Indian coast. In actuality, the possibility is probably far smaller. While we do have operational experience and prototypes, this technology is not yet available for purchase. The "National Institute of Ocean Technology" (NIOT) has a wave energy plant that can desalinate 7,000 to 8,000 litres of water daily, or 6-7 kW (Pillai and Banerjee, 2009).

1.3 Barriers to renewable/sustainable energy technologies adoption

According to the research, there are some obstacles. Institutional, governmental, and regulatory hurdles; social and environmental obstacles; and financial, technological, and market hurdles, such as uneven pricing systems, are all examples of such obstacles. Some of these obstacles may be country- or region-specific, while others may be technology-specific. The following is an explanation of these:

1. **High initial capital cost**

Though it may need a larger initial investment, imported technology from wealthy nations is often more efficient, but it can also be more expensive (Karakosta, Doukas and Psarras, 2010). Renewable and sustainable energy technologies may not be widely adopted by consumers due to their high and uncompetitive initial costs (Hirmer and Cruickshank, 2014) For many buyers, reducing operational costs takes a back seat to keeping the initial investment low (Reddy and Painuly, 2004).

2. **Lack of financing mechanism**

RE technologies in India are still in their early stages of development. For India, like other developing nations, development of sustainable and RE technology seemed to

be heavily influenced by financial and economic concerns. According to S. Reddy & Painuly (2004) industry and enterprises are not being adequately incentivized to utilize renewable and sustainable energy technology by the government. An important problem with the widespread use of RE sources is the limited access to financing for their acquisition (Painuly, 2001). While SMEs may have connections to bigger technology producers and official communication channels, they mostly confront the problem of "lack the finances" when it comes to implementing greener technologies.

3. Transmission and distribution losses

India's coal-fired generating plants are mostly subcritical and have 35–38% thermal efficiency. Due to management inefficiencies and Indian coal's low heat and high ash content, these plants often have thermal efficiencies of around 30% (Bhattacharya and Cropper, 2012). Over 30% of power is lost in generation, transmission, distribution, and consumption. Continuous surveillance is needed to manage losses like power theft (Ansari *et al.*, 2013). Geography affects the viability of converting renewable and sustainable energies into mechanical and electrical forms. Transmission and distribution losses can be high when generation and consumption are far apart.

4. Ineffective technology

According to Ansari et al. (2013), thermal power plants in India produce 50-120% higher CO_2 per kWh due to inefficiency compared to their counterparts in the EU-27. These plants burn coal, oil, or gas. Inefficient technology or technological risk may cause technological underperformance or early obsolescence. Rejection may be site-specific, posing a technological risk (Painuly, 2001). Early-stage technologies include concentrated solar power and wind power. RES cost higher than coal-fired power facilities. S. Bhattacharya & Cropper (2012). The unreliability of modern technology in India is one reason they are not widely adopted. Cellulosic ethanol and hot dry rock geothermal resources are significant, but India has been sluggish to use them. The renewable energy policies of India do not adequately address the potential of cofiring and BIGCC (Bhattacharya and Jana, 2009).

5. Lack of subsidies

In several countries and jurisdictions, renewable energy has been subsidized through rebates or output rewards. You can get your money back in a few different ways using rebates. You can get a set amount for each installed unit of capacity, or you can get a percentage of the total installation costs (like 30%). More easily accessible financial incentives, like tax breaks, long-term credit, low-interest loans, subsidies, and funding specifically designated for grid-connected projects in mountainous or remote areas, could help RE initiatives.

6. Lack of technological awareness among consumers

The imperfect market is the biggest challenge because people have less information than with traditional energy systems. Their main source of information was newspapers and magazines. If stakeholders are not informed about renewable/sustainable energy technologies' costs and benefits, they may not promote them (Reddy and Painuly, 2004). Since they are unaware of the latest innovations in the field, India's largest electricity consumers are concerned about the sustainability and reliability of renewable energy products and services (Kennedy and Basu, 2013; Harish and Kumar, 2014).

7. Insufficient resources for information technology

Poor "information flow and communication" (IFC) is a major barrier to technology transfer. Connecting to efficient RE technology demands information. IT can help firms maximize support resources and reduce study consumption (Luthra *et al.*, 2011). Every technology transfer participant must be aware of how information technology affects the process (Al-Mabrouk and Soar, 2009).

8. Technology complexity

Most RE and sustainable technology solutions are complex. Wind energy comes from Earth's rotation, solar heat, ocean and polar ice cap cooling, land-sea temperature gradients, and physical obstacles like mountains (Kumar *et al.*, 2010). Bioenergy production optimizes for numerous conflicting aims, therefore trade-offs must be carefully addressed to reach a compromise. The issue is complex, involving capacity, technology, location, and route analysis.

9. Lack of research and development work

India is developing RE technology (Painuly, 2001). Research and development funding shortages make renewable technology deployment challenging (Frondel *et al.*, 2010; Bhattacharya and Cropper, 2012). High research and development costs prevent widespread deployment of sustainable and RES. Private companies can miss out on R&D perks. Research and development spending may help society, but firms may not profit (Brown, 2001).

10. Lack of local infrastructure

Here, "infrastructure" refers to both the physical structures and the resources upon which electricity transmission and distribution networks are dependent. Organizations at the federal, provincial, and municipal levels do not seem to be distinct from one another when it concerns the development and use of renewable resources for power generation. (Cherni and Kentish, 2007). These technologies do not have any formal systems in place to offer assistance after the sale. Existing institutional structures lack the impetus to serve new markets due to low levels of private sector involvement and target-linked programs (Ravindranath and Balachandra, 2009).

11. Absence of lawsuits in the public interest

Public interest litigations have not efficiently promoted renewable and sustainable energy technology. Energy efficiency data can be spread by putting energy consumption labels on appliances and machinery and validating efficiency claims. The Bureau of Energy Efficiency is working on this; however, India does not enforce some labelling procedures. Public interest litigation is scarce in India, making sustainable and renewable energy technology promotion difficult (Rajamani, 2007).

1.4 Carbon Taxation

An example of a pollution fee is the "carbon tax" that is imposed when specific "greenhouse gas" (GHG) emissions from the combustion of fossil fuels are quantified. The carbon content of fossil fuels is really a common basis for this type of tax. Carbon taxes are an example of a Pigouvian tax, which is imposed on market activity due to their potential for unintended consequences.

According to British economist Arthur, this report and many others have entered the public discourse, and scholars agree that these taxes are a cost-effective way to internalize externalities (Baranzini, Goldemberg and Speck, 2000). However, most governments have not implemented this tax. Environmental change doubt has led to enquiries into human involvement and the harm it might cause to society (Al-Abdullah, 1999) and skepticism about a carbon tax. Since the Paris Climate Accord and ongoing international climate negotiations have revived attention to climate change, the carbon tax has been gaining support.

Furthermore, it has been repeatedly demonstrated that a carbon price may effectively reduce carbon emissions (Speck, (1999); Wier et al., (2005); Zhang & Baranzini, (2004)). There have been several countries and regions that have implemented carbon taxes since its inception in the 1990s. These include Slovenia (in 1996), Latvia (in 1995), Iceland (in 2010), Mexico (in 2014), Estonia (in 2000), British Columbia (in 2008), France (in 2014), Ireland (in 2010), Switzerland (in 2008), Japan (in 2012), and Portugal (in 2015). In addition to Chile and South Africa, two other countries have published carbon price policies, in 2016 and 2018, respectively. Additionally, South Korea and China are thought to be considering implementing carbon taxes. Research into the effects of carbon taxes after the fact has indicated that they have the potential to lower emissions of GHG. As an example, Andersen compared 20 ex-post studies for the Nordic nations and found that carbon emissions were lower than expected under the status norm (Andersen, 2010). Between 1991 and 1993, Norway's carbon tax home emissions by 3-4%; from 1991 to 1997, Denmark managed a 7% decline in industrial CO2 emissions although total industrial production increased by 27% (Andersen, 2010). Sweden also saw a 9% drop in emissions between 1990 and 2007, according to an IPCC assessment (IPCC, 2022). Furthermore, the efficiency of the tax has been also supported by ex-ante simulations (Li and Lu, 2015; Wesseh and Lin, 2016). Examples of carbon taxes include those proposed by Meng et al. (2015) for Australia, which would result in a 12% decrease rate in emissions between 2004 and 2005, and by Cabalu et al. (2015) which would lead to a 9.8% decrease in emissions from Philippines between 2015 and 2020 and a $23/tCO2 tax in the Philippines. The IPCC,

(2022) found in its literature analysis that a 10% growth in gasoline prices might eventually result in a 7% decrease in fuel usage and emissions.

Despite scientific evidence that carbon/GHG taxes and carbon emission trading programs reduce energy use and emissions, many nations under pressure to cut CO2 emissions are still cautious. Environmental levies often face political hostility from the public and industry, contributing to this situation (Kallbekken and Sælen, 2011). US energy tax was a failure.

Overview of carbon taxation designs

An economy with a carbon price benefits and hurts some people. As shown in Fig. 1, a carbon price redistributes national income and primary distribution, affecting numerous economic players in the short term. Carbon taxes will raise energy prices and a production sector's energy expenses (Fig. 1.1), but it may change its inputs and outputs. Sectoral input adjustment includes manpower, capital, and inputs from multiple sectors. Outputs affect its income and taxes (Wang and Liang, 2015). Carbon taxes will generate a constant stream of revenue for the government, which will either increase its GDP share or return monies to taxpayers. Price elasticities of products affect how easily enterprises may pass on tax costs to customers. Industries making goods with higher price elasticity may lose money due to taxation and sales decline (Oladosu and Rose, 2007; Liang and Wei, 2012). The charge raises energy and other product prices, which raises direct and indirect taxes and changes customers' labor and capital income. A carbon price will have far-reaching and maybe unanticipated effects due to the importance of energy to any economy (Porter, 1991; Shakya, Kumar and Shrestha, 2012). If carbon taxes motivate companies to research and deploy low-carbon technologies to reduce energy use and prices, they may benefit long-term. Carbon mitigation can help homes improve environmental quality and reduce environmental change, benefiting humans and the environment in the long run. To classify carbon tax distributional impacts, one needs understand their transmission mechanism.

A carbon price would have complex, multi-factor distributional impacts. Business production structures and rivalry, household consumption patterns, how environmental co-benefits are dispersed, and carbon tax design may contribute. Many believe the carbon tax's

design—particularly its revenue utilization—can affect its policy performance (Klenert and Mattauch, 2016; Parry, 2021).

When designing a carbon tax, it's important to consider what should be taxed, who should pay it, the rate of taxation, the timing of taxation, how to distribute the funds, and what to do with the money collected (also known as preferential policy design). They may find that different countries' carbon tax systems have different designs based on studies that have presented and modelled possible vehicle carbon taxes and on the actual experience of nations that have executed such taxes. Generally speaking, the majority of taxpayers are either individuals or companies, however there are some notable exceptions to this rule. Although fossil fuels used in the production of primary and secondary energy are included in the tax base, most research advises simply taxing primary energy in order to avoid a double tax. At various points throughout the energy chain, either upstream or downstream decisions might be made to implement the tax. For instance, in 2015, tax rates varied greatly from one country to another, with Sweden having a hefty charge of $130/t CO_2 and Mexico and Poland having rates below $1/t$CO_2$. Political feasibility, marginal abatement cost of carbon, or financial constraints are some of the factors that could influence these decisions (Liang & Wei, (2012); Kerkhof et al., (2008); Barthold, (1994)).

A carbon tax's impact can only be predicted by studying its intricacies. Although a carbon tax can boost government revenue, its efficiency in achieving environmental goals and its impact on social and economic results rely on its design. Instead of detailing the carbon tax plan, we'll focus on how the money will be spent today. Past carbon taxation plans have included positive efforts, according to our analysis. Norway levied a half-rate tax on study products and exempted shipping and aviation; Sweden raised energy product taxes while lowering income taxes (Speck, 1999); and Denmark allowed some sectors to pay a lower tax rate if they promised to reduce emissions, and all carbon tax revenues could be used for wages or energy efficiency investments. Carbon tax rates for the production sector were 25% of the household rate. Thus, pollution tax preference policies and omissions must be briefly described before discussing its distributional effects.

Before the carbon tax takes effect, exempt or lower tax rates for vulnerable people may mitigate its distributional impact. Lowering additional distortionary taxes or raising transfer payments after the event can also help the most impacted groups (Speck, 1999). Combining these complementary measures can achieve tax neutrality or keep the same government share.

Overall, these mitigation techniques can reduce the influence of carbon tax. Every design has merits and cons, but some work better in certain situations. Ex-ante measures like tax cuts for energy-intensive sectors could reduce economic and political constraints, but they would have little impact on the environment (Andersen, 2010). One way to fix carbon taxes' regressiveness is to give individuals a lot of money at once or utilize it for direct transfers or subsidies. Allocating carbon tax monies requires balancing efficiency and justice. Some writers suggest reducing a distortionary tax to boost GDP growth and employment (Goulder, 1995), but this is inferior (Zhang and Baranzini, 2004). An improved tax strategy might emerge from giving due consideration to all of these factors. Cutting indirect tax rates and increasing subsidies to low-income and vulnerable households are two ways carbon taxes can mitigate economic harm and income inequality (Liang and Wei, 2012; Liang, Wang and Wei, 2013). However, more bureaucratic work for the government would result from a carbon tax. There isn't going to be a carbon tax that suits everyone, but the government can pick one depending on its socioeconomic status and policy goals and tweak it if it doesn't (Crocker *et al.*, 1976).

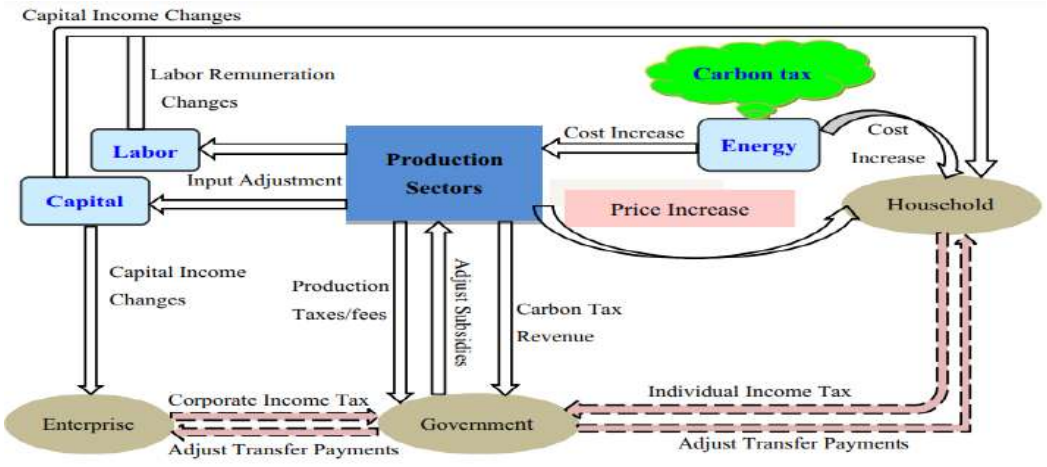


Figure 1.1: An illustration of how carbon tax will spread in the short term. (The dotted lines indicate the effects that were communicated in the income redistribution, whereas the solid lines indicate the effects that were transferred in the primary income supply.) The initial (Wang et al., 2016)

Effects of carbon taxation on distribution across production sectors

Carbon tax distributional effects usually concern households, not corporations. A carbon price may have immediate and long-term repercussions on industry. Due to product input patterns and price elasticity, these effects may vary among manufacturing sectors.

Carbon taxes seem to be proportional to fossil fuel use, so the biggest consumers would be hurt worst. Previous study supports this. According to Oladosu & Rose (2007), a US SRB carbon tax will have the greatest immediate and long-term influence on energy production. Power, coal, petroleum, and crude oil would lose the most production. Labandeira et al. (2009) observed mixed economic consequences from Spain's energy tax adjustment. Energy-intensive industries would lose production and cost more. Alton et al. (2014) found that a carbon tax in South Africa would have the greatest influence on mining jobs, which produce a lot of carbon. Carbon tariffs in China would reduce production overall, say Liu & Lu (2015). Carbon-intensive industries would suffer most. Carbon tax and cap-and-trade systems may alter sectoral effects. Carbon permit allocation (Bovenberg and Goulder, 2022) determines cap-and-trade's sectoral distribution.

In carbon tax systems, energy-intensive businesses are frequently excused from liability. The offshore oil and gas business in Norway, for instance, is subject to a high tax rate, while other industrial processes are eligible for exemptions. Industry in Sweden was subject to a comparable rate in 1991, but by 1993 it had dropped to 25% of household rates, and by 1996 it had risen to 50% again; today, it is repeatedly adjusted according to inflation (Andersen, 2010). A very complex three-tiered industrial tax system exists in Denmark, with one normal rate and agreements on energy savings, three lower rates for energy-intensive activities, etc. However, carbon taxes are expected to have less of an impact on reducing emissions if ex-ante measures are instituted. Hence, the government always opts to install preferential policies to shield energy-related sectors from a potential national

carbon tax, which might have a short-term impact on GDP. The policy design should prioritize the development of low-carbon technologies and their replacement of older, inefficient ones rather than relying solely on ex-ante protective measures such as tax cuts or exemptions. This would help decrease emissions over time. This can be accomplished in one of two ways: either by giving money directly to cutting-edge tech or by setting aside a portion of the carbon levy to go towards environmentally focused initiatives. Such a unique security measure ought to be gradually eliminated over time.

Before closing, household distributional issues are prioritized over industry-wide ones. Past research lacks detail for policymaking. Geographic location, production scales, and long-term advantages affect industry distributional difficulties evaluations. Since RE and carbon reduction projects share aims and interact, they should be coordinated (Linares, Santos and Ventosa, 2008). Exemptions for non-CO2 GHG emissions will distort industrial tax and trading costs and benefits. Industries will favor and fund this system, but regulation will be problematic (Godal and Holtsmark, 2001).

Some mitigation goals may overlap reducing local emissions and their influences on ecosystems and human health, protecting and guaranteeing access to food, biodiversity, energy, and water, distributing income equitably, maximizing tax system efficiency, addressing labor supply and employment, halting urban sprawl, and ensuring sustainable growth of developing countries. Mitigation may also have drawbacks. The most obvious cost-benefit is environmental impact. Carbon reduction reduces pollution and environmental harm, improving health and quality of life in short and long term (Shakya, Kumar and Shrestha, 2012; Saari *et al.*, 2015). These environmental benefits reduce pollution globally and locally. They reduce climate change globally, reducing extreme weather and rising sea levels. Lowering NOx, SO2, and PM 2.5 levels locally reduces pollution. National carbon tax would have the greatest impact in the most polluted regions, and even the worldwide impact can vary locally (coastal regions may feel the effects of rising sea levels more than other places). The financial and social effects of a carbon price may not be evenly distributed. (Vehmas *et al.*, 1999).

Many studies have examined vehicle bon taxes' effects on income supply, but few have measured their environmental benefits. These include carbon and GHG levies and other mitigation techniques. The IPCC observed that most macroeconomic cost calculations only examine mitigation costs, ignoring the advantages of lowering CO2eq concentrations and slowing climate change. These prices exclude mitigating measures' downsides. Ignoring these environmental advantages while assessing the distributional impact of such a charge may increase emissions abatement costs and reduce its impact (Saari *et al.*, 2015). Low-income workers and households must benefit most from environmental improvements because they are most susceptible to pollution and least protected. This gap may have been overlooked in previous study. Recent studies have begun to capture and characterize the skewed distribution of additional environmental benefits of carbon emission cuts across regions/provinces (Dong *et al.*, 2015). A comparison analysis across income/socioeconomic strata or even within the same country is still lacking.

1.5 Problem statement

In recent years, the global address on climate change has intensified, driven by rising GHG emissions and the resultant influence on the environment. The situations in the climate system have become worse with more recurrent and severe disasters, loss of species and an increase in human diseases. He stated that given the current situation, it was necessary to ensure that there were a lot of quick policy changes to decrease emission of carbon. GHGs emissions are largely caused by the burning of fossil fuels, which are used to generate power, fuel vehicles, and power industries. The urgency of transitioning to RES to mitigate the impact of climate change is, thus, growing. RE has obvious monetary and ecological benefits, but there are substantial obstacles to its broad adoption. These include high upfront costs, market volatility, resistance from established fossil fuel industries, and policy gaps in many countries.

A carbon price may be the best tool for encouraging RE source adoption. Carbon taxes, a levy per ton of carbon in fossil fuels, differentiate renewable and carbon-energy plant costs. By affecting carbon emissions costs, carbon taxes can shift energy production

and usage towards greener options. Economists and environmentalists say carbon prices can financially incentivize corporations and individuals to invest in RE sources and reduce fossil fuel use. RE projects may also receive Carbon Tax funds to subsidies green technologies or reduce the economic and social burden on disadvantaged people most affected by the low-carbon economy.

Policymakers, researchers, and industry players disagree whether carbon taxes promote RE adoption. To determine its potential, several crucial challenges must be addressed. First, how should carbon taxes balance environmental aims with economic growth and social equity? A poorly planned carbon tax may disproportionately harm low-income households or fossil fuel-dependent regions, causing popular opposition and political obstacles. Second, carbon taxes interact complexly with RE subsidies, emissions trading systems, and regulatory requirements. A unified and effective energy policy framework requires understanding how carbon pricing complement or conflict with these initiatives. Third, carbon taxing has had mixed results in some countries. Some carbon taxes have reduced emissions and increased RE investments, whereas others have had little or no effect due to loopholes, insufficient enforcement, or external economic factors. These conflicting findings highlight critical concerns about when carbon price can best stimulate RE adoption.

One more difficulty is getting carbon taxing policies coordinated on a global scale. Even though different countries have different energy needs, economic systems, and political objectives, we must all work together to combat climate change. Major emitters like the US, China, and India have embraced carbon taxes as part of their climate plans, while other nations, especially Europe, have been slower. This mismatch raises the risk of carbon leakage, where emission-intensive sectors shift to countries with fewer environmental regulations, reducing global carbon levies. International coordination and policy harmonisation are needed to ensure that carbon prices contribute significantly to global efforts to reduce carbon emissions and boost RE.

Given these complications, this study examines how carbon taxes promote RE adoption, including policy formulation, implementation challenges, and economic and

social effects. The study examines these aspects to show how carbon prices might be successfully implemented in national and international climate policy to accelerate the transition to sustainable energy.

1.6 Significance of the study

Understanding appropriate policy instruments to encourage the move from fossil fuels to RE is crucial since climate change poses enormous environmental and economic concerns. This study has implications for policy, society, the economy, and environment. The purpose of this study is to investigate whether or not carbon taxes are effective in reducing emissions of GHG, which would be the first such investigation into the topic of climate change mitigation. The need for immediate climate action is the research will reveal how carbon prices can affect energy markets, consumer behaviour, and investment decisions in RE sources. It will examine how carbon taxation can change businesses' and individuals' cost-benefit analyses, making RE an ecologically responsible and economically feasible alternative.

The study is relevant economically because it examines whether carbon taxes may promote RE sector innovation and competition through market-based solutions. This research will help governments decarbonise their economies while maintaining economic stability by showing how carbon tax revenues can be used to fund clean energy projects, research and development, and social programs that protect vulnerable populations. The research will also highlight the RE transition's economic benefits, including new sectors and jobs. This finding has major policy implications for politicians trying to balance social equality, environmental goals, and economic prosperity in climate policies. In preliminary case studies of governments that have implemented carbon fees, the project will highlight best practices and problems in policy formulation and implementation, providing a roadmap for nations contemplating carbon taxing as part of their climate strategy. The research will also show how carbon taxes can work with other policy tools like RE subsidies and emissions trading systems to reduce carbon emissions.

In sum, our research will shed light on how carbon taxes can encourage the use of RE, which in turn will help get us closer to our long-term objective of a low-carbon, sustainable future.

1.7 Research Questions

The study investigates the association between carbon taxes and use of RE technology by answering various research questions.

A. **RQ1** investigates how individuals' attitudes toward carbon taxation, such as its perceived fairness or necessity, shape their intentions to adopt RE, highlighting the role of personal beliefs and values.
B. **RQ2** examines the influence of subjective norms, or the social pressure perceived by others, on behavioral intentions, emphasizing the importance of societal and cultural expectations regarding carbon taxation.
C. **RQ3** explores how perceived behavioral control, defined as the perceived ease or difficulty of adopting RE, mediates relationship between carbon taxation and actual RE adoption, showing the significance of individual capabilities and external barriers.
D. **RQ4** evaluates how perceptions of the effectiveness of carbon taxation in achieving environmental sustainability influence attitudes and behaviors toward RE adoption, focusing on the link between policy effectiveness and public response.
E. **Lastly, RQ5** investigates the impact of behavioral intention, formed through norms, attitudes, and perceived control, on the actual adoption of RE technologies, emphasizing the critical transition from intention to action in the context of carbon taxation policies.

1.8 Research Aim and Objectives

This study goals to investigate how carbon taxation influences the implementation of RE, focusing on its effectiveness in shifting energy consumption from fossil fuels to renewables. Additionally, the study examines the broader influence of carbon taxation on innovation, market dynamics, and technological advancement, to provide insights that

support policy development and global transition to a sustainable energy future. The following sub-objectives are more specifically stated in the study:

1. To evaluate the impact of attitudes towards carbon taxation on the intention to adopt RE.
2. To analyse the influence of subjective norms on the adoption of RE technologies in response to carbon taxation.
3. To assess the role of perceived behavioural control in mediating the relationship between carbon taxation and RE adoption.
4. To determine the relationship between perceived effectiveness of carbon taxation and the adoption of RE.
5. To identify the effect of behavioural intention on the actual adoption of RE in the context of carbon taxation.

CHAPTER II:
REVIEW OF LITERATURE

2.1 Attitudes Towards Carbon Taxation and Renewable Energy Adoption

Douenne and Fabre (2020) assessed the trajectory of France's climate policy in the aftermath of the Yellow Vests protests, which prevented a planned hike to the carbon price. Their findings on climate change knowledge, attitudes, and values, as well as opinions on carbon taxes and other climate measures, were derived from a large-scale representative survey. The connection between how people understand climate change and their views on related policies is highlighted in particular. Attitudes' political and socio-demographic antecedents are also examined in depth in the research. Their findings reveal a lack of understanding and a great deal of worry about climate change, among other things. They also show that tighter standards and green investments have majority support, but that the carbon tax has widespread opposition. They further explain why people have these preferences. Better access to research may help enhance support for climate policies since they discover that climate awareness raises support for such policies without indicating that attitudes are formed through partisan cues, as is the case in the US.

Umit and Schaffer (2020) Although carbon prices have the potential to be beneficial, in reducing emissions of greenhouse gases, several nations have recently found that they are too unpopular to implement. Still, we only know about one or a handful of instances where people are against these tariffs, and that's while governments all across the globe are getting ready to make their nationally defined payments to the Paris Agreement. Using information from the European Social Survey (n = 44,387), this research shows the opinions of citizens in 23 nations—the majority of which have never been mentioned in literature—on the topic of imposing higher taxes on fossil fuels to mitigate environmental change. Many individuals are opposed to carbon taxes, according to the research. For example, this becomes significantly worse for customers who heavily rely on energy due to the apparent burden of taxes. On the flip side, things improve when there is external political efficacy and political trust, both of which help to dispel the aura of mystery around policy suggestions. According to the findings of this study, if these variables were to be

changed independently, the impact would be substantial enough to overcome popular opposition to carbon pricing in some nations. These findings hold up under different scrutiny and in response to different criteria.

Hao and Shao (2021) New dangers to human civilization are emerging as a result of environmental change. According to the majority of scientific research, emissions of "greenhouse gas" (GHG) that are created by humans are the primary driver of global warming. Combustion of fossil fuels is the primary global source of GHG emissions. Raise your voice in favour of renewable energy if you want to cut down on these emissions and halt global warming in its tracks. This study looks at a variety of potential reasons that could lead to RES becoming widely used. Panel data from 118 nations throughout the world are analysed from 1995 to 2021. The results show that nations with lower carbon usage and higher likelihood of climate change vulnerability are the ones that employ RES more frequently. On the other hand, the implementation of RES is unaffected by carbon costs. By looking at the connection between renewable energy usage, climate change sensitivity, carbon intensity, and carbon pricing, this study adds to what is already known. When countries are incentivised and their economies reduce their reliance on fossil fuels, the results demonstrate that they are more inclined to support RES.

Hammerle, Best and Crosby (2021) A low-cost strategy for lowering carbon dioxide emissions, carbon taxes are frequently limited by how widely accepted they are. In two approaches, this research examined whether or not the Australian public is in favour of carbon pricing. They begin by measuring the amount of money people are willing to spend on increased electricity prices as a result of carbon tax design features using a discrete choice experiment. Schemes that reinvest in low-income households and promote the use of low-carbon technology have a higher value, according to the findings. People who took the survey are strongly opposed to policies that aim to alter people's conduct by recycling money and collecting too much personal data. One possible governmental agency to oversee the carbon fee is the Department of Energy. Second, they check to see if "carbon tax" or "carbon price" is more popular; the former is less likely to garner support. Studies of the public's suitability of carbon taxes in various countries can be informed by the design

and techniques of the comprehensive carbon pricing scheme, which could result in reductions in emissions worldwide.

Khan and Johansson (2022) To fight climate change, several countries have started to implement carbon pricing. Nevertheless, the current systems vary greatly in terms of coverage, level of stringency, and how the collected funds are utilised. Research synthesises previous research on the elements that influence carbon pricing system adoption, implementation, and design in this literature review. The implementation has been affected by factors such as the form and extent of commercial control, popular opposition, and foreign influences, in addition to the features of real political systems. Modifying the systems' architecture to accommodate various social interests has allowed them to circumvent implementation hurdles. Thus, tax breaks and preferential treatment are widespread, creating incoherent incentives for emission reductions across industries. The findings have real-world implications for policymakers working on carbon policies, as they show that carbon pricing is an essential constituent of any comprehensive strategy to achieve both short-term reductions in emissions and longer-term decarbonisation goals. Carbon pricing and its potential synergies with other policies necessitate more investigation into specific challenges faced by these initiatives in different settings.

Carattini, Carvalho and Fankhauser (2018) A carbon price is an efficient and inexpensive tool for environmental sustainability. Their practical use, however, has been very restricted. Public resistance is one of the key challenges to carbon taxes, which is addressed in this study. They lay out the factors that encourage and discourage popular support for carbon taxes, and they offer lessons on the topic's general acceptability through the use of stylised facts. Policy "failures" and "successes" contribute to the expanding body of material from which they draw their conclusions. They come up with a series of recommendations for the structure of carbon taxes based on the stylised facts. Some of the methods that are being considered include improved communication tactics, tax rebates, lump sum transfers, tax escalators, environmental earmarking, and trial periods.

Bashir et al. (2022) aimed to learn how environmental taxes and regulations affect the use of renewable energy sources so that we can come up with policies to fight climate

change and achieve environmental sustainability. From 1996 to 2022, this study analyses environmental taxation, renewable energy, and technology using data from 29 OECD nations. To be more specific, look at how renewable energy usage has changed as a result of environmental legislation and technology. Quantile regression, CIPS, CADF unit root tests, panel Wester land co-integration test, and FMOLS were among the many econometric tools utilised by the author. According to econometric studies, environmental regulations make it harder for OECD countries to employ renewable energy. If wealthy nations are serious about increasing the usage of RES, they should prioritise environmental policies that encourage development of environmentally friendly technologies and coordination of environmental legislation.

2.2 Influence of Subjective Norms on Renewable Energy Adoption

Yun and Lee (2015) Instead of looking at ways to increase demand from society to disseminate the new energy technology, developers of renewable energy systems have focused on technical advancements. This study examined the demand-side issues related to sustainable energy innovation by taking a socio-technological approach to analysing key components of renewable energy system dissemination. An investigative framework based on theories of planned behaviour (TPB) considered both "societal" and "technology" elements, along with the latter including technological enabling conditions and the perceived quality of the system, as well as "societal" features like trust and social support. According to this study, three factors—attitude, subjective norm, and PBC —influence customers' inclinations to use renewable energy systems. Furthermore, factors influencing attitude and subjective norm include social trust and support, while factors influencing perceived behavioural control include facilitating technical conditions. Business managers and policymakers, according to this study's conclusions, should have a plan to balance technological progress with social readiness for sustainable energy innovation.

Wall et al. (2021) investigate what factors influence Thai consumers' adoption of RES. This investigation made use of TPB with three more components added to it. A survey of Thai customers was carried out in five major cities and provides the bulk of the data utilised in this quantitative analysis. "Structural equation modelling" (SEM) was used

for data analysis. When consumers are aware of RES, have a positive attitude towards them, believe in their potential, care about the environment, and can see the benefits of utilising them, research shows that they are more inclined to accept these sources. When looking at the factors that influence adoption, researchers exposed that the price of renewable energy had no impact, but that consumers' views of risk and trust did. According to the study's findings, stakeholders might potentially support increased renewable energy adoption among Thai consumers by appealing to their self-efficacy, environmental consciousness, familiarity with RES, and perspectives on advantages of renewable energy.

Liobikienė, Dagiliūtė and Juknys (2021) Renewable energy development is highly dependent on public acceptability. As a result, promoting renewable energy requires an increase in the desire to consume such energy. Considering Lithuania's location in CEE and applying the idea of planned behaviour, this study addressed the question of what elements influence the country's aspiration to utilise RES. The majority of respondents favour solar energy, according to the figures. However, few locals intended to use hydropower or biomass to power their homes. Consequently, based on the regression research, the most influencing factors on intention to use RE are financial capability and development of renewable energy. In addition, it was also revealed that perceived subjective norms were the most influential factor that affected the intention to use RES with a coefficient of 0.337 at p-value of 0.001. However, concerning purposes of using renewable sources of energy, the respondents' attitudes were not influenced in any way. The only ones that span in addition, the intention to use RES was favourably and strongly affected by subjective standards. However, the attitude towards the utilisation of RES did not correlate with the plans to implement them. Environmental concerns and attitudes towards RES are the only factors that influence the actual intention to use such sources. Therefore, the knowledge of renewable energy generation and its utilization throughout the EU, and specifically in CEE countries, is expanded with this research. The paper establishes that the two hypotheses that the intention to use RES is positively related to the level of environmental concern are valid.

Jabeen et al. (2019) Scholars are constantly drawn to investigate the various factors that impact the complex and multi-faceted process of renewable power generation technologies (RPTs) deployment. This study's overarching aim is to learn what influences Pakistani customers' decisions to buy RPTs for home use. Consumers' choices to embrace or reject RPTs can be better understood with the help of the present study, which adds the critical influencing component of limited access to energy in distant areas to the framework of planned behaviour theory. Primary data was gathered from 230 families in Pakistan for this study. These houses were located in the federal capital Islamabad as well as in the provincial capitals of Quetta, Peshawar, Karachi, and Lahore. Using structural equation modelling (SEM), a state-of-the-art technology, the assertions are evaluated. Customer desire to utilise RPTs in Pakistan was positively impacted by aspects such as attitude, perceived behavioural control, lack of electrical access, relative advantage, and subjective norms, according to the statistics. Cost, on the other hand, appears to influence consumers' intentions to use RPTs. Research has shown that consumers' desire to use RPTs is unaffected by their moral norms, environmental concerns, knowledge, or awareness.

Chibuogwu et al. (2021) looked at the antecedents of intention to engage in the use of RE and the challenges to its usage in Nigeria. This research used the technology adoption and usage unified theory, the theory of planned behaviour, prior work on acceptance and the technology acceptance model. To do so, they employed structured questionnaires to administer questionnaires to 500 family heads in Nigeria and assess the theories. The analysis by structural equation modelling enabled the researchers to evaluate the extent to which factors such as relative benefit, usability, perceived behavioural control, income, cost, attitude, gender, age, awareness, and education are related to the purchase intention. The outcomes further show that attitude played the role of mediator between intention to utilized and determinants, although demographic characteristics such as education level, age, gender and income did not moderate purchasing intentions. The study's results might bolster the renewable energy industry's decision-making process for companies in Nigeria and other emerging nations. Policy choices concerning the utilisation of RES may potentially be influenced by the results of this study.

2.3 Perceived Behavioral Control and Its Role in Mediating Renewable Energy Adoption

Mustafa et al. (2023) Scholars are constantly drawn to investigate the various factors that impact the complex and multi-faceted process of renewable power generation technologies (RPTs) deployment. This study's overarching aim is to learn what influences Pakistani customers' decisions to buy RPTs for home use. Consumers' choices to embrace or reject RPTs can be better understood with the help of the present study, which adds the critical influencing component of limited access to energy in distant areas to the framework of planned behaviour theory. Primary data was gathered from 230 families in Pakistan for this study. These houses were located in the federal capital Islamabad as well as in the provincial capitals of Quetta, Peshawar, Karachi, and Lahore. The claims are assessed using structural equation modelling (SEM), a cutting-edge technique. Customer desire to utilise RPTs in Pakistan was positively impacted by aspects such as attitude, perceived behavioural control, lack of electrical access, relative advantage, and subjective norms, according to the statistics. Cost, on the other hand, appears to influence consumers' intentions to use RPTs. Research has shown that consumers' desire to use RPTs is unaffected by their moral norms, environmental concerns, knowledge, or awareness.

Masukujjaman et al. (2021) While energy correlates with economic and social progress, modern energy is crucial to long-term sustainability. Specifically, this cross-sectional study aims to identify the variables that impact rural residents' intentions to purchase renewable energy equipment. Several theoretical frameworks and prior publications on the subject of technology adoption were utilised to generate the research model and thirteen hypotheses of this study. This empirical test is grounded in research that was conducted in Bangladesh among 300 rural residents who did not utilise renewable energy technologies. A systematic questionnaire was used for participant interviews, and a stratified random sample approach was used for participant recruitment. Attitude, perceived knowledge, perceived cost, perceived utility, and perceived behavioural control are the factors that influence the readiness to adopt renewable energy, according to a cross-sectional survey that tested the hypothesis using Analysis of Moment Structures software

in SEM. The study's findings show that perceived ease of use and social impact have little effect on the propensity to purchase renewable energy solutions. Furthermore, the findings show that there is a correlation between attitude and both knowledge and perceived utility, understanding impacts attitudes regarding the purchase of renewable energy technology, while perceptions of their ease of use influence attitudes towards understanding. In addition to useful insights for management and policymakers, report clarifies plans to purchase renewable energy in Bangladesh.

Rahmani and Bonyadi Naeini (2023) In the last few decades, the exhaustion of fossil fuels has increased global emissions of GHGs, which causes climate change. The agricultural industry, which relies heavily on this type of energy, is largely responsible for the present issues. One way to fix current issues and set the stage for renewable energy generation is to apply solar energy technologies (SETs) to this sector. This study used SEM to find out what factors affect farmers' openness to using SETs. The findings demonstrated positive and substantial influences of attitude, self-efficacy, awareness, performance anticipation, confidence in technology, and favourable conditions on usage intention; thus, 57.4% of usage intention for SETs was anticipated. “Distance from power grids” (DPGs) moderates three correlations: (1) mindset and purpose for using the technology, (2) enabling circumstances and faith in the technology, and (3) faith in the technology and purpose for using it. All factors were moderately to significantly affected by attitude, except self-efficacy and usage intention. The practical application of this research goes beyond its theoretical significance; it can help policymakers in poor nations improve their strategies for boosting solar power and other renewable energy utilization.

Yun and Lee (2015) Instead of looking at ways to increase demand from society to disseminate the new energy technology, developers of renewable energy systems have focused on technical advancements. From a socio-technological vantage point, this study analyses critical components of dissemination of renewable energy systems to comprehend demand-side concerns pertinent to sustainable energy innovation. An investigational framework based on a “theory of planned behaviour” (TPB) was established by incorporating "societal" elements like social support and trust as well as "technology"

concerns like technological enabling conditions and perceived system quality. Consumers' intentions to utilise renewable energy systems are influenced by attitude, PBC and subjective norms, according to this research. Furthermore, factors influencing attitude and subjective norm include social trust and support, while factors influencing perceived behavioural control include facilitating technical conditions. Business managers and policymakers, according to this study's conclusions, should have a plan to balance technological progress with social readiness for sustainable energy innovation.

Hossain, Fekete-Farkas and Nekmahmud (2022) Given the massive increase in energy consumption in emerging nations, encouraging energy-saving habits among inhabitants is a crucial subject from academic and industrial perspectives. This study's overarching purpose was to employ an enhanced version of TPB to forecast whether or not consumers will buy energy-efficient home appliances. Incorporating consideration for the environment and moral principles, this research broadened the TPB model. The postulates were appraised utilizing “partial least squares structural equation modelling” (PLS-SEM) regression after 1,155 clients in Bangladesh were given a self-administered questionnaire. Factors that influence customers' likelihood to buy “energy-efficient appliances” (EEAs) include their attitudes, their perceptions of their behavioural control, and subjective criteria. The results of this study provide credence to the long-standing TPB, which states that customers' propensity to make purchases is substantially impacted by rising moral standards. Concerns for the environment, however, were not paramount in the case of Bangladesh. This research uses an enlarged TPB model to predict EEHA purchase intent, which is unique among empirical studies conducted in Bangladesh as far as the authors are aware. The outcomes of this study can be used by politicians and marketers to create plans that will benefit environmentally conscious customers more. From both a theoretical and practical standpoint, the study sheds light on sustainable energy use in developing nations and environmental marketing.

Bhutto et al. (2021) To empirically assess Pakistani consumers' intentions to buy EEAs, this study employs an expanded TPB. Emerging nations often experience power outages. Consequently, EEAs are seen by many nations as a means to address energy-

related issues and educate customers about sustainable consumption. Despite the enormous potential for EEA adoption in developing markets, prior research has ignored developing nations in this regard. They used normative attitudes, moral obligations, warm glow advantages, and utilitarian environmental benefits as antecedents to TPB variables to understand EEA adoption. Furthermore, this study sought to understand how eco-literacy influences the association between EEA perspectives, subjective norms, PBC, and desire to purchase. A total of 673 Pakistani consumers participated in the survey, which allowed us to examine these hypotheses. The results demonstrate that the warm glow advantages and the practical environmental benefits significantly influence how people view EEAs. There is a favourable correlation between normative ideas and subjective norms, the results show. Subjective standards serve a similar purpose to eco-literacy in that they reinforce the link between attitude and desire to buy. In contrast, eco-literacy seems to have little effect on the correlation between PBC and willingness to buy. To identify statistically significant differences between the groups, they conducted a multi-group analysis that included education level, age, gender, and income as socio-demographic factors. The research revealed that consumers with higher levels of education, younger consumers, and female consumers were more influenced.

Gumasing et al. (2023) Sustainable and naturally replenishable, renewable energies (RE) are a type of alternative energy. Power from the sun, water, wind, geothermal heat, and the ocean are all examples of renewable energy sources. To determine what factors, influence renewable energy usage in the Philippines, this research aimed to apply "Pro-Environmental Planned Behaviour" (PEPB) model. Study participants filled out a questionnaire that helped researchers collect the necessary data and identify the elements impacting Filipinos' behavioural intention to adopt RE. Through analysis of the data, SEM with PLS-SEM was employed to uncover further linkages. According to studies, out of all the characteristics that affect Filipinos' BI, the one that has the greatest impact on their PEC is “Perceived Authority Support” (PAS). In terms of its impact on BI, the “Subjective Norm” (SN) is the most important component. Consequently, the findings point to the need for incentive-based initiatives to help the public embrace shift from conventional to RES,

to mitigate the effects of SN. To raise awareness and close knowledge gaps among Filipino residents, educational initiatives and campaigns can also be implemented.

Xuan et al. (2020) Household energy conservation aspirations typically exhibit very consistent individual differences. One probable reason for these variations could be innate personality features. Nevertheless, it is still not known how exactly personality factors influence the aim to conserve energy in the home. In order to discover the roles of personality types in this domain, this research aims to apply TPB to link Big Five personality traits with energy conservation goals for households. Results from a survey of 279 legal homes in Xi'an, China, provide the basis of this study. All four of these personality traits have an effect on the likelihood that a household will make an effort to reduce its energy consumption, but only extraversion has a direct effect. All three TPB predictors demonstrate positive relationships with agreeableness and openness. When it comes to attitude, neuroticism is only negatively correlated, while conscientiousness is positively correlated with perceived behavioural control. The goal of this research is to find out how households plan to reduce their energy consumption by integrating TPB with personality traits. The findings provide some evidence from northwest China about the relationships between environmentally conscious actions and individual characteristics.

2.4 Effectiveness in Reducing Carbon Emissions

Gao et al. (2020) China has made its carbon reduction goals quite apparent in response to global warming concerns. A key component of China's plan to reach these goals is the launch of an emissions trading program (ETS). In 2011, China began developing the ETS, and in 2013, it was piloted in several places. Finding out if and how the ETS affects carbon leakage was the focus of this research. To begin, they determined the amount of carbon leakage, emissions based on consumption, and emissions based on production for 28 different industries in 30 different provinces from 2005 to 2015 using ecologically enhanced input-output tables. Next, the efficacy of ETS was assessed using difference-in-differences and difference-in-difference-in-differences models. The study arrived at these findings- (1) Emissions trading systems help reduce pollution in areas and businesses that participate in them. (2) Emissions trading systems are more effective in

reducing emissions from production than from consumption. (3) The unequal distribution of emissions among China's provinces is exacerbated by carbon leakage, sometimes called the "pollution haven effect," because ETS encourages the transfer of emissions from places that are being tested to those that are not. Other emerging economies can learn from China's ETS achievement in reducing emissions.

Chai et al. (2022) Governments worldwide are paying attention to the environmental problems and climate change caused by carbon emissions. To get emitting enterprises to include carbon emission reduction in consumption and production decisions through carbon price, China is constructing a nationwide carbon emission trading market, mimicking the EU's strategy. Is this strategy an effective market-based policy for environmental regulation? With China's successive 2013 ETS experiment launches, one of the current main topics is the effectiveness of reducing carbon emissions. The study used the "difference-in-differences" (DID) method to determine how ETS affected emission reductions. Researchers in China evaluated eight ETS trials' effectiveness in reducing emissions using a "data envelopment analysis" (DEA) and Super-SBM model. They learnt that emissions have decreased thanks to the carbon trading program and that green economic growth considerably increases regional GDP during the implementation stage. Regional development should be coordinated to form China's unified carbon market. Regional ecological compensation and development mitigation strategies still lack some necessary supporting measures.

Zhang and Wang (2017) Global warming and environmental degradation are major concerns for many countries and areas due to the fast growth of their economies and the excessive production of “greenhouse gases” (GHGs). Household carbon (dioxide) emissions are a leading contributor to global warming and have far-reaching consequences on ecosystems across the globe. In response, governments have put in place some policy tools. Utilising data from 144 nations worldwide, this research presents a two-pronged analysis of these efforts at carbon reduction policies. After weighing the pros and cons of each strategy, the study find that countries' income levels significantly influence policy selection, with high-income nations often using demand-side policy tools. Rather than

relying on demand-side policies like targets and regulations, low-income nations rely on supply-side policies like these. Despite objectives, regulations, and carbon taxes being the most popular GHG reduction policy tools globally, geographical location has a significant role in shaping the selection of policy instruments owing to climatic differences among regions. The United States favours tendering and net metering, but Europe implements feed-in-tariff (FIT) regulations more often than not (more than 70% of the time). Economic development, urbanisation, and geography all contribute to Asia's relatively weak supply-side and demand-side policy implementation.

Guseva (2019) This study shows that developing nations and low-income nations can advocate for carbon abatement and the financial sector by changing their focus from supply-side to demand-side techniques. However, they are at a different economic level. In order to aid in the creation of regulations to decrease carbon emissions from households, this critical study offers a comprehensive grasp of the numerous carbon emission laws in place across the globe.

Ye et al. (2017) Reduced carbon emissions from energy consumption in homes are essential for improving urban climates on a local level and ensuring cities can continue to grow sustainably in the face of fast urbanisation. Residents' lifestyle is significantly impacted by low-carbon behaviour. The promotion of low-carbon households can benefit from an understanding of how that behaviour impacts energy use in the home. Xiamen, a city on the coast, was split into high-risk and low-risk flood zones for this study. They investigated the causes and consequences of low-carbon behaviour on residential energy use and emissions by combining the path analysis method with behavioural and socioeconomic variables. They discovered that low-carbon behaviour and socioeconomic factors affected household carbon emissions both directly and indirectly. The greatest contribution to the decrease of carbon emissions came from low-carbon behaviour in the high-risk sector. In the low-risk zone, educational attainment was the determining factor. In the high-risk areas, home carbon emissions were effectively reduced by government-led measures that encouraged low-carbon behaviour. On the other hand, spreading awareness

about low-carbon lifestyle choices can effectively lower carbon emissions in low-risk regions (Yang *et al.*, 2019).

Zhang, Li and Yin (2020) A low carbon economy is not possible if there are no advanced technologies put in place by the governments. While the catalyst for low-carbon growth has garnered a lot of attention, the part played by energy consumption in reducing the impact of technological progress on carbon reduction has gotten surprisingly little attention. This study examines the association between technological innovation energy savings and carbon emissions reduction using panel data obtained from Chinese provinces from 2005 to 2020. It used a threshold regression model, a mediating effect model, and a linear regression model to conclude. Energy usage and its effects on this influencing mechanism are also important areas of study. Although the effect coefficients varied among the three areas of China, technological innovation has successfully encouraged energy savings and reduction of carbon emissions nationwide. Moreover, technical advancements in reducing carbon emissions are somewhat counteracted by energy use. Thirdly, energy consumption is the ceiling beyond which technological progress will not reduce carbon emissions. Efforts to decrease carbon emissions through technical innovation are greatly supported by low energy usage. Once energy consumption hits a certain point, technology's ability to reduce carbon emissions through innovation will start to backfire.

Wang, Yang and Sun (2020) China needs to improve its reduction strategy and evaluate the efficacy of carbon emission reduction programs in each province thoroughly if it wants to reach its "Nationally Determined Contribution" (NDC) emission reduction goals. At the outset, this research assesses the industry's impact on emission reductions in 30 different regions of China. Then, a two-dimensional view of the cost of emission reduction and carbon emission efficiency is used to optimise the strategies for cutting emissions in "lagging regions" that haven't reduced their industrial carbon emissions to the target level by 2030. China has already reduced its industrial carbon emissions more than its 2020 goal, according to this report. There are nine possible "lagging regions" that did not achieve their 2020 goals; (2) if China keeps cutting emissions at its current rate, it can reduce industrial carbon emissions more than its 2030 objective; nevertheless, eleven

"lagging regions" remain. The provinces of Guangxi, Liaoning, and Shaanxi can set ambitious but achievable goals to reduce emissions, while other "lagging regions" can take it easy. There is a definite difference between the "lagging regions" when it comes to shadow pricing and efficiency of carbon emissions (Chen *et al.*, 2022).

Nabernegg et al. (2019) Emissions of consumption-based CO2 (carbon footprints), which are embedded over the entire supply chain (including foreign parts), may be difficult, if not impossible, for national climate policies to achieve in a world where emission reduction objectives are at odds with one another. Building development, public health, and transportation are three areas in Austria where consumption-based emissions are especially high, and they examine a variety of solutions in these areas. Their method incorporates a "Multi-Regional Input-Output model" (MIOM) with a "Computable General Equilibrium" (CGE) to account for worldwide supply chain-wide emission reductions and replacement opportunities caused by these policies. Compared to an information duty on unoccupied residences and a penalty payment for unavailability of vacant structures, a carbon-added tax is found to be a far more effective measure in lowering consumption-based emissions during building construction. However, this approach is rendered ineffective due to reallocation of investment capital. Emissions connected to manufacturing are more effectively reduced by decarbonising logistics for transporting commodities, but emissions related to public health and mobility can be reduced just as effectively by mandated energy efficiency measures. How well policies work to reduce emissions from consumption is dependent on factors such as the sector's backward and forward connections, the impact of replacement on final demand, and other similar factors (Ioannou, Li and Serafeim, 2016).

Koval et al. (2022) Environmental policy for the European region has to make the protection of the environment a critical issue as emission which is caused by human activity is contributing to the rising concentration of GHG like carbon dioxide. By doing so, this work provides a theoretical basis for research into the influence that environmental taxes exert on the development of technologies that are less damaging to the environment, and how the effectiveness of such taxes can be assessed. Because of its potential impact on

lowering GHG emissions and opening the door to clean industrial technologies, this is of the utmost importance. Environmental tax revenues to EU budgets are inadequate to pay for protecting the environment from greenhouse gas damage, according to an examination of these revenues; thus, the fiscal procedures system needs to be changed. Taxes on emissions of GHG into the atmosphere increased by 71% between 2000 and 2020, contributing to a 1.5-fold increase in the tax rate, which contributed to a 53% increase in total environmental taxes received by the EU budget (Shamsuzzaman *et al.*, 2021). By applying the suggested methodology and analysing the correlation coefficient, the study found that between 2000 and 2020, there is a very strong connection strength of +0.971 between the total values of all environmental taxes and revenues collected from environmental taxes on emissions of GHG into the atmosphere, and a rather robust feedback relationship of +0.913 between these revenues and the EU budget as well as EU GDP. Consequently, different environmental tax rates should be applied at different stages of developing clean technologies.

Cavallaro, Giaretta and Nocera (2018) The primary goals of road pricing as a transport policy are to control traffic demand, discourage the use of personal automobiles in congested city centres, and pay for road maintenance. One of the most crucial criteria for a transport system's sustainability is its ability to reduce carbon dioxide emissions; this technology can help with environmental externalities as well. Nevertheless, the economic evaluation of the carbon potential provided by road charge is infrequent, demonstrating that CO2 is assigned a secondary role in urban settings (Almeida and Ferreira, 2017). In certain contexts, the effective role of road pricing in reducing carbon emissions is substantial, accounting for an overall percentage greater than 10%. This research accurately analyses the relationship between congestion-based, distance-based, and pay-as-you-drive road pricing. There is also discussion of practical recommendations for policymakers regarding the measure's implementation, with an emphasis on the safeguards that must be in place to incorporate a fair carbon evaluation into a comprehensive and effective analysis.

Dissanayake, Mahadevan and Asafu-Adjaye (2020) used in an energy-and environmentally-conscious "Global Trade Analysis Project" (GTAP) to evaluate three

distinct approaches to reducing Indonesia's carbon emissions, a developing country notorious for its high pollution levels. Emissions trading schemes, gasoline taxes, and carbon taxes are all part of this set of policies. The goal is to find the most active way to combat these emissions. Despite a 0.29 percentage point increase in GDP in 2030 from fuel taxes, inflation, welfare loss, wage fall, and job loss are all less affected by the 0.11% drop in GDP caused by carbon taxes and ETS. Since the price of coal has increased by more than 100% as a result of the carbon tax and ETS, it is probable that similar to the fuel tax, these policies will encourage the switch to RES. The amount of US$36/ton of CO_2 that Indonesia needs to achieve its emissions goal is substantial. In the near to medium term, developing nations facing political and economic limitations in their energy and transport sectors would be better off with the carbon tax, which is easier to implement and takes less time overall, rather than the ETS.

Jiang et al. (2020) Reducing air pollution levels, particularly emissions of carbon dioxide (CO2), is a priority for China's power sector. This study examines the methods used by the power industry to regulate air pollution and decrease carbon emissions at the regional level. Through the use of structural and technological solutions, its principal objective is to lessen emissions of carbon monoxide and air pollution. A technological method successfully lowers air pollution but increases CO_2 emissions due to the higher power consumption of APCDs, whereas structural solutions have overall co-benefits, according to the research. By comparing the extra costs of producing power and reducing pollutants, this study provides the power sector with cost-effective techniques in four case sites. Meeting the designated targets for reducing emissions is the objective. Policymakers and stakeholders in China's power sector can benefit greatly from the operational and regulatory guidance that these solutions offer in their efforts to decrease emissions of carbon dioxide and other air pollutants and to advance low-carbon sustainability.

Bui and de Villiers (2017) This study interviews 38 employees from 30 companies that utilized carbon management control systems to learn about different kinds of systems and who is responsible for what inside them. Various carbon controls, as well as their internal and external purposes and goals, are detailed in the research. Businesses can shift

their focus to meet various goals at different times by implementing carbon controls to either boost performance or achieve compliance. Absolute reduction targets, management buy-in, and carbon management funding are all necessary for emissions reductions, according to the results. Carbon controls must be integrated into operational and strategic processes for organisations to efficiently manage compliance costs or increase performance, according to the research. Both managers and researchers can benefit from the proposed framework, which can serve as a roadmap for implementation or a structure for conducting research. Managerial communication, information quality, and employee perspectives are the three pillars that the framework identifies as essential for effective control. To successfully reduce carbon emissions, it is essential to supply high-quality carbon data in an easily digestible format and to disseminate this data in an accessible manner. This will guarantee that employees have a positive impression of the information and are willing to support its implementation.

Zhang et al. (2020) There has been a lot of recent attention on the transport sector because of its role in accelerating global warming. This study set out to answer the question, "How difficult is it to reduce emissions compared to the absolute reductions that could be achieved by creating the ideal model of urban traffic flow?" using a thought of carbon emission satisfaction as a foundation. Rail transit is the most popular alternative, and private automobile usage may be drastically decreased, according to the analysis of Shanghai as an example. Based on the findings, improving the urban transportation system in Shanghai might lead to a decrease of carbon emissions of 47.62% in present traffic environment. Shanghai has prioritised human and governmental pleasure over environmental concerns, leading to poor carbon emission satisfaction regarding urban traffic. Reducing other targets to increase carbon emission satisfaction is not an easy task, and transport has limited capacity to reduce carbon emissions. Hence, for Shanghai to meet its carbon emission reduction goals—without jeopardising the achievement of other targets—it must employ measures related to transportation technology, urban planning, and resource allocation to enhance the current state of traffic (Chen and Lin, 2021).

2.5 Behavioral Intention and Actual Adoption of Renewable Energy

Masrahi, Wang and Abudiyah (2021) even though home energy consumption in the US is heavily influenced by consumers' demographics, behaviours, and physical attributes, research has shown that public acceptability is crucial for instant and future use of RE. This study sought to identify criteria influencing residential consumers' implementation of RES in US by examining demographics, socioeconomic position, and behavioural aspects. In this study, we looked at how well the TPB research model's willingness to pay component predicted that customers would choose RES. A total of 22 percent of the nation's renewable energy came from the states that took part. Consumers' inclination to use RES is significantly influenced by their household income, as shown in the data. Even the TPB structural equation model's predictions are congruent with the results. Customers' attitudes towards renewable energy usage were slightly affected by the willingness to pay construct, but the subjective norm (perceived behavioural control) had a considerable influence on their intents to use RE.

Khalid et al. (2021) The extent to which Polish consumers are willing to embrace RES was also included. Research aimed to identify the characteristics that influence the technology's utilisation, as its primary objective is to encourage environmental conservation. Main data for the study came from 467 Polish households that use RES; the research approach was quantitative. Based on the investigation, TAM model was utilised. The independent variables in this study included renewable energy trust, relative advantage, usage convenience, financial incentives, environmental concern, risk, and cost. Wind power's increasing popularity served as the dependent variable. The study's hypotheses were examined using SEM. According to the study's findings, renewable energy technology adoption in Poland is positively and significantly impacted by relative advantage, simplicity of use, financial incentives, and worries about the environment. On the other hand, trust in renewable energy and initial investment risk did not show a statistically significant correlation with renewable energy uptake. While advocating for the use of renewable energy, stakeholders should keep environmental concerns in mind, as stated in the report. The government and “non-governmental organisations” (NGOs)

should be incentivised to employ RES. It is crucial to educate households about the merits and advantages of RES.

Yun and Lee (2015) Instead of looking at ways to increase demand from society to disseminate the new energy technology, developers of renewable energy systems have focused on technical advancements. From a socio-technological vantage point, this study analyses critical components of the dissemination of renewable energy systems in order to comprehend demand-side concerns pertinent to sustainable energy innovation. An investigational framework based on TPB was developed by incorporating "societal" elements like social support and trust as well as "technology" concerns like technological enabling conditions and perceived system quality. Consumers' intentions to utilise renewable energy systems are influenced by attitude, and perceived behavioural control, subjective norm, according to this research. Furthermore, factors influencing attitude and subjective norm include social trust and support, while factors influencing perceived behavioural control include facilitating technical conditions. Business managers and policymakers, according to the study's results, need a plan to reconcile technological advancement with social readiness for sustainable energy innovation.

Gârdan et al. (2023) As a result of long-standing political and military conflicts, a new energy crisis is taking shape at a faster rate than before. This research aims to validate a number of specific variables using a sample of 1,126 respondents. These variables include environmental concern, ease of use, perceived utility, knowledge about renewable energy, attitude towards RE utilisation, behavioural intentions to use RE, and attitude towards RE utilisation. Perceived utility social influence, and environmental concern were found to be among the most influential latent factors in shaping attitudes towards the utilisation of renewable energy. Consumers' preferences for renewable energy technologies are becoming a more transparent indicator of their behavioural intentions and actual consumption behaviour for RE. Correlations with variables like income and education level are becoming readily apparent.

Perri, Giglio and Corvello (2020) Existing methods of producing and consuming power pose some technological, social, and environmental challenges that smart grid

technology may help to resolve. Users' habits will need to shift, though, for smart grids to become widely used. An individual's propensity to engage in "smart consumption and production behaviours" is the focus of this research. The successful implementation of programs to encourage behavioural changes that would promote the spread of smart grids depends on our ability to understand and account for these aspects. Using Ajzen's theory of planned conduct, we may understand this intention to adopt. Elicitation studies involve sending out questionnaire surveys to a randomly selected set of consumers to collect salient modal beliefs. The analysis of the main survey data is based on structural equation modelling. Structural equation modelling confirms the subjective norm, hypothesis that one's attitude and perceived behavioural control have a favourable effect on the intention to adopt Specifically, According to the research, energy savings is the most important notion associated with attitude, and perceived behavioural control is the variable with the highest assessed loading factor. Additional research shows that reluctance to change, an exogenous element, negatively affects intention. This study's findings offer credence to the theoretical model's explanatory capacity and shed light on how to best undertake behavioural change activities to aid in the spread of smart grids.

Korcaj, Hahnel and Spada (2015) For photovoltaic (PV) system installations to guarantee a financial return on investment (ROI), German lawmakers established a feed-in tariff. They looked into additional homeowner motivations related to PV system purchasing intention to encourage adoption in the future when this tariff isn't in place. Two hundred homeowners who did not have photovoltaic systems installed took part in the online poll. Few homeowners had any intention of installing a PV system. With a low-price sensitivity and a high intrinsic desire to purchase a PV system, we may expect to see prices drop in the near future. Utilising route analysis, the study demonstrated that an individual's subjective norm and attitude towards PV had a significant impact on their desire to purchase. The risks, hassle, and expense of PV systems have a detrimental impact on attitude. Social status, autarky, and material rewards were the primary drivers of attitude. They conclude that in an effort to facilitate the use of more widely spread technologies, it is required to create and market energy storage systems that provide higher levels of

autonomy and cost reduction. Also, homes that are interested in installing PV systems should not be afraid of the potential risks, thus there should be official testing and labelling of PV systems (Nurwidiana, Sopha and Widyaparaga, 2021).

Wang et al. (2021) Household energy conservation aspirations typically exhibit very consistent individual differences. One probable reason for these variations could be innate personality features. Nevertheless, it is still not known how exactly personality factors influence the aim to conserve energy in the home. This study intends to use TPB to establish a connection between Big Five personality traits and home energy conservation objectives to investigate the functions of personality types in this area. This study is based on survey results from 279 legal households in Xi'an, China. The results show that all four personality qualities have an outcome on the intention to save energy in the home, except extraversion, and that this effect is mediated in different ways. All three TPB predictors demonstrate positive relationships with agreeableness and openness. While neuroticism is only negatively correlated with attitude, conscientiousness is positively correlated with perceived behavioural control. The findings provide some empirical data about the relationships between environmentally conscious behaviours and personality traits in northwest China. Sustainable community development policies could benefit from this study's results.

Muwanga and Mwiru (2021) determined how and to what extent people's cultural and societal attitudes influenced their intentions to use “renewable energy technologies” (RETs). The study's use of the theory of planned behaviour framework proved that participants' social-cultural views are necessary but not sufficient criteria for their behavioural intents to adopt RETs. There were 369 households surveyed in the three urban districts of Uganda (Kampala, Wakiso, and Mukono) for this study. The results showed that cultural beliefs had little to no effect on behavioural intentions to adopt RETs, while religious beliefs and perceptions did. More than any other notion, intentions were shaped by perceptions of the practicality, ease of use, and outcomes of RET adoption. Advocates for RETs can use these results to foster the favourable views and sentiments that are critical to the widespread adoption of these technologies. Unfortunately, the research methodology

that yielded these results may have limited their applicability because it did not account for elements that are strongly tied to beliefs, such as attitudes and norms.

2.6 Global Perspectives on Carbon Taxation

Köppl and Schratzenstaller (2021) The topic of suitable climate policy instruments is pertinent in light of environment change, the EU increased climate targets for 2030, and Austria's plan to achieve climate neutrality by 2040. Thus, over recent years, increased attention has been paid by scholars, economists, and environmentalists to the advantages and disadvantages of carbon pricing mechanisms, including the carbon tax. This study provides a review and synthesis of the existing literature on carbon taxes, analytical and experimental. The most crucial aspects of carbon taxes' impacts are examined here: their efficacy on the environment, their effects on key macroeconomic indicators (particularly employment and growth), their influence on innovation and competition, their distributional consequences, and public acceptance.

Kotlikoff et al. (2021) Impacts of change in environmental conditions on current and future generations will not be the same in all the geographical regions. This work develops the first and only carbon policy and climate change model that addresses, among other features, overlapping generations, multiple regions, and yearly calibration. It contains region-dependent functions for damage and temperature, as well as a phase-dependent influence of emissions on global and regional temperature calibrated to latest scientific knowledge. According to threatening damage levels, GDP in many areas could be cut by climate change inaction: Severe. In the long-run, the South Asian Pacific, India, and Brazil would be most affected. Besides, the policy has the potential of; Reducing the carbon externality; a carbon tax in combination with transfers based on generation and location can increase the well-being of all agents, both present and future, by 4.3% worldwide. The decrease in the trajectory of global emissions and the influence on the use and longevity of fossil fuels are both enormous. But if we succeed in making everyone's welfare benefits the same, some generations in some areas would have to pay astronomical sums to make up. Luckily, a carbon tax with redistribution plan can provide a welfare benefit of 4% or more for all humans, both now and in the future, while keeping this burden at less than

10% across all generations and regions when calculated on a consumption-equivalent basis. But until all big polluters, especially China, implement them promptly, carbon taxes set through time at carbon's marginal societal cost will not be enough to reduce climate change.

Criqui, Jaccard and Sterner (2019) Most economists see carbon pricing as an essential part of any climate policy. The prevailing belief is that it will introduce straightforward, easy-to-understand, and inexpensive ways to alter spending and investment habits. Carbon taxes are the simplest solution, but they are also the most difficult to execute. The purpose of this research is to learn about carbon pricing from the experiences of three nations: France, Canada, and Sweden. By comparing the three countries' experiences, it is clear that carbon prices indeed have the intended effect. When it comes to this, they work well. As the research reveals many scenarios regarding progress, problems, and outcomes, it is crucial to carefully analyse social and political aspects that lead to the adoption and effective utilisation of these economic tools. In this context, four key findings emerge from the comparison that merit additional investigation from social scientists and economists: the capacity to integrate purely economic tools with other forms of regulation or policy and measure; the control of special interests and lobbying groups; the formulation of a distinct plan for reuse of carbon tax revenues, whether designated or not; and lastly, significance of these three aspects of carbon taxes within the context of zero net emission policies.

Malerba et al. (2022) While carbon taxes are crucial for reducing emissions, they have several drawbacks, such as the fact that they can be regressive and lead to higher poverty rates; furthermore, there isn't consensus among both the public and lawmakers on how to implement them. One possible solution to this problem is to redistribute the tax money that has been collected to low-income families. On a worldwide scale, however, the optimal approach to formulating such a policy remains unknown. To alleviate poverty and injustice, both domestically and internationally, this study compares and contrasts several approaches to carbon taxes and revenue recycling. The most successful policy mix for decreasing poverty, according to their findings, would consist of a consumption tax (with higher rates on luxury products) and the redistribution of income through expanded social

assistance programs, like the expansion that occurred during the COVID-19 epidemic. While it's good that different countries have different tax rates on different things, countries should keep their average tax rate the same so that governments in low- and middle-income countries can have more money to help the needy. The collection of a global climate fund from wealthy nations and its subsequent redistribution to poorer nations according to poverty headcounts will help alleviate poverty and inequality both domestically and internationally. However, to fully realise the promise of revenue recycling to alleviate poverty, especially in nations of Sub-Saharan Africa, there is an immediate and critical need to upgrade social assistance institutions. It will be necessary to make extra mitigation measures in other areas since the short-term effect of carbon taxes on reducing emissions will be hindered if the monies are recycled to fight poverty and inequality.

Ariffin (2024) More and more, climate action is being pushed for as a matter of paramount importance, particularly in light of the Paris Agreement's stated objectives. Malaysia has pledged to cut its overall emissions of greenhouse gases by 45 percent by the year 2030 as part of Paris Agreement. To guarantee a decrease in carbon emissions, Malaysia has done what is necessary. However, it does not include financial penalties for the emitters; rather, it merely emphasises fiscal incentives and motives for a clean environment. A shift towards tax-based policies is occurring among policymakers around the globe as a means to reduce carbon emissions. It is believed that Malaysia would likewise soon impose a carbon tax. Finding out which sector of Malaysia's economy is most responsible for carbon emissions and how people feel about a carbon price are the primary goals of this research. This study gathers data from several sources, including the industry, the Inland Revenue Board of Malaysia, and the general public, through desk research and questionnaires. Findings from this study show that certain industries are major contributors to GHGs, and they also show how people feel about the idea of a carbon price. Also emphasised are the study's implications.

Ajmera and Dr. Vivek Nemane (2023) At the same time, climate change can be simultaneously named the most acute global problem, as well as one of the greatest opportunities for its economic solution, comparable in terms of its complexity and potential

consequences with none of the opportunities since the industrial revolution. As an example of a supervisory fiscal component of international economic law, this study uses carbon taxes to look at how they could affect economic prospects in line with the aims set by governments in Paris Agreement of 2015. They need to know if a carbon tax or a reorganisation of tax rates can effectively control emissions of this greenhouse gas and steer businesses, households, and investors on a more sustainable path. This study takes a look at three carbon tax case studies: one in South Africa, one in British Columbia, and one in the context of the aviation industry's modification of the EU Energy Taxation Directive. The best use of tax funds and the appropriate selection of tax rates are two of several areas that it aims to examine to successfully decrease carbon-based emissions. The study suggests a carbon tax as a potential model for global carbon neutrality in light of the COVID-19 pandemic, based on the policies of the case studies and concerns and solutions to these difficulties.

Timilsina (2018) The literature on the carbon price has been steadily building up over the last 30 years, and this study delves into it all. It also shows how the carbon price is being put into action and how the debate around it is continuing. The study follows the evolution of carbon tax literature through the use of subjects and research methodologies as categories. The four primary issues that the literature clarifies are economic ramifications, distributional implications, revenue recycling choices, and competitiveness and border tax adjustment. Statistical analysis, especially computerised general equilibrium modelling, is backbone of the field's study. Findings from the study highlight concerns about competitiveness and possible negative economic effects as the primary hurdles to implementing the carbon tax. New approaches to carbon taxes have emerged from in-depth analyses of the problem on a national, regional, and international scale. Although carbon taxes were mostly discussed in academic circles until recently, they have gained significant traction among policymakers, especially in the wake of “Paris Climate Agreement” (PCA), and are now being considered as a primary market tool to combat climate change. Despite extensive study on some key aspects of the carbon price, its possible linkages with poverty and shared prosperity have not been examined.

2.7 Behavioral Economics and Carbon Taxation

Kettner-Marx, Kletzan-Slamanig and Kettner (2018) Since market-based tools guarantee compliance at the lowest cost to society, they are widely favoured in economic literature as a means to regulate environmental externalities. Since Kyoto Protocol was adopted in 1997, there has been a noticeable increase in the introduction of emission fees worldwide, with a particular emphasis on carbon dioxide (CO2). This review compiles and analyses the theoretical economic works concerning energy and pollution taxes. Environmental taxes, and carbon taxes in particular, are the subject of theoretical suggestions for their ideal design, relative performance to other instruments, the idea of a double dividend, and possible distribution and competitiveness implications. When it comes to climate policy and getting emissions down the road, carbon taxes can be a game-changer. A sustainable, effective, and efficient regulatory framework to reduce emissions could be possible with the help of this economic analysis.

Davies, Shi and Whalley (2014) Carbon pricing on a worldwide scale has the potential to generate substantial enough funds to open up substantial redistributive options on a global scale that benefit the poor. They look at possible multidecade growth trajectories for big global economies from 2015 to 2030 to stabilise emissions despite both continuous national expansion and advances in the efficiency of autonomous energy usage. The primary scenario shows that once carbon pricing is internalised on a worldwide scale, revenues will first reach 8% of GDP, then declining to 6%. While rapid economic development in China and India has a long-term positive impact on reducing poverty and inequality, global carbon pricing revenues have the potential to accomplish significant incremental redistributive impacts. A worldwide carbon tax, when considered in isolation, has a regressive impact on economies around the world, according to both estimates of within-country effects and between-country effects found in the literature. However, if its profits were distributed evenly on a worldwide scale through per capita payments, as we fundamentally assume, the bottom decile's proportion would rise by 81% on average between 2015 and 2030 and the world income Gini coefficient would fall by about 3%. In 2015, the number of individuals living in poverty decreased by 16%. Finally, if the world's

poorest people received just one-third of the money collected from carbon taxes, poverty would be eradicated by 2015, at least according to the estimates.

Lackner, Fierro and Mellacher (2024) The "Opinion Dynamics with a Macroeconomic Agent-Based Model" (OD-MABM) is the name of integrated approach. Finding out how backing for climate change mitigation strategies has changed over time is the primary goal of the research. The DSK model, which has been adjusted for European countries using panel poll data, and OD-MABM merges a new model of opinion dynamics with it. Various factors influence household views on stringent climate policies. These include the complex interplay between social, political, economic, and climate systems; personal financial circumstances; views on climate change; industry-sponsored disinformation; and societal pressures. They take a look at 133 different policy avenues in the EU, including different carbon price plans and strategies to recycle money. While the research shows that effective carbon tax policies do reduce public support at first owing to large macroeconomic transition costs, they also produce a favourable social tipping point down the road. This change is caused by the fact that the industry reliant on fossil fuels is losing economic and political clout as time goes on. The second point is that this intertemporal trade-off can be effectively addressed through hybrid revenue recycling systems that incorporate climate dividends and green subsidies. This approach has public support from the very beginning of the carbon price.

Woerdman and Bolderdijk (2017) Expanding carbon pricing in the EU to families is the subject of this first research study that systematically and openly combines behavioural science with law and economics. Instead of taking a stance on the matter, this study aims to analyse carbon trading for households rather than advocate for or against it. This study aims to accomplish just that by collecting pertinent theoretical insights and delving into how well-established empirical evidence might inform the development of a feasible plan. In addition to outlining potential behavioural and economic hurdles, the research provides feedback on its institutional design by outlining potential solutions to these problems. A more obvious and immediate carbon incentive can be achieved through downstream distribution, while administrative expenses can be lowered by focusing

enforcement and monitoring upstream. By emphasising the effectiveness and fairness of emissions trading, for example, strategic communication can increase behavioural acceptance. Consistently updating households on their carbon transactions can motivate them to reduce energy consumption. Because of this, the results of their activities will be easier to see. It is still debatable whether these requirements are sufficient to ensure political support.

Nadiri, Gündüz and Adebayo (2024) Carbon dioxide (CO2) emissions are primary source of environmental damage, which is an urgent topic that the study addresses. These emissions endanger the sustainability of the environment on a worldwide scale, including in EU member states. Despite the continued existence of global warming, the causes of the decrease in carbon emissions in EU countries have not been thoroughly investigated in prior research. To address a knowledge vacuum, this study examines influence of RE, carbon levies, and eco-innovation on CO2 emission reduction initiatives from 1994 to 2019. This research makes use of state-of-the-art methodologies, such as cross-sectional autoregressive distributed lag methodology and Wester fund cointegration strategy, to identify long-term connections among the evaluated variables. Concerns about environmental sustainability in the European Union can be better addressed through economic development, according to the study. Additionally, it stresses the significance of globalisation, eco-innovation, renewable energy, and carbon prices in reducing environmental damage. These results highlight the need for strong plans to lower CO2 emissions and lessen negative effects on the environment.

DOMINIONI and HEINE (2019) By analysing the influence of carbon levies, eco-innovation, and RE on CO2 emission reduction initiatives from 1994 to 2019, this study addresses a knowledge vacuum. To find long-term relations among variables that were studied, this study employs cutting-edge approaches including the Wester fund cointegration strategy and the cross-sectional autoregressive distributed lag methodology. Customers' perceptions of their agency, the equity of carbon taxes, and other behavioural factors like present bias and loss aversion may all play a role in whether or not they choose renewable energy. Here are some ways these behavioural factors are defined: By keeping

these considerations in mind, lawmakers can craft carbon tax programs that appeal to people's emotions while also providing financial incentives. One strategy to make carbon taxes more successful is to frame them as a tax on future generations or to highlight the potential immediate benefits of switching to RES. To further contribute to more effective energy sustainability, it is important to identify the influence of social norms and peers to design communication tactics that would increase the usage of renewable power sources in response to carbon taxes.

2.8 Economic Impacts of Carbon Taxation on Renewable Energy Adoption

Miguel Angel Tovar Reañosa (2019) The public is opposed to carbon taxes in part because they are regressive policies. Using "Exact Affine Stone Index" (EASI) demand system, they examine the distributional effects and degree of emission reductions brought about by carbon taxes in Ireland. Because they found that the Engel curves for various categories of commodities are non-linear, their demand system is better than others in the literature. Although it is regressive, they discovered that raising the carbon tax can reduce emissions. These regressive impacts can be reduced by redistributing the revenues to families. While both approaches can help decrease the regressive impacts of a tax increase, a targeted allocation that sends money to lower-income families do a better job of reducing inequality than a flat allocation that gives money to everyone.

Sabine et al. (2020) A carbon-based economy, reliant on fossil fuels, governs Reunion Island as it does most insular regions. Aiming to achieve a 100% renewable energy mix by 2030, this offshore French territory has just adopted the energy transition to a low-carbon economy as its motto. Without compromising economic progress, everyone should do what they can to reduce their dependency on fossil fuels. This is a critical concern for all territories, but especially for island nations that are physically and structurally limited. There needs to be a quantification of the costs and opportunities associated with energy transition and severe reductions in GHG emissions. To reach the goal, set by Paris Agreement, France implemented a carbon price policy, which this study analysed from both an environmental and economic perspective. The potential for tax revenue recycling is a key factor in the tax's acceptability. The simulations consider various potential

redistributions of tax revenue. They employed a “computational general equilibrium” (CGE) model that accounts for all the distinctive features of Reunion Island to comprehend the island. According to the available data, carbon pricing achieves its objective of decreasing CO2 emissions by promoting the substitution of RES for fossil fuels. A counterargument is that the tax hits the economy as a whole hard. Reimbursement systems for tax revenue recycling help to lessen the blow, but the outcomes are very different because different recycling programs benefit different economic players.

Sun et al. (2020) The global community is actively attempting to lessen the impact of environmental change, and a carbon tax is one method that several nations are doing. Given that different industries will feel the tax's effects on GDP growth and carbon emission reduction in different ways, this goal may be attained by applying carbon taxes more uniformly across all industries. The possibility of varying carbon tax rates has been largely disregarded by scholarly journals. To better manage carbon emissions and decrease carbon intensity, this study lays forth a plan to optimise carbon tax rates using the CGE model. One model's objective is to raise GDP, while the other's is to lower carbon emissions. The approach is illustrated through the use of a case study involving China. The findings demonstrate that a more effective way to lower carbon intensity is through an optimised taxation plan and that more CO2 reduction is possible without a corresponding drop in GDP. An improved energy infrastructure may result from a more environmentally friendly tax system.

Máté, Török and Kiss (2023) Decreased atmospheric concentrations of GHGs, such as CO2, hasten the process of global warming and heighten the incidence and severity of severe weather events. Finding out how various energy sources and environmental costs influence carbon intensity is the primary goal of the study. The research used a generalised method of moments model (2SGMM) estimator that considered instrumental factors to examine the direct and indirect influences of environmental levies on carbon intensity. Primary energy supply and environmental-related levies have a favourable effect on carbon intensity, as shown in this study, which supports the EKC theorem. Increasing the utilized of RES can greatly reduce emissions of carbon dioxide, as demonstrated in the second

discovery. The results of this study contribute to the increasing amount of evidence showing that taxes mitigate the impacts of renewable and primary energy sources. Instead of an incentive effect, the empirical analysis indicates that the charge has a budgetary effect. More sustainable development pathways towards energy independence and carbon neutrality require substantial financial resources and fiscal policies on top of the present economic and energy crises.

Abrell and Kosch (2022) looked at the best ways to modify renewable energy assistance policies to consider carbon prices. Changing carbon prices necessitates modifying RE production subsidies, as demonstrated both conceptually and practically, for two distinct reasons: The first step is to lower renewable energy premiums so that they more accurately reflect the market price of carbon. Secondly, once the transition from coal to gas power happens, the feed-in tariffs and renewable energy premiums will need to be revised. To reflect shifts in RE's minimal external benefit, this modification is required. Using the UK as an example, they calculate the best possible RE subsidies and how those subsidies might change in response to a fuel transition. Optimal RES is also examined about the effects of different carbon prices through numerical simulations. As a result of rising carbon prices, they demonstrate that the required adjustment for a fuel switch is experimentally rather small, but as cost of carbon is more reflected in price of energy on the market, RE premiums will have to be phased out. And lastly, while a fuel swap does more to boost solar-induced abatement, it has little effect on wind-induced abatement. Wind and solar power receive relatively similar levels of renewable energy subsidies.

Silva, Soares and Pinho (2012) examined the impact on GDP and carbon emissions of increasing the share of RES in power generation. Three variables make up the "Structural Vector Autoregressive" (SVAR) model used in this study. Their sample included four nations with varying social and economic systems and degrees of economic growth, all of which have made investments in RES in recent decades. From 1960 to 2012, they looked at this period. By looking for unit roots, we were able to deduce that the variables were stationary. Increasing RES has a negative influence on GDP per capita for all sample nations except the US, according to the SVAR estimate utilising “impulse response

functions” (IRF). There was a considerable decrease in CO2 emissions per capita as well. The percentage of RES-E explained a large part of the variance in the GDP per capita prediction error and a smaller part of the CO2 per capita forecast error, according to the variance decomposition analysis.

Adão, Narajabad and Temzelides (2024) Early technology adoption could lead to significant capital replacement costs when technological progress is rapid. They factor in endogenous arguing costs, externalities, and spill overs associated with new renewable energy technology adoption, carbon emissions, and an analytical Integrated Assessment Model. They used the calibrated model to look at the best way to switch to renewable energy and what effect the scrapping channel would have on adoption rates. The optimum policy would be a Pigouvian carbon tax, but in its absence, a policy that encourages renewable energy by absorbing spill overs would have little impact and would even slow down growth in the short term. On the other hand, when Pigouvian tax is also implemented, the decrease in fossil fuel usage due to internalising technology spill overs is much bigger. A 1.4 percent improvement in consumption-equivalent welfare is achieved by comparing the current situation to the one in which both measures are put into place. The study recommended against jumping to the conclusion that direct subsidies can replace a Pigouvian carbon price in the face of cutting costs caused by fast technological advancement. To maximise societal well-being, carbon taxes and renewable energy policies that reduce or eliminate spill over externalities should be seen as complementary measures, not alternatives.

Doğan et al. (2022) This study views economic growth, energy consumption, economic complexity, and rent from natural resources as important drivers of emissions. It examines the G7 nations' carbon emissions and the influence of an environmental tax from 1994 to 2021. The study delves into the potential effects of a green tax on the utilisation of green electricity, rent from resources, and conventional power generation, while also confirming "Environmental Kuznets Curve Hypothesis" (EKCH) for G7 nations. Additionally, it delves into the potential marginal effects of this tax. Businesses will be able to implement cleaner manufacturing techniques as a result of stringent environmental

tax requirements, according to the report. Finally, the study concludes that governments could have a higher chance of achieving UN SDG 7 and 13 if they redirected tax dollars to initiatives that research and develop sustainable technology.

2.9 Carbon Taxation and Energy Market Transformation

Kong, Li and Tan (2023) Using data collected from 211 Chinese prefecture-level cities between 2015 and 2021, this study aimed to build indices for carbon markets, green development, energy transformation, and financial development. Thinking at it from a green economics perspective, the author wanted to find out how to implement a carbon emissions market and what impact it would have on green growth so that we could achieve green development. This study takes a different approach than others by looking at how carbon markets affect green development through the energy transition's pathways for renewable energy usage and better energy efficiency. Next, we'll take a look at how green growth, carbon markets and financial development have mediated across eastern, central, and Western China. Empirical evidence from this study supports the idea that carbon markets promote environmentally friendly growth. Furthermore, energy transition links green development to carbon markets; secondly, financial development mediates the connection between these three factors.

Orlov and Grethe (2012) Russia ranks high among world's carbon-based energy producers and consumers. Reducing emissions and encouraging investments in energy efficiency are two potential outcomes of implementing carbon fees. They look at how carbon taxes would affect Russia's economy in perfect competition and Cournot oligopoly production market. Here are the key takeaways: (i) If labour taxes were to substitute carbon taxes, Russia would reap substantial benefits; but, the magnitude of these gains would depend on factors such as the degree to which the labour supply and capital are elastic, as well as the degree to which energy and labour are interchangeable. (ii) Compared to a perfectly competitive market for metals, natural gas, chemical goods, petroleum, and minerals, the environmental welfare costs of a Cournot oligopoly with symmetric enterprises and homogeneous products might be higher. Because carbon taxes reduce already suboptimal production, they exacerbate pre-existing distortions caused by

imperfect competition. (iii) Moreover, as a consequence of enterprises leaving affected markets, markups can be higher when energy costs rise.

Xingmeng Li (2023) Given China's double carbon targets and the country's highly energy-dependent economy, the country must step up its efforts to decrease carbon emissions. Due to its status as a major energy province, Shanxi is no stranger to problems like excessive energy usage and air pollution. Consequently, China's energy-related businesses can learn a lot about how to reduce carbon emissions by studying transformation and adjustment of Shanxi's industrial structure. The growth of energy-related companies will unavoidably be affected by the carbon tax, which is applied by numerous nations across the globe as a means of reducing carbon emissions. In order to achieve its dual carbon targets on time and promote high-quality economic development, China must consistently improve auxiliary measures and set fair tax rates.

Dissou and Siddiqui (2014) While several studies have looked at how carbon taxes affect commodity prices, few have considered how these changes in commodity prices affect individual welfare as a result of shifts in factor costs. Capital and labour do not have the same impact on household incomes since these taxes do not treat them equally. By examining both the commodity and income channels at the same time, this study offers a thorough evaluation of how carbon taxes affect inequality. They suggest breaking down the shift in individual welfare indicators. The next step is to create a general equilibrium model that takes into account the Lorenz and concentration curves as well as the Gini index to determine how carbon taxes will affect commodity and factor prices, and then how those taxes will be distributed among households. The findings imply that factor price changes and commodity price fluctuations impact inequality in different ways. As a whole, carbon taxes have the effect of lowering inequality due to shifts in factor prices while simultaneously widening it due to shifts in commodity prices. Thus, they discover that carbon taxes and inequality have a non-monotonic (U-shaped) connection. Looking at changes in commodity prices as the sole measure of how carbon taxes affect inequality can be misleading, according to the findings. Findings from the analysis of carbon prices' effects on inequality highlight the value of both approaches.

Lin and Jia (2018) Emissions of carbon dioxide have been rising due to human activity; a carbon price might provide governments with a strong incentive to lower these emissions. To examine the possible impacts of the "Carbon Tax System" (CTS) on energy, the environment, and the economy, this study produces nine scenarios that take into consideration varying carbon tax rates and taxable businesses. Even under the worst-case scenario, they determine that CTS's negative effect on GDP is manageable, coming in at less than 0.5 percent. There will be little change in carbon emissions even if a high carbon tax rate is imposed on energy-intensive businesses. With a higher carbon tax rate, CO_2 emissions from transportation will be reduced more significantly, both marginally and overall. The rate of carbon taxes is determined by law of rising marginal emission reduction. They claim that energy companies ought to bear the brunt of taxation. The energy market's efficiency in reducing emissions and conserving energy can only be realised in this manner. This study backs the idea that China should implement CTS, which would raise taxes on energy firms and energy-consuming businesses at the same time. While this will have a minor effect on GDP, it will maximise emissions reductions.

Ebaidalla (2024) Considering the current state of global warming, one of the most important things we can do to reach the seventh SDG—a reduction in carbon emissions—is to switch from using fossil fuels to RE. The investment environment is greatly affected by tax policy, which in turn affects all aspects of the shift to renewable energy, including trade openness and technological innovation. Incomplete tax data has impeded research into direct and indirect effects of taxes on investment in renewable energy. Consequently, this study takes advantage of the newly published Government Revenue Dataset (2023) to investigate, for a selection of the 37 leading countries that generated renewable energy between 1996 and 2021, the intricate relationship between taxes, technical advancement, trade openness, and investment in this sector. Across all model assumptions, both short- and long-term, the results of “pooled mean group” ARDL (PMG-ARDL) and “cross-section” ARDL (CS-ARDL) models show that taxes significantly and negatively affect investments in renewable energy. Clean energy investment, on other hand, is positively and significantly affected by innovation and trade openness. The findings showed that tax

revenues dampen the beneficial effects of technology innovation and international trade when it comes to the moderating role of taxes. The FMOLS and DOLS models showed that the CS-ARDL and PMG-ARDL models produce durable long-term results. Renewable energy generating nations can use the study's findings to inform tax policy reforms that will allow them to capitalise on trade and technological advancements to boost investment in renewable energy.

2.10 Impact on Energy Prices and Consumer Behaviour

Podbregar et al. (2021) determine the influence of energy-saving guidelines on residential power usage. A total of 330 homes served as subjects in the Randomised Control Trials that underpinned the study's methodology. The study's setting was the Republic of Serbia, a country with some of Europe's most inefficient power usage and the lowest electricity prices. In order to analyse quantitative data, Difference in Difference approach was used. By tracking the shifts in power usage between the treatment and control groups, this method determines how effective the energy-saving recommendations were in the aggregate. Findings indicate that when electricity prices are very low, energy-saving advice has little to no effect on changing customer behaviour. Different heating technologies may have varying degrees of efficiency, which could explain the inefficient use of power. Information may not have much of an effect on people's energy-saving habits for two reasons: first, people may lack the motivation to alter their habits, and second, changing their habits is practically impossible (unless they want to buy a new heating system, which would be expensive). The findings can be utilised to examine potential reforms to the structure and regulation of the power sector across all SEE nations.

Nguyen et al. (2016) determined the nature and duration of the behavioural changes prompted by dynamic electricity pricing. The investigation's conclusions aim to lower consumption overall and transfer consumption to days with stronger solar radiation. The authors further discuss how these findings can inform policies on demand management. Fifty homes were a part of the dynamic pricing experiment that took place on central Japan's Nushima Island. This inquiry used the difference in differences technique and panel analysis with random effects as its methodologies. The log of electric energy consumption

per hour is predicted using a series of linear regression analyses that take into account a variety of household characteristics, lifestyle variables, how often users access the visualisation website, and the effects of weather variables. In the experimental time, electric energy usage was 13.8% lower than the pre-experiment period, all because of dynamic pricing, according to the results. Further, this study offers evidence that individuals can develop habits by employing a unique experimental design strategy.

Zhang et al. (2022) It is well-established in the literature on energy systems that the sum-utility maximisation problem is significant. Assuming the utility is concave is the standard way to tackle this problem. However, this assumption does not accurately represent customer behaviour and is not appropriate for many critical applications. The authors use a sigmoidal distribution for the consumer's utility and apply it to a specific class of functions to solve a more general optimisation problem. There is a minimum of two compelling arguments in favour of the assumed class of functions. The first step is to avoid the classical NP-hardness problem that is often linked to sum-utility maximisation. Furthermore, the class of functions being examined includes popular performance indicators that are employed to examine price and energy-efficiency issues. This not only reduces peak power but also flattens power demand, which in turn allows for the creation of an ideal new pricing scheme called "inclining block rates" (IBR). They also show how to take use of a simple algorithm to maximise energy efficiency. When associated to current rules, simulations completely support the benefits of the proposed strategy.

Rausser, Strielkowski and Mentel (2023) Consumers' perspectives on energy efficiency and behavioural changes related to energy usage are the focus of this editorial research. With Europe experiencing a unique energy crisis owing to the diversion of Russian oil and gas supplies caused by the war in Ukraine, this topic takes on added significance today. The evolution to RES appears to be in jeopardy, even though Russian oil and gas have long been a lifeline for Europe. They served as a nebulous foundation for the goal of decarbonising the economy by 2030 and the European Green Deal. Energy efficiency and security have not seen a noticeable uptick in recent years, and many people are hesitant to break long-standing practices just because they are used to having power on

hand whenever they need it or in case of an emergency. Not only would shifting energy consumption habits help with the present energy crisis, but they would also pave the way for future energy savings trends, which are critical for sustaining economic growth and fighting environmental change and global warming.

Zhou and Yang (2016) Improving energy efficiency and promoting energy conservation can be achieved by understanding and modifying residential energy usage behaviour. The widespread use of both traditional and emerging forms of information and communication technology in the energy sector is hastening the digitalisation of formerly analogue energy systems. An innovative approach to studying and comprehending people's energy consumption behaviour is made possible by energy big data, which in turn promotes energy conservation and efficiency. First, they present a structure for the multidisciplinary study of energy, society, and information; this framework incorporates fields such as energy informatics, social informatics, and energy social science. The following section presents many aspects and study paradigms of energy consumption behaviour in households. Three dimensions can be used to study household energy consumption behaviour: time, users, and space. There are two main schools of thought when it comes to studying how households utilise energy: the behaviour-oriented paradigm and the economic paradigm. They wrap up by talking about the "4V" qualities of energy big data: volume, velocity, variety, and value.

2.11 Technological Innovation and Carbon Taxation

Lina (2013) Carbon tax policies and allowance restrictions are two ways the government can lower carbon emissions and inspire companies to invest in low-carbon technology. The corresponding carbon tax, according to the three-stage game model, is not a constant but rather varies within a specified interval when the low-carbon technological spill over is considered. When taxes are too high, small companies can't help but close their doors. In addition, getting big companies to buy carbon-reducing gear is the main point of a carbon tax. Meanwhile, the time limit and carbon emission limit determine the carbon tax balance. A higher initial tax rate might entice large companies to invest in manufacturing technologies that produce less carbon. The government can reduce the tax

rate after a certain period to avoid the formation of a monopoly on low-carbon technologies and the correspondingly high transfer fees. To reduce the costs of transferring technology that produces fewer carbon emissions, the government will continue to subsidise R&D of such technologies through the carbon emissions tax.

Zhang (2023) This study utilises a dynamic game to analyse the possible strategic communications between an alliance of resource users and a cartel of energy producers about carbon pricing, in light of the impending arrival of a new, affordable carbon-free technology. Investments in research and development can impact the uncertain innovation time. As a result of lower producer prices and first carbon taxes, results show that initial resource exploitation and carbon emissions are greater when innovation expectations are high. Cooperative settings are not immune to the 'green paradox' influence that could result from innovation; however, this effect can be lessened through deliberate communication and cooperation between resource providers and users. According to both global planners and resource consumers, the ideal amount of money to spend on research and development in order to encourage innovation rises as the initial concentrations of CO_2 rise. Instead of following the advice of a global planner, resource users may decide to invest more in R&D.

Mu and Zhao (2023) A number of nations have enacted regulations concerning carbon emissions; these regulations push businesses to find greener ways to produce goods or to invest in greener industrial technologies. This is because the manufacturing industry's production process is a major contributor to carbon emissions. Considering that manufacturers will always put economic profit above anything else in their operations, it is crucial to find out how effective carbon policies are. Three distinct carbon emission policies—a cap-and-trade system, a carbon tax, and an intensity target—as well as variables like production and carbon emission levels, product costs and emission permits, technological advancements for emission reduction and production enhancement, and the intensity target, were compared in this study. Furthermore, the comparison includes the effects of the policies on the production strategies and investments in technical innovation of enterprises. According to the research, carbon market prices go up and emission rates go down when intensity target legislation is in place. To reduce (increase) production and

carbon emissions, intensity target policies incentivise (disincentivise) producers with higher (lower) initial emission intensities. Manufacturers with lower beginning emission intensities are more incentivised by cap-and-trade to innovate technology that improves output, whereas manufacturers with higher initial intensities are more incentivised to innovate technology that reduces carbon emissions.

Zhanga and Danting Zhangb and Tingfeng Xie (2023) To address a lack of research on the topic, this study looks at seven developed economies' approaches to carbon neutrality from 1990 to 2018 via the lenses of green invention, technical diffusion, environmental change adaptation technologies, and tax income from environmental sources. To solve problems with cross-sectional dependency and slope heterogeneity, they use sophisticated panel estimators. Carbon emissions in the sample countries have been considerably and adversely affected by technical diffusions and green technological developments, according to the long-term results. The importance of environmental policy in tackling environmental vulnerabilities cannot be overstated. The results show that climate technology is necessary to achieve long-term carbon neutrality, but the size of their marginal effects varies, especially when it comes to adaptation and dissemination. Using different estimators to deal with endogeneity problems yields the same recommendations, and climate technology's inclusive approach is a boon to the green growth initiative.

KENNEDY (2018) That the world's average temperature rise not exceed 2 degrees Celsius above its preindustrial average, and numerous governments have committed to lowering their CO2 emissions during the next few decades. As a policy tool, taxing carbon emissions is expected to gain traction. This would have the desired effect of encouraging the development of fewer carbon-intensive technologies. According to studies, this kind of innovation helps bring down the price of reducing emissions, and if the money from carbon tax is put into tax incentives for investment and innovation, it could even be possible to do away with the expenses completely.

Karmaker et al. (2021) An abundance of research has examined the influence of environmental levies on GDP growth and carbon emissions. On the other hand, there is a dearth of research that has provided a quantitative connection between environmental

levies and technological progress. This study aims to find out whether there is a connection between environmental taxation and innovative environmental technologies by using a robust and statistically significant model. From 1995 to 2018, this model examined 42 high- and medium-income nations to determine the effect of environmental taxes on technical innovation in this field. Panel cointegration analysis, which accounts for cross-sectional dependence, was used for this purpose. Environmental levies promote technological innovation, as shown by the long-term effects. For example, according to the AMG approach, environmental technological innovation increased by 0.78% in middle-income nations and by 0.57% in high-income countries for every 1% increase in environmental levies. This study has important policy implications: it suggests that high- and middle-income nations can speed up the growth of technologies to reduce carbon emissions and endorse sustainable development by imposing environmental taxes. This idea could work for many countries, but it could help developing nations cut down on energy transition timelines.

Köppl and Schratzenstaller (2023) Finding effective climate policy tools is becoming more important as the world faces more and more climate difficulties and sets more and more ambitious climate goals. So, carbon pricing—like a carbon tax—and its effects are rising to the forefront of policy and academic discussions. It is common practice in literature reviews of the empirical repercussions of carbon taxes to examine a variety of impact characteristics, including environmental efficacy, influences on innovation macroeconomic consequences, distributional implications, competitiveness, and public acceptance. There is mounting evidence that carbon taxes can successfully lower or at least slow the increase of carbon emissions without having a detrimental influence on employment, competitiveness, or economic growth. Carbon taxes may have different effects on different households based on factors such as energy consumption type, the indicators used to measure these effects, and other household characteristics, according to the available empirical research. In order to mitigate regressive effects, lump-sum transfers would benefit those with lower incomes more, while a reduction in labour taxes would benefit those with higher incomes more. If we want more people to embrace carbon taxes,

we need to educate them, lessen their impact on distribution, and put part of the money into "environmental projects."

Ma, Murshed and Khan (2021) Emission taxes, research energy sector investments, and tertiary sector development, technical innovation, development spending, and carbon dioxide emission statistics for Chinese provinces from 1995 to 2021 are the subjects of this study. An economic study made use of state-of-the-art techniques for handling structural break problems, slope heterogeneity, and cross-sectional dependency. Research shows that expanding China's tertiary sector and provinces are major contributors to the country's worsening carbon dioxide emission trends. Instead, China can achieve its carbon abatement objective and lower its emissions by investing more in energy, developing new technologies, switching to RE, increasing expenditure on research, and development, instituting carbon emission fees. More specifically, the findings demonstrated that carbon emissions can be further condensed by the coordinated use of RES, technological innovation, pollution fees, and expenditures in research and development. Several recommendations at the policy level are made by the results described earlier.

CHAPTER III:
METHODOLOGY

3.1 Overview of the Research Problem

The essential to limit GHGs and promote sustainable energy has never been more urgent — worldwide. The role of one increasingly important policy approach in this effort—one that charges entities a fee equal to the sum of their carbon emissions, or what might be called internalizing the environmental costs of fossil fuel consumption (Stavins, 2019) —is carbon taxation. Carbon taxation has been acknowledged as a relatively cheap way to attack the root cause of climate change, fossil fuel carbon emissions (Nordhaus, 2019). There has been some success with carbon taxes in some countries, but little is known about how effective they are or what kind of long-term consequences they can have in terms of their stated goal of encouraging the use of RES. One important question that comes up as the world tries to move away from energy systems that use a lot of carbon and towards systems that use more renewable energy is: how can we use carbon taxes to promote the usage of renewable energy? Research suggests that carbon taxes, by making fossil fuels less appealing from an economic standpoint, would speed up the adoption of RES (Metcalf and Stock, 2023). Nevertheless, the pathway is highly complex and can differ widely, depending on local economic, social, and political conditions (Carattini, Kallbekken and Orlov, 2019). For instance, carbon tax in some of these regions can enhance renewable energy investment substantially because it directly reduces fossil fuel subsidies, whereas the tax revenue in other regions can be largely directed to general government spending and has minimal effect on renewable infrastructure development (Murray and Rivers, 2015a).

One important consideration when implementing a carbon price is potential influence on the demand for energy sources that produce a lot of carbon. Carbon taxes may discourage fossil fuel consumption and investment in renewable energy sources, but they may not have the desired effect in developing countries with a strong reliance on fossil fuels (Baranzini *et al.*, 2017). For illustration, research illustrates that to have an impact carbon taxes must be very high in regions where fossil fuels remain cheap, which may be

politically unfeasible (Sumner, Bird and Dobos, 2011). As a result, there is an ongoing need to explore how different levels and structure of carbon taxation affect the rates of renewable energy adoption across multiple national contexts. The addition of revenue recycling into the picture adds another layer of complexity, as the revenue from carbon taxes is then recycled. The evidence is that if tax revenues are reinvested in renewable energy projects, infrastructure development or technology research, such tax can have great effectiveness in promoting adoption of renewable energy (Lu, Tong and Liu, 2010). Revenue recycling is particularly a strong tool when it comes to moving away from dirty energy since it reduces the influence of higher energy costs on low-income earners (Rausch and Karplus, 2014). As such it becomes necessary to also look at the extent to which carbon taxation policy has promoted renewable energy given the revenue recycling mechanisms and the overall macro socio-economic environment within which such policies are made.

To the degree that the general population views carbon taxes favourably, they will be more effective. Many countries' public and businesses are opposed to carbon taxes because they worry about increased prices and economic disadvantage compared to other countries (Dresner *et al.*, 2006). Such political pushback can often lead to lower tax rates or even policy reversals, but this undermines the long-term possibility of renewable energy growth since it places a limit to how much of the economy can move to renewables (Carattini, Kallbekken and Orlov, 2019). As a result, we argue for a carbon taxation that is a sustainable approach, building public and political support to enable the carbon tax to support the growth of RE. In addition, RE markets are not only sensitive to the presence of carbon taxes but are also sensitive to the broader regulatory environment. Countries with supportive policies including subsidies for renewable technologies, robust infrastructure for renewable energy distribution and clear long-term energy transition strategies are more likely to reap the rewards of carbon taxation (Pizer and Sexton, 2019). The potential gains from a carbon tax imply that it should not be considered in isolation as a standalone policy, but instead within the context of a broader energy policy framework that incorporates also other incentives and regulations that support renewables, (Aldy and Stavins, 2012). It hence necessitates looking at the policy landscape within which it already operates, and at its

potential complementary measures that can strengthen its effects. Overall, carbon taxation could lead to lower GHG emissions and increased adoption of renewable energy, but these incentives can also vary greatly; levels of the tax, revenue recycling, public and political support, and the policy environment. More empirical study on these processes is required to optimise carbon tax systems and encourage renewable energy. To achieve global climate targets and promote sustainable energy, policymakers can only use carbon taxes by understanding these factors.

3.2 Operationalization of Theoretical Constructs

The "Theory of Planned Behaviour" (TPB) was used as a theory of reasoned action in this study. The TPD was developed by Ice Ajzen to predict human behaviour (Ajzen, 1991). There are some factors that contribute to an individual's behavioural intention, including their attitude towards the behaviour, their perception of their own control over the behaviour, and subjective norms, as stated by the TPB.

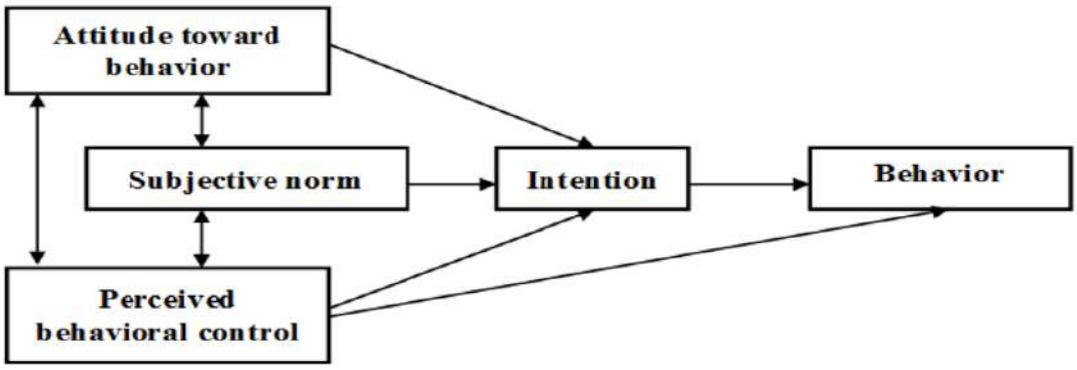


Figure 3.1: Theory of Planned Behaviour – TPB

Source: - Octav-Ionut and Macovei (2015)

According to Ajzen (1991). The primary concept in the theory is behavioral intention, which stands for the factors that drive behavior. There is a direct correlation between the intensity of an intention and the probability that the intention will be put into action. Second, there's an attitude towards the behavior, which can be defined as how positively or negatively one views a particular action. Beliefs about behaviour and assessments of its consequences make up attitude-pier. As a last consideration, subjective norm refers to the societal pressure to engage in or abstain from a particular behaviour. The

subjective norm is the product of a person's normative views and their desire to conform. Another component of the TPB is perceived behavioural control and it concerns people's attitude regarding the likelihood of carrying out the intended behaviour.

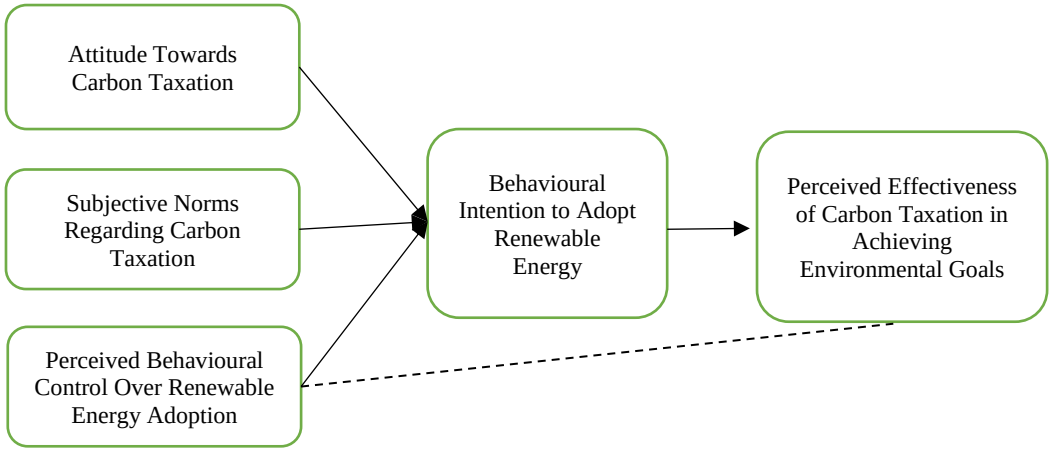
Attitude toward carbon taxation plays a very significant role in the adoption of renewable energy intention. Positive public opinion of carbon price as a fair and efficient means of limiting carbon emissions is associated with increased support for renewable energy sources, according to the study. The likelihood of making preparations to switch to and make greater use of renewable energy sources increases when people are optimistic about this move (Umit and Schaffer, 2020).

Subjective norms are a kind of inference towards the perception of social norms experienced by individuals in terms of whether to execute a given behaviour or not. If people think that family or friends impose certain expectations on them to utilize renewable energy in response to the imposition of carbon taxation then they are likely to develop the intention. This effect is more realised in the churches because of the value that has been upheld of being environmentally sustainable (Ajzen, 1991).

Perceived behavioral control (PBC) represents the extent of a person's self-efficacy towards performing the behaviour. In the light of adoption of renewable energy, PBC embodies issues like economic viability of the technology, availability of the technology and the simplicity of its deployment (Ho, Goh and Chuah, 2022). High PBC can also act as a moderator between carbon taxation and renewable energy adoption intention, because when people feel they are capable of coping with change, then they will be willing to switch to RE.

In the end, there's the behavioural goal, which is seen as a direct precursor to the act itself. When compared to perceived behavioural control and subjective norms, the predictive power of a positive attitude is lower (Barbera and Ajzen, 2020). For actual behaviour in the form of usage and adoption of renewable energy technologies. When carbon prices are put into place, these kinds of correlations can be useful in crafting policies that will make that RE is used correctly.

The process of turning theoretical constructs into variables in such operationalization depicts the process of converting theoretical constructs into empirical ones. At the same time, this study uses Likert-scale statements to capture participants' attitudes towards carbon taxes, subjective norms about carbon taxes, ways of thinking about and planning to use renewable energy, and how effective carbon taxes are at achieving environmental goals (Ajzen, 1991). Each construct for questionnaires has several items about dimensions of the concept to be investigated. For example, carbon taxation beliefs are measured in statements assessing the perceived efficiency, equity, economic impact, and role in advancing renewable energy of the policy. Perceived norms are evaluated in terms of perceived social and societal pressure toward supporting carbon taxation, by peers, leaders, and groups that advocate for the environment (Bamberg and Möser, 2007; Stella Emeka-Okoli *et al.*, 2024). Measures of perceived behavioural control include items related to individual readiness, perceived obstacles and facilitators concerning the use of RE. The last one is behavioural intention which is about the probability of adopting renewable energy through planning for sustainable energy systems(Steg, Perlaviciute and van der Werff, 2015). A technical and systematic approach to measuring the important factors of public opinion, behaviour, carbon taxes and renewable energy use is made possible by these operationalised constructs. The following structure has been built from this:



3.3 Research Purpose and Questions

This thesis examined the applicability of carbon tax policies to promote renewable energy consumption. It also analyses the efficiency of carbon taxes in reducing carbon emissions, promoting the innovation of clean technologies and moving from conventional carbon-rich resources. The study provides case studies and policy impacts to analyse which remedies best capture carbon taxes as approximated climate change metrics for stimulating sustainable economic growth through innovative mechanisms.

The Research Questions for this Research are as follows:

1. ***How do attitudes towards carbon taxation influence the intention to adopt renewable energy?***

This question explores how individuals' opinions and beliefs about carbon taxation—whether positive or negative—affect their willingness or intention to adopt renewable energy (RE) technologies. Understanding this relationship helps assess how taxation policies influence environmental behavior.

2. ***To what extent do the subjective norms regarding carbon taxation affect the behavioural intention to adopt renewable energy?***

This examines the role of societal expectations or pressures regarding carbon taxation in shaping individuals' intentions to transition to RE. It considers how peer influence, community standards, and cultural factors impact decision-making.

3. ***How does perceived behavioural control (i.e., the perceived ease or difficulty of adopting renewable energy) mediate the relationship between carbon taxation and renewable energy technologies?***

This focuses on the perceived ease or difficulty of adopting RE technologies and how this perception influences the relationship between carbon taxation policies and the actual adoption of RE. It assesses whether the availability of resources or personal confidence in adopting RE mitigates barriers.

4. ***What is the perceived effectiveness of carbon taxation in achieving environmental sustainability, and how does this perception affect the adoption of renewable energy technologies?***

This investigates how individuals perceive carbon taxation as a tool for achieving environmental sustainability and how this perception affects their adoption of RE technologies. It assesses whether believing in the effectiveness of taxation encourages behavioral change.

5. ***How does behavioural intention affect the adoption of renewable energy in the context of carbon taxation?***

This explores the direct impact of an individual's intention to adopt RE on their actual behavior in the context of carbon taxation. It aims to understand the extent to which intentions translate into tangible actions toward using RE technologies.

3.4 Research Design

In this research method, it was considered most effective to conduct quantitative data collection tools are used due to the complexity of the research question. Quantitative data helped establish the extent of the outcome of carbon taxation on the utilisation of renewable energy across the regions. This may involve conflicts in energy use data, carbon taxes and levies and investment in renewable energy to draw resemblance. Structured questionnaires and structured surveys were employed to administer quantitative data from business organisations, policymakers, and consumers about their attitudes to carbon taxation. The primary distinction between the quantitative research and qualitative study elucidates the motivations and concerns not quantified in the prior approach, along with the stakeholders' perceived efficacy of particular carbon taxation methods and their effects on stakeholders (Jorgenson *et al.,* 2018). By using the quantitative approach, the research explains not only the degree of quantitative effect of carbon taxation on renewable energy uptake but also the factors that underpin these effects and determine the net effect of carbon taxation beyond mere quantification (Kusumawardhani, Saptadjaja and Cahyono, 2024).

3.5 Population and Sample

The target population regarding the effect of carbon taxation in promoting usage of renewable energy for this study comprised all people and organisations in a position to be influenced by the carbon tax policies and those in the RE industries. This audience includes

economic policymakers, business managers, environmental activists, and ordinary consumers in different parts of the world (Enusah, Aboagye-Otchere and Boateng, 2024). A convenience sampling technique ensured effective data collection. This means that 100 participants who were easily accessible and willing to spend some time giving their opinions on the subject were selected using convenience sampling (Kovalskyi *et al.*, 2024). Also, convenience sampling involved participants from renewable energy conferences or seminars concerning climate policy. Thus, adopting this method, the study gathered various viewpoints within a short time, even though using this approach results in somewhat restricted generalizability of the outcomes. Still, the generated insights will help provide useful information on the effect of carbon taxation on the penetration of RE technologies and policies. This approach guarantees a practical and effective approach to the analysis of the topic while noting the limitations that are characteristic of convenience sampling (Trimble, 2023).

3.6 Participant Selection

The participant selection of this carbon taxation analysis by using Inclusion and exclusion criteria that are as follows in the form of the table: -

Criteria	**Inclusion Criteria**	**Exclusion Criteria**
Geographic Location	Participants must be based in countries or regions that have implemented or are planning to implement carbon taxation.	Participants from regions without any carbon taxation policies.
Experience	Individuals with experience in environmental policy, renewable energy, or carbon taxation (e.g., policymakers, industry experts, academics).	Individuals without relevant experience or knowledge in environmental policy, renewable energy, or carbon taxation.
Job Role	Professionals from sectors directly impacted by carbon taxation and renewable energy adoption (e.g.,	Individuals from sectors not significantly affected by

	energy sector, manufacturing, transportation).	carbon taxation or renewable energy policies.
Educational Background	Participants with relevant educational qualifications (e.g., degrees in environmental science, economics, engineering).	Participants lacking relevant educational background or qualifications.
Knowledge and understanding	Participants must clearly understand carbon taxation mechanisms and their impact on renewable energy.	Participants with limited or no understanding of carbon taxation and renewable energy interactions.
Engagement	Participants actively engaged in discussions or activities related to carbon taxation and renewable energy.	Participants who are not actively engaged or involved in related discussions or activities.

3.7 Instrumentation

- **Self-structure Questionnaire**

Demographics Details
Age:
⇨ 18-25 years
⇨ 26-35 years
⇨ 36-45 years
⇨ 46-55 years
⇨ 56 years and above
Gender:
⇨ Male
⇨ Female
⇨ Other/Prefer not to disclose
Educational Qualification:
⇨ High School

⇨ High Secondary School
⇨ Bachelor's Degree
⇨ Post Graduate Degree
⇨ Professional Degree (e.g., MBA, PhD)
⇨ Other
Occupation:
⇨ Employed (Private Sector)
⇨ Employed (Public Sector/Government)
⇨ Self-Employed
⇨ Unemployed
⇨ Retired
⇨ Other
1. Strongly Disagree **2.** Disagree **3.** Neutral **4.** Agree **5.** Strongly Agree

- **Attitude Towards Carbon Taxation**

Statement	**1**	**2**	**3**	**4**	**5**
I believe carbon taxation is an effective tool to combat climate change.					
Implementing carbon taxes will promote the use of RES.					
Carbon taxation is a fair approach to holding polluters accountable for their emissions.					
Carbon taxes will drive innovation in green technologies and renewable energy.					
Carbon taxation can effectively change consumer behaviour towards sustainable practices.					
I believe that carbon taxation is essential for future environmental sustainability.					

Carbon taxation is a necessary step to reduce reliance on fossil fuels.					
I believe carbon taxation will lead to long-term economic benefits despite short-term costs.					

- **Subjective Norms Regarding Carbon Taxation**

Statement	**1**	**2**	**3**	**4**	**5**
I feel pressured by my social circle to support policies like carbon taxation.					
Most people whose opinions I value endorse the use of carbon taxes to combat climate change.					
Environmental organizations I follow support carbon taxation as a key policy.					
I feel encouraged by public figures (celebrities, influencers) who advocate for carbon taxes.					
There is a general expectation in society to adopt carbon taxation measures for the future.					
I feel that businesses supporting carbon taxes are viewed positively by society.					

- **Perceived Behavioural Control Over Renewable Energy Adoption**

Statement	**1**	**2**	**3**	**4**	**5**
I feel that my personal efforts can contribute to reducing carbon emissions through renewable energy.					
Financial constraints make it difficult for me to adopt renewable energy.					
The installation process of renewable energy systems (e.g., solar panels) feels manageable to me.					
I am not easily discouraged by potential challenges in adopting renewable energy.					

I believe that external factors (like policies, availability) significantly influence my energy choices.					
I feel that I can overcome any barriers to adopting renewable energy if I am determined.					

- **Behavioural Intention to Adopt Renewable Energy**

Statement	**1**	**2**	**3**	**4**	**5**
I am likely to choose RES if given the opportunity.					
I am committed to making the switch to renewable energy as soon as possible.					
I will actively seek out information about renewable energy options for my household.					
I expect to include renewable energy in my long-term plans for home energy management.					
I am confident that I will follow through with my intention to adopt renewable energy.					
I believe that adopting renewable energy is a priority for me in the coming years.					

- **Perceived Effectiveness of Carbon Taxation in Achieving Environmental Goals**

Statement	**1**	**2**	**3**	**4**	**5**
Carbon taxation effectively reduces greenhouse gas emissions.					
The environmental benefits of carbon taxation outweigh its economic costs.					
Carbon taxes effectively incentivize businesses to reduce their carbon footprint.					
The goals of carbon taxation align with the broader objectives of environmental sustainability.					

Carbon taxation helps in achieving global climate agreements and targets.					
I believe that carbon taxation will continue to be effective in addressing future environmental challenges.					

Table 3.1: Descriptions of Research questions, Research Hypothesis and related Variables

Research Question	Research Hypothesis	Variables Considered
RQ1: How do attitudes towards carbon taxation influence the intention to adopt renewable energy?	**H01:** There is no significant impact of attitudes towards carbon taxation on the intention to adopt renewable energy. **H1:** There is a significant impact of attitudes towards carbon taxation on the intention to adopt renewable energy.	Attitude Towards Carbon Taxation Behavioral Intention to Adopt Renewable Energy
RQ2: To what extent do subjective norms regarding carbon taxation affect the behavioral intention to adopt renewable energy?	**H02:** There is no significant influence of subjective norms on the adoption of renewable energy technologies in response to carbon taxation. **H2:** There is a significant influence of subjective norms on the adoption of renewable energy technologies in response to carbon taxation.	Subjective Norms Regarding Carbon Taxation Behavioral Intention to Adopt Renewable Energy
RQ3: How does perceived behavioral control mediate the relationship between carbon taxation and	**H03:** Perceived behavioral control does not mediate the relationship between carbon taxation and renewable energy adoption.	Perceived Behavioral Control Over Renewable Energy Adoption

actual adoption of renewable energy technologies?	**H3:** Perceived behavioral control mediates the relationship between carbon taxation and renewable energy adoption.	Perceived Effectiveness of Carbon Taxation in Achieving Environmental Goals Behavioural Intention to Adopt Renewable Energy
RQ4: What is the perceived effectiveness of carbon taxation in achieving environmental sustainability, and how does this perception affect the adoption of renewable energy technologies?	**H04:** There is no significant relationship between perceived effectiveness of carbon taxation and the adoption of renewable energy. **H4:** There is a significant relationship between perceived effectiveness of carbon taxation and the adoption of renewable energy.	Perceived Effectiveness of Carbon Taxation in Achieving Environmental Goals Perceived Behavioural Control Over Renewable Energy Adoption
RQ5: What is the effect of behavioral intention on the actual adoption of renewable energy in the context of carbon taxation?	**H05:** There is no significant effect of behavioral intention on the actual adoption of renewable energy in the context of carbon taxation. **H5:** There is a significant effect of behavioral intention on the actual adoption of renewable energy in the context of carbon taxation.	Behavioral Intention to Adopt Renewable Energy Perceived Behavioural Control Over Renewable Energy Adoption

3.8 Data Collection Procedures

This study sought to determine the involvement of carbon taxation in advancement of RE, and data collection was conducted using the following approaches. Firstly, the nature and state of knowledge on carbon taxation policy, the existing implementation process, and the effect produced on the promotion of RES were surveyed in a library (Ayodele, Mustapa and Ayodele, 2023). This involved using scholarly articles, reports from government and other organisations and publications from the industry. After this, quantitative data was gathered from self-completed questionnaires administered to a purposive sample of policymakers, energy professionals, and business executives engaged. The questions addressed in the survey were related to views on carbon taxation, whether it works and to what extent it might change investors' approach to funding renewable technologies. Also, secondary data was collected from governmental and international databases on carbon tax rates and their revenue with the extent of investments in renewable energy sectors across the regions. The findings accumulated from literature review, surveys, interviews, and cases were used to evaluate the carbon taxation policy and the revelation of recommendations for improving its effectiveness in encouraging the use of renewable resource (Mcfayden, 2017).

3.9 Data Analysis

- **Statistical Package for the Social Sciences:**

Statistical Package for the Social Sciences (SPSS) is a software device used for statistical analysis and was employed in this study as well. It provides a user-friendly interface to conduct statistical tests, manage data, and visualise results. Here's a brief overview of what SPSS can do for data analysis in the context of this study.

1. **Descriptive Statistics:**

Frequency Tables: SPSS analysed frequency distributions for variable quantities like renewable energy types, carbon taxation levels, and adoption rates. These assistants recognise the regularity and spread of different categories in the data.

Measures of Central Tendency: It mainly Computed mean, and std. error mean to summarise the data on variables such as average carbon tax rates and renewable energy adoption rates.

Measures of Dispersion: It calculates standard deviation to determine inconsistency in data **related** to carbon taxation levels and renewable energy acceptance. This helps measure the spread and constancy of these variables (Lin and Zheng, 2023).

2. **Inferential Statistics:**

Regression Analysis: Employed regression analysis to explore how differences in carbon taxation influence renewable energy acceptance rates. This was comprised simple ordinal regression to assess the influence of a carbon tax on acceptance rates or multiple reversion to consider other swaying factors.

3. **Correlation Analysis:**

Spearman's Rank Correlation: Since data was not dispersed or deals with ordinal variables, the study used Spearman's rank correlation to measure the association between carbon taxation and renewable energy adoption (Svetunkov and Svetunkov, 2024).

Table 3.2: Research Questions statistics and Variables

Research Questions	Test Applied	Variables
RQ1: How do attitudes towards carbon taxation influence the intention to adopt renewable energy?	Regression Test	- **Independent Variable**: Attitude Towards Carbon Taxation
		- **Dependent Variable**: Behavioral Intention to Adopt Renewable Energy
RQ2: To what extent do subjective norms regarding carbon taxation affect the behavioral intention to adopt renewable energy?	Regression Test	- **Independent Variable**: Subjective Norms Regarding Carbon Taxation
		- **Dependent Variable**: Behavioral Intention to Adopt Renewable Energy

RQ3: How does perceived behavioral control mediate the relationship between carbon taxation and actual adoption of renewable energy technologies?	Correlation Test	Perceived Behavioral Control Over Renewable Energy Adoption Perceived Effectiveness of Carbon Taxation in Achieving Environmental Goals Behavioural Intention to Adopt Renewable Energy
RQ4: What is the perceived effectiveness of carbon taxation in achieving environmental sustainability, and how does this perception affect the adoption of renewable energy technologies?	Correlation Test	Perceived Behavioural Control Over Renewable Energy Adoption Perceived Effectiveness of Carbon Taxation in Achieving Environmental Goals
RQ5: What is the effect of behavioral intention on the actual adoption of renewable energy in the context of carbon taxation?	Regression Test	- **Independent Variable**: Behavioral Intention to Adopt Renewable Energy - **Dependent Variable**: Perceived Behavioural Control Over Renewable Energy Adoption

3.10 Research Design Limitations

Some methodological limitations to be recognised in studying the role of carbon taxation are the following about the research design. Firstly, there is variation in carbon tax policies, creating problems regarding making generalised conclusions. The taxes involved may include local taxes, and therefore, the rates, strategies employed, and legislation accompanying the implementation of taxes may vary from one jurisdiction to another; hence it will not be easy to generalise what can be applied across states (Nchofoung, Fotio and Miamo, 2023). Furthermore, this study can be limited by the data collected as the level of adoption based on carbon taxation may be affected by economic conditions; technology and policy formulated in the economy. Another challenge that the researcher might face is

distinguishing between the direct impacts of carbon taxation from other extraneous factors such as subsidies and market trends. Furthermore, the variation of the interests and reporting standards of the different stakeholders may lead to a bias in the assessment of influence of the carbon taxes (Song and Hua, 2024). The time horizons for evaluating the effect of carbon taxation may also present constraints, especially because new changes in the utilized of RES may take a longer time to show their effect. Moreover, assessing the impact of policies is still often considered a matter of personal opinion. The tools designed for this purpose may not be as universally recognised in each country or may have different interpretations. These weaknesses have been grouped into the following categories to show that it needs a more sensitive, systematic, and systematic analysis to address the problem and to examine the correlation between carbon taxation and renewable power generation by investigating all the possible sources of data and from every angle (Yiadom *et al.*, 2024).

3.11 Conclusion

Carbon taxation is a policy tool that must be employed in promoting renewable energy and combating climate change. Carbon taxes work similarly to a price on carbon, though it puts a direct price on each tonne of carbon emitted, which in turn makes the use of fossil fuels rather costly in an economic sense. The impact of these taxes on encouraging the development of RES depends on the policy, the rate of taxation, coverage and utilisation of the generated revenues. In this respect, the research points out that better-designed carbon taxes remain critical for boosting the requisite investments into renewables, catalysing technological innovations, and supporting international climate objectives. Nonetheless, the effect of carbon taxation is not homogeneous across various regions and is thus affected by the prevailing market forces and policies. Nevertheless, based on the above-discussed strengths of carbon taxation, it can be stated that with proper design and appropriate policies in support, carbon taxation can play a significant role in transforming energy systems towards sustainability. The results in the following chapter will provide an understanding of potential drawbacks of natural capital value assessment for policy and imply a careful approach to carbon taxation policy design and the further assessment of its impacts on the trajectory for the transition to the low-carbon economy.

CHAPTER IV:
RESULTS

4.1 Reliability Analysis

Table 4.1: Reliability Statistics

Cronbach's Alpha	N of Items
.943	32

Based on the reliability analysis presented in Table 4.1, the Cronbach's Alpha value for the scale's 32 items is 0.943. Excellent internal consistency is shown by a Cronbach's Alpha value above 0.9, which also shows that the scale's items significantly correlate with one another and evaluate the same notion.

4.2 Frequency Analysis

Demographic Details of Respondents

Table 4.2: Description of Demographic Details of Respondents

		Frequency	**Percent**
Age	18-25 years	28	28
	26-35 years	34	34
	36-45 years	30	30
	46-55 years	6	6
	56 years and above	2	2
	Total	100	100
Gender	Male	48	48
	Female	52	52
	Total	100	100
Educational Qualification	High School	1	1
	High Secondary School	7	7
	Bachelor's Degree	31	31

	Post Graduate Degree	27	27
	Professional Degree (e.g., MBA, PhD)	30	30
	Other	4	4
	Total	100	100
Occupation	Employed (Private Sector)	63	63
	Employed (Public Sector/Government)	19	19
	Self-Employed	12	12
	Unemployed	5	5
	Other	1	1
	Total	100	100

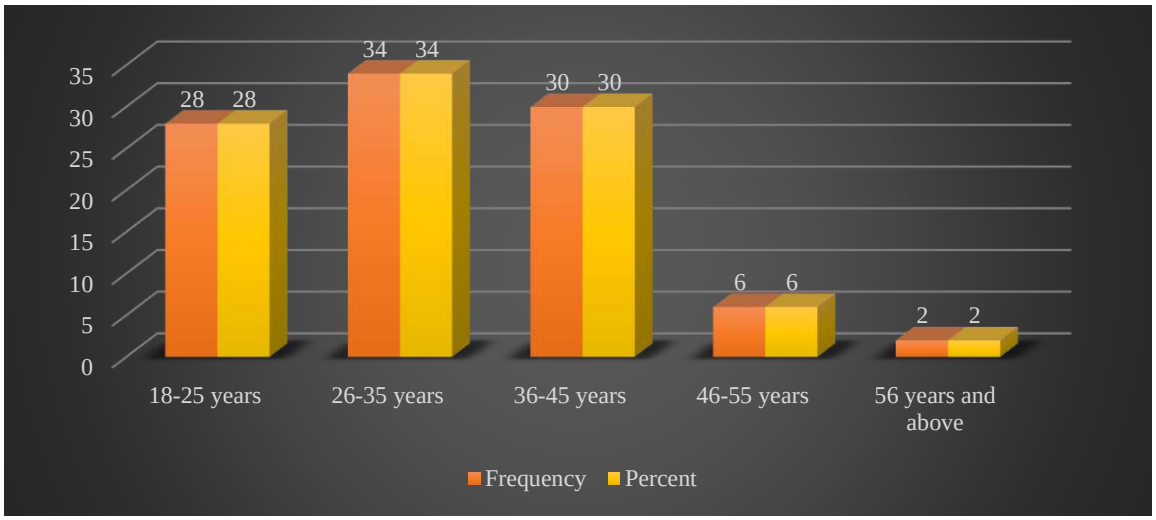


Figure 4.1: Age Group

The Figure 4.1 shows the age distribution of the respondents. Of the respondents, 34 percent were between the ages of 26 and 35, followed by those who were 18 to 25 (28%), and those who were 36 to 45 (30%). A younger respondent base is indicated by the lower percentage of respondents in the 46–55 years (6%) and 56 years and above (2%) groups.

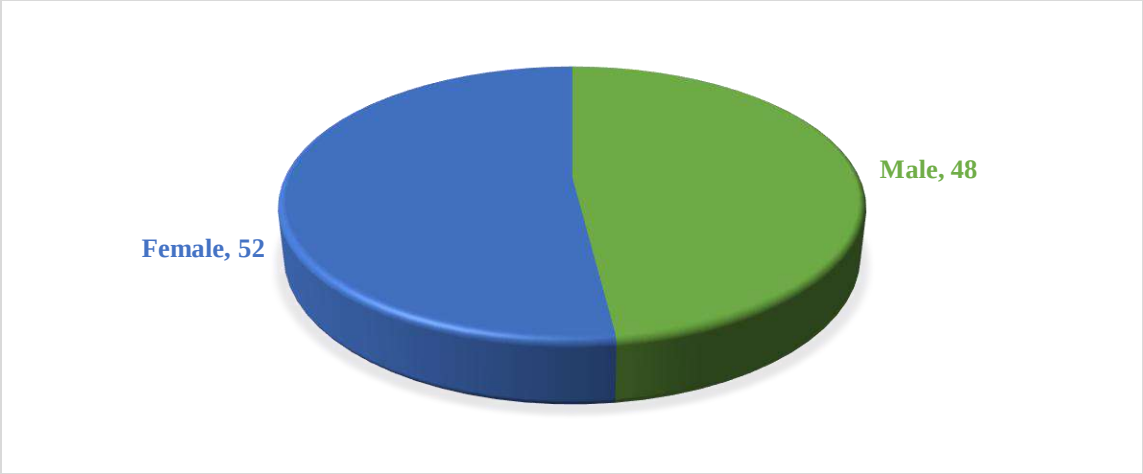


Figure 4.2: Gender

The gender distribution is nearly equal, as seen in Figure 4.2, with 52% of respondents identifying as female and 48% as male, demonstrating balanced gender involvement in the survey. This equitable representation promotes varied perspectives and inclusion in the data collected.

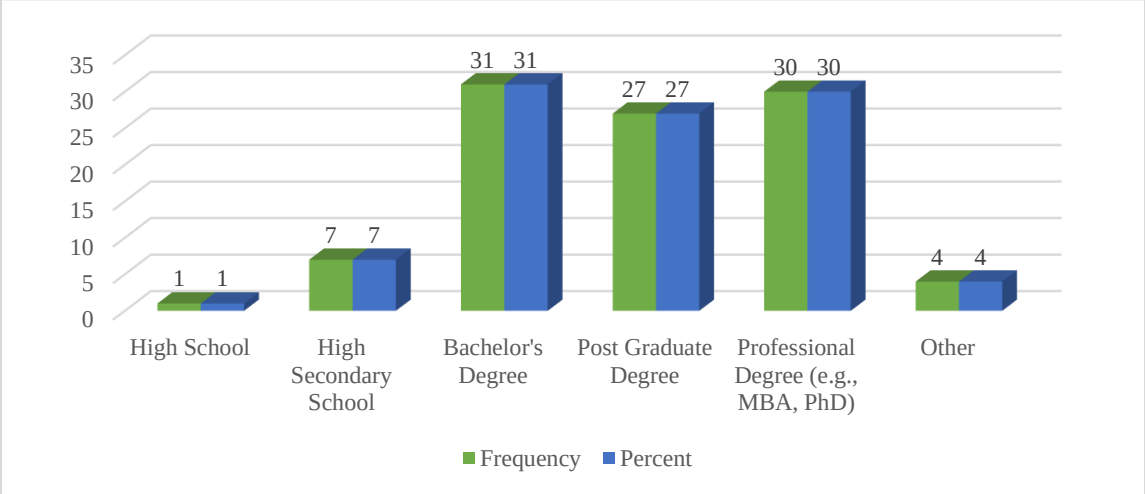


Figure 4.3: Educational Qualification

The respondents' distribution of educational qualifications reveals a wide range, as seen in figure 4.3 above. Higher education levels are demonstrated by the majority's Bachelor's (31%) and Professional (30%) degrees. Twenty-seven percent have a postgraduate degree, seven percent have completed higher secondary school, and one percent have completed

high school. 4% is made up of additional criteria. Nearly 88% have at least a bachelor's degree or better, indicating a highly educated population. The information reveals a solid intellectual background among participants, appropriate for research needing insights into higher education.

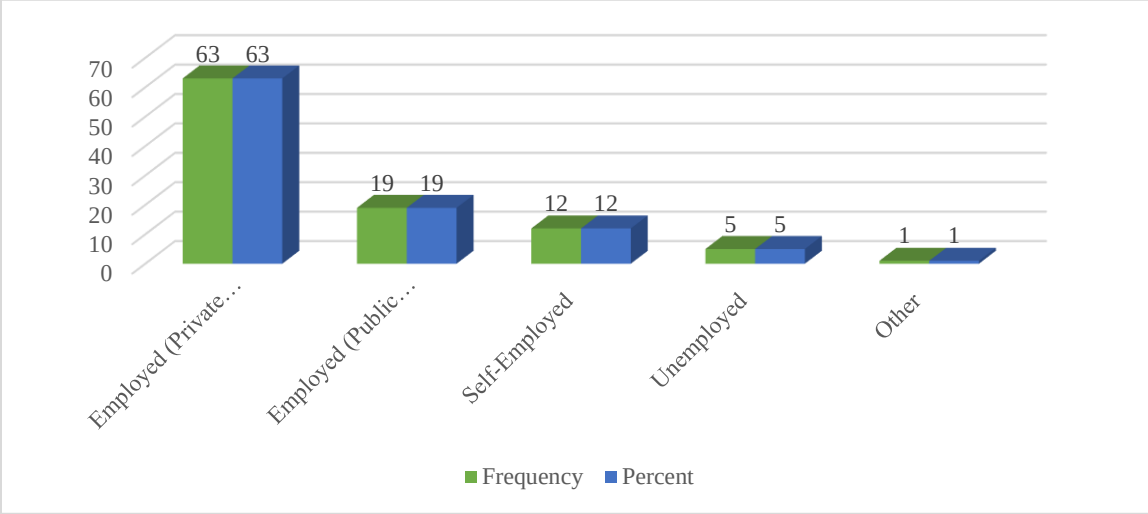


Figure 4.4: Occupation

According to the figure 4.4 above the majority of respondents are **employed in the private sector** (63%), followed by those employed in the **public sector/government** (19%) and **self-employed** individuals (12%). A smaller proportion is **unemployed** (5%) or listed under **other** occupations (1%), highlighting a predominantly employed respondent base.

Attitude Towards Carbon Taxation

Table 4.3: Description of Participants Responses on Attitude Towards Carbon Taxation

Statement		**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
I believe carbon taxation is an effective tool to combat climate change.	Frequency	6	8	21	36	29
	Percent	6	8	21	36	29
	Frequency	1	12	21	33	33

Implementing carbon taxes will promote the use of RES.	Percent	1	12	21	33	33
Carbon taxation is a fair approach to holding polluters accountable for their emissions.	Frequency	4	9	17	39	31
	Percent	4	9	17	39	31
Carbon taxes will drive innovation in green technologies and renewable energy.	Frequency	3	7	22	34	34
	Percent	3	7	22	34	34
Carbon taxation can effectively change consumer behavior towards sustainable practices.	Frequency	2	9	17	39	33
	Percent	2	9	17	39	33
I believe that carbon taxation is essential for future environmental sustainability.	Frequency	5	7	20	30	38
	Percent	5	7	20	30	38
Carbon taxation is a necessary step to reduce reliance on fossil fuels.	Frequency	2	8	23	40	27
	Percent	2	8	23	40	27
I believe carbon taxation will lead to long-term economic benefits despite short-term costs.	Frequency	4	8	22	35	31
	Percent	4	8	22	35	31

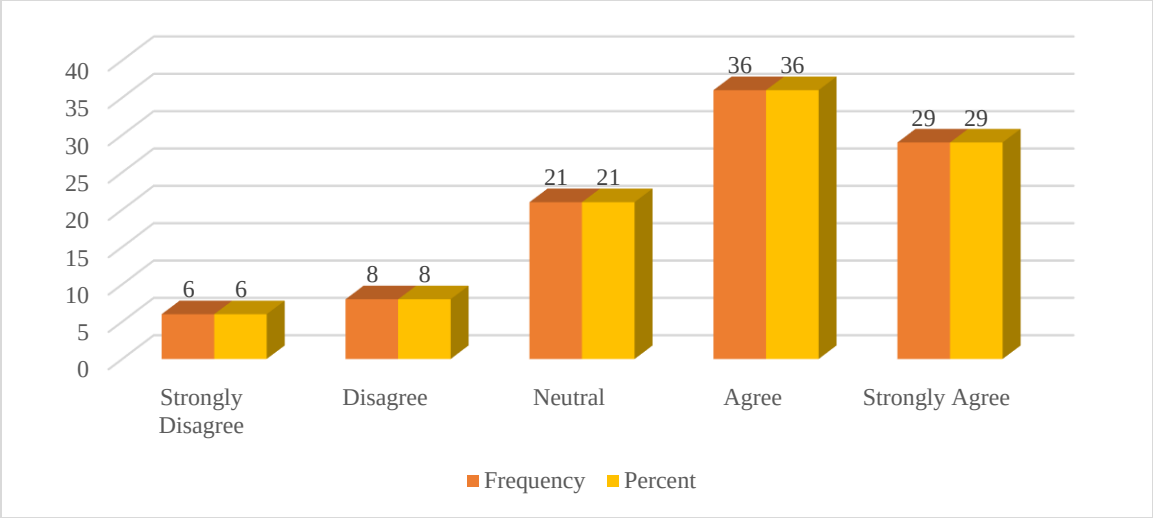


Figure 4.5: I believe carbon taxation is an effective tool to combat climate change.

The distribution of respondents' opinions about the statement "I believe carbon taxation is an effective tool to combat climate change" is shown in figure 4.5 above. A sizable majority, 65% (made up of 36% who agreed and 29% who strongly agreed), thought that carbon taxes would be a good way to combat climate change. This implies that most participants are aware of its potential advantages in reducing carbon emissions. Nonetheless, 21% had no view, suggesting hesitancy or a lack of conviction. Conversely, 14% of respondents (6% strongly disagree and 8% disagree) voiced negative opinions, which may have been a reflection of doubts about its efficacy or worries about possible negative economic effects.

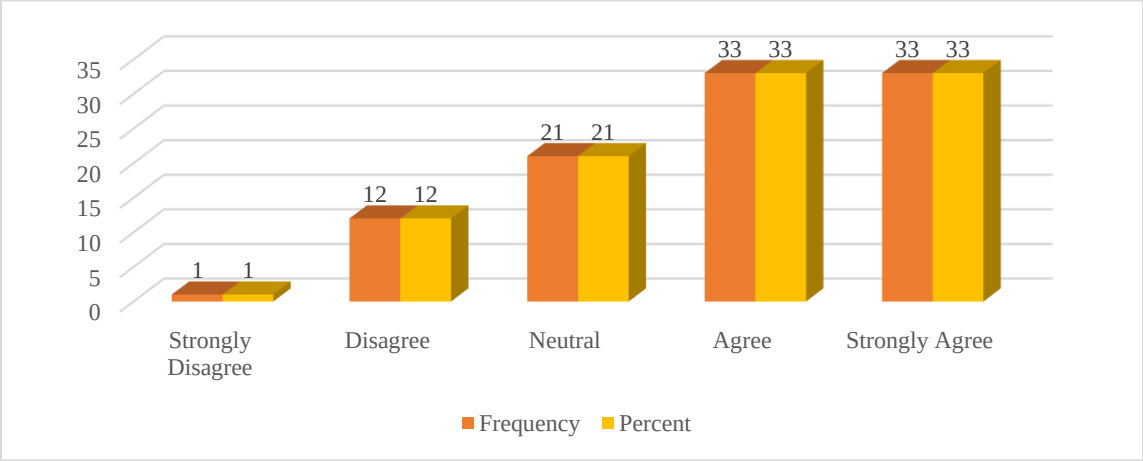


Figure 4.6: Implementing carbon taxes will promote the use of RES.

Above figure 4.6 shows that the statement "Implementing carbon taxes will promote the use of RES" has a frequency distribution that shows respondents primarily have a positive opinion of it. Significantly, 66% of respondents (33% agree and 33% strongly agree) think that carbon prices promote the use of renewable energy, demonstrating their faith in the ability of this policy to propel sustainable energy transitions. Furthermore, 21% of respondents expressed no opinion, indicating some hesitancy or doubt regarding how carbon taxes will affect the usage of renewable energy. The notion was opposed by a small minority of 13% (12% disagree and 1% strongly disagree), who may have been worried about the economic ramifications or doubted the efficacy of a carbon tax.

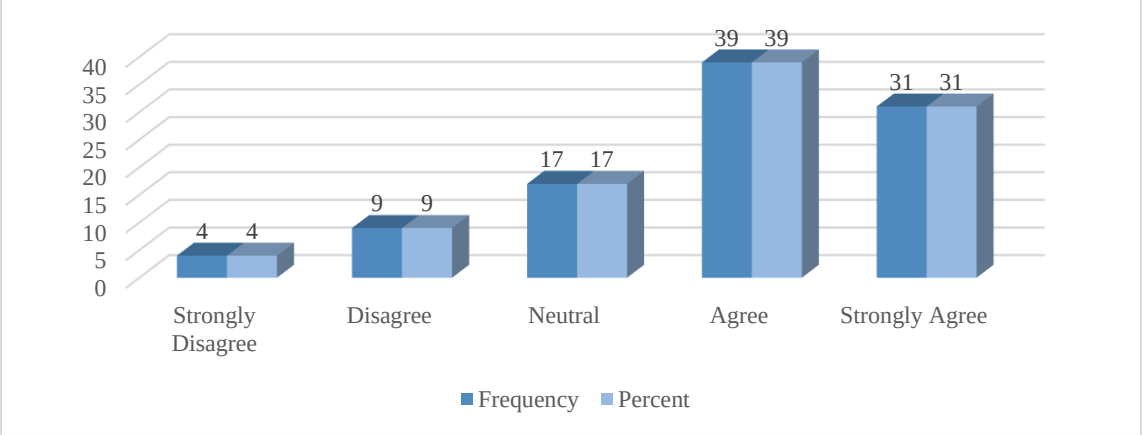


Figure 4.7: Carbon taxation is a fair approach to holding polluters accountable for their emissions.

Above figures 4.7 indicate that a majority of respondents, **70%** (39% agree and 31% strongly agree), perceive carbon taxation as a fair approach to holding polluters accountable for their emissions. This reflects significant support for the principle of polluter-pays and its potential to encourage responsible environmental behavior. However, **17%** of participants remained neutral, suggesting some uncertainty or lack of strong opinions. A smaller proportion, **13%** (9% disagree and 4% strongly disagree), opposed this view, possibly due to concerns about economic impacts or perceived inequities in implementation. Overall, the data underscores broad support for carbon taxation as a fairness-driven policy tool.

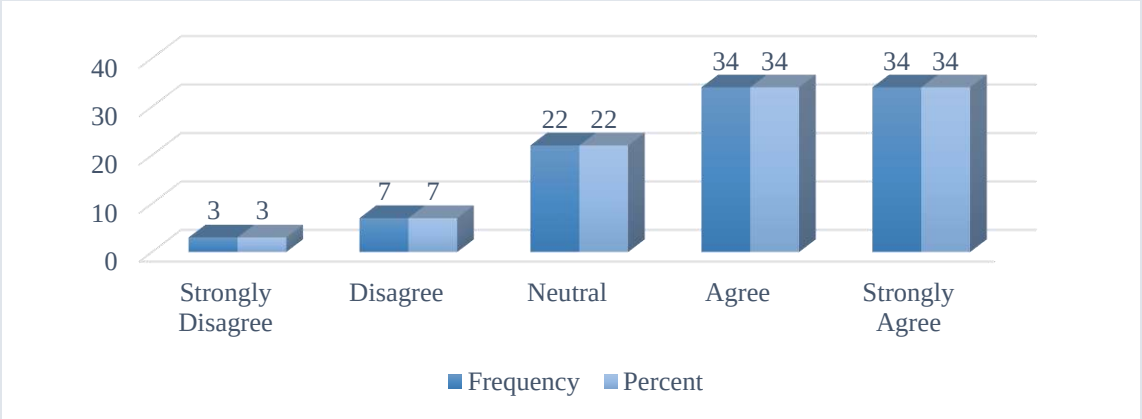


Figure 4.8: Carbon taxes will drive innovation in green technologies and renewable energy.

According to figures 4.8 above, a substantial majority of respondents 68% think that carbon prices will spur innovation in renewable energy and green technology (34% agree and 34% strongly agree). This shows hope for the ability of carbon taxes to encourage technological development and facilitate the switch to sustainable energy sources. 22% of those surveyed expressed no opinion, suggesting considerable hesitancy over the magnitude of its influence. 10% of respondents (7% disagree and 3% strongly disagree) voiced scepticism, maybe as a result of doubts about how well tax laws promote innovation. Overall, the research shows that carbon prices are widely supported as a spur for innovation.

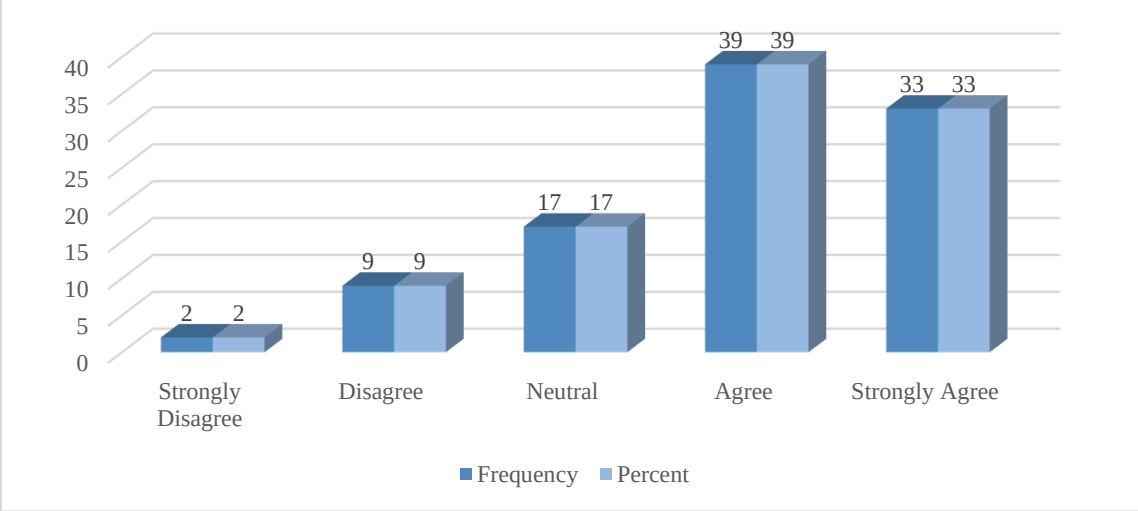


Figure 4.9: Carbon taxation can effectively change consumer behavior towards sustainable practices.

Above figure 4.9 shows that **72%** of respondents (39% agree and 33% strongly agree) believe carbon taxation can effectively change consumer behavior towards sustainable practices, indicating strong support for its potential impact. Meanwhile, **17%** remain neutral, suggesting uncertainty or limited awareness of its effects. A small minority, **11%** (9% disagree and 2% strongly disagree), oppose this view. Overall, the findings highlight confidence in carbon taxation as a tool for promoting sustainability.

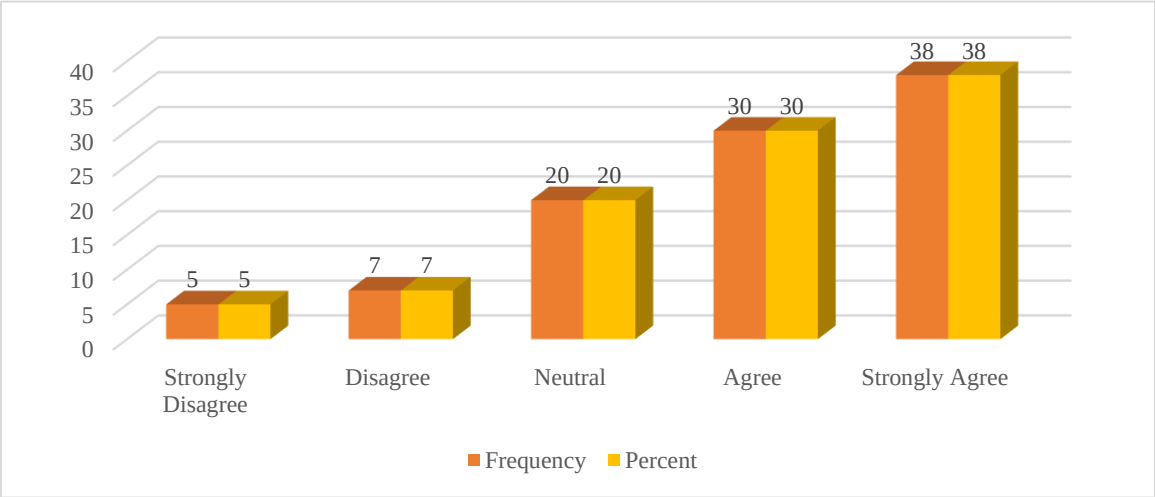


Figure 4.10: I believe that carbon taxation is essential for future environmental sustainability.

Above figure 4.10 indicates that **68%** of respondents (30% agree and 38% strongly agree) believe carbon taxation is essential for future environmental sustainability, demonstrating strong support for its role in preserving the environment. **20%** of participants are neutral, suggesting some uncertainty or lack of strong opinions. A small minority, **12%** (7% disagree and 5% strongly disagree), oppose this view. Overall, the results underscore widespread recognition of carbon taxation's importance in achieving sustainability goals.

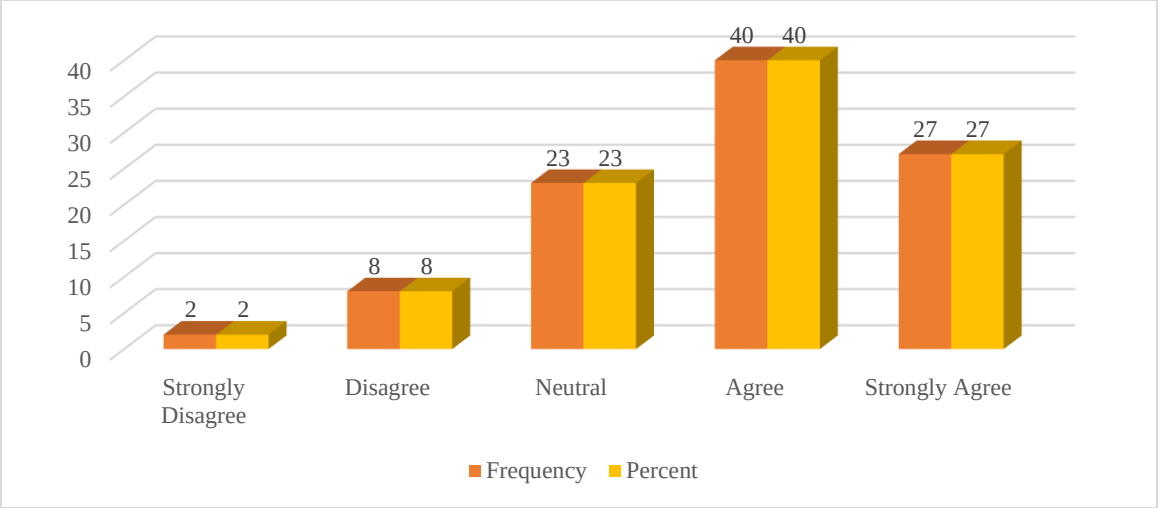


Figure 4.11: Carbon taxation is a necessary step to reduce reliance on fossil fuels.

According to the figure 4.11, there is high support for carbon taxation's role in promoting the energy transition, as 67% of respondents (40% agree and 27% strongly agree) think it is an essential step in reducing dependency on fossil fuels. 23% have no opinion, indicating hesitancy or a lack of conviction. 10% of people disagree with this viewpoint, with 8% disagreeing and 2% strongly disagreeing. Overall, the results show that the potential of carbon taxes to promote fossil fuel substitutes is widely acknowledged.

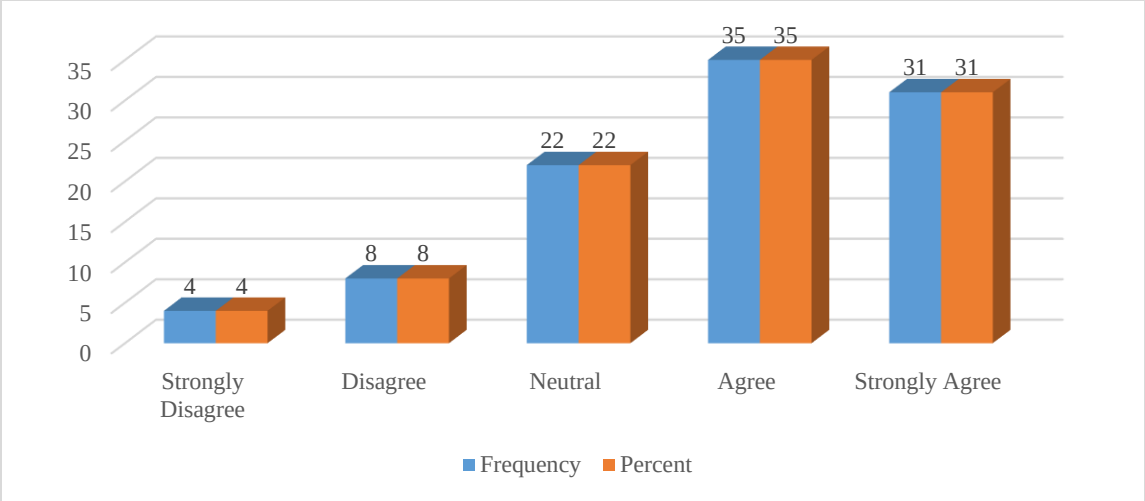


Figure 4.12: I believe carbon taxation will lead to long-term economic benefits despite short-term costs.

Despite possible short-term costs, 66% of respondents (35% agree and 31% strongly agree) think that a carbon tax will have long-term economic benefits, as seen in figure 4.12 above. This shows that there is faith in the long-term benefits of carbon prices for the economy. 22% are neutral, suggesting some hesitancy or a lack of conviction. The notion is opposed by a lesser percentage, 12% (8% disagree and 4% strongly disagree), maybe as a result of worries about immediate financial burdens. Overall, the results point to hope for the long-term financial benefits of carbon taxes.

Subjective Norms Regarding Carbon Taxation

Table 4.4: Description of Participants responses on Subjective Norms Regarding Carbon Taxation

Statement		**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
I feel pressured by my social circle to support policies like carbon taxation.	Frequency	18	14	24	30	14
	Percent	18	14	24	30	14
	Frequency	5	15	23	34	23

Most people whose opinions I value endorse the use of carbon taxes to combat climate change.	Percent	5	15	23	34	23
Environmental organizations I follow support carbon taxation as a key policy.	Frequency	5	16	27	33	19
	Percent	5	16	27	33	19
I feel encouraged by public figures (celebrities, influencers) who advocate for carbon taxes.	Frequency	4	16	29	29	22
	Percent	4	16	29	29	22
There is a general expectation in society to adopt carbon taxation measures for the future.	Frequency	5	8	30	31	26
	Percent	5	8	30	31	26
I feel that businesses supporting carbon taxes are viewed positively by society.	Frequency	5	10	17	48	20
	Percent	5	10	17	48	20

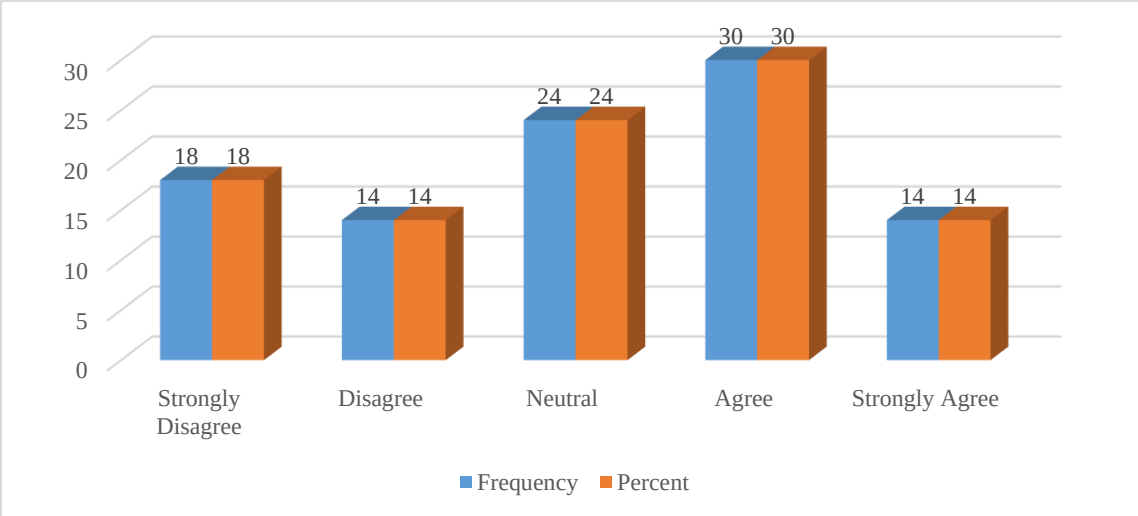


Figure 4.13: I feel pressured by my social circle to support policies like carbon taxation.

Above figure 4.13 indicate that **44%** of respondents (30% agree and 14% strongly agree) feel pressured by their social circle to support policies like carbon taxation, suggesting a moderate influence of social pressure. However, **32%** (18% strongly disagree and 14%

disagree) do not feel pressured, highlighting a significant portion who are unaffected by social influence. **24%** are neutral, indicating uncertainty or indifference toward social pressure on this issue.

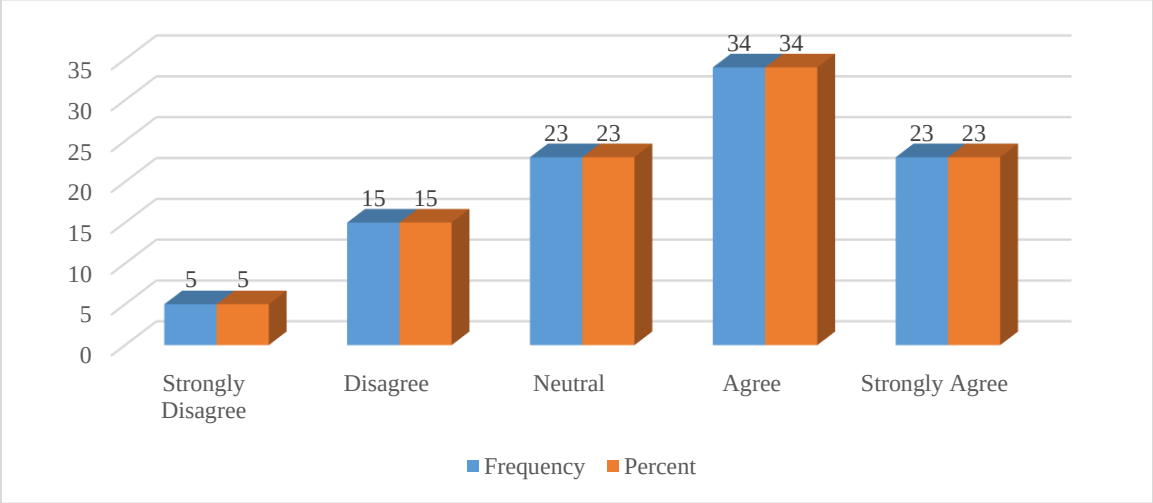


Figure 4.14: Most people whose opinions I value endorse the use of carbon taxes to combat climate change.

According to figure 4.14 above, 57% of respondents (34% agree and 23% strongly agree) think that most individuals whose opinions they value support the use of carbon taxes to fight climate change. This suggests that there is broad agreement on this topic within their social circles. Nonetheless, 23% have no opinion, indicating hesitancy or lack of conviction. There appears to be some debate on this issue as 20% of people in their valued social circle feel that carbon taxes is not supported by them (15% disagree and 5% strongly disagree).

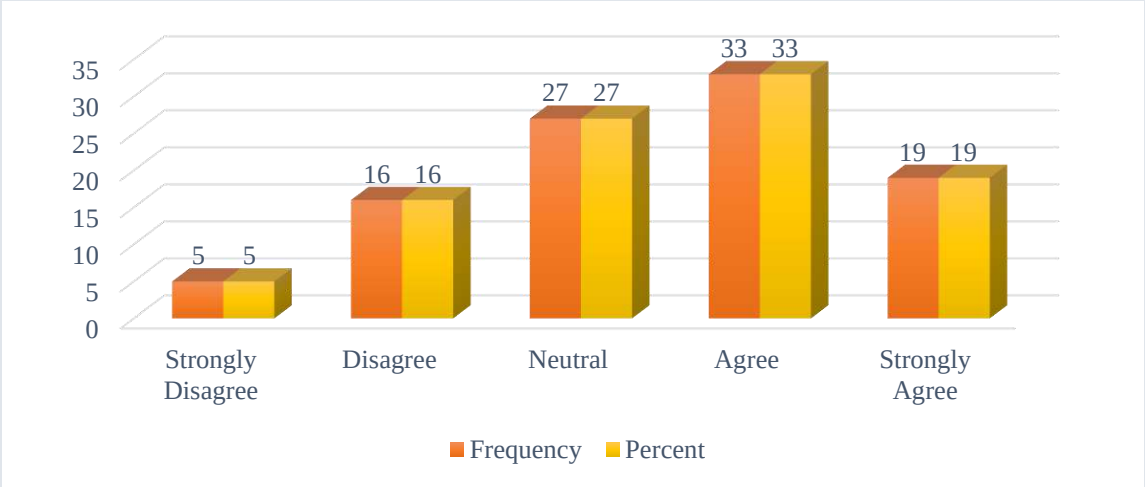


Figure 4.15: Environmental organizations I follow support carbon taxation as a key policy.

According to the figure 4.15 show that 52% of respondents (33% agree and 19% strongly agree) think that the environmental groups they follow favour carbon taxing as a crucial policy. This suggests that many people have faith in these groups' positions on the matter. 27% are neutral, which could indicate a lack of clarity or insufficient understanding of the organisations' stances. A lesser percentage, 21%, believe that these groups oppose carbon taxation (16% disagree and 5% strongly disagree), indicating some divergent views within the community. Overall, the organisations that respondents follow show a high degree of support for carbon taxes.

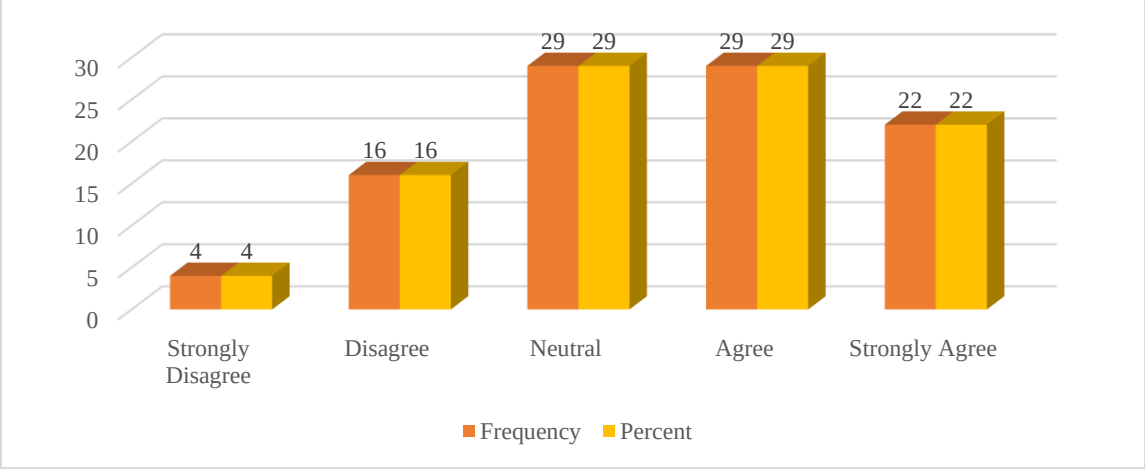


Figure 4.16: I feel encouraged by public figures (celebrities, influencers) who advocate for carbon taxes.

Figure 4.16 above shows that 51% of respondents feel inspired by public figures who support carbon prices, including influencers and celebrities (29% agree and 22% strongly agree). This suggests that prominent personalities have a moderate impact on people's support for carbon taxes. Nonetheless, 29% are neutral, indicating hesitancy or disregard for public individuals' viewpoints. 20% of respondents say they are not inspired by this kind of advocacy (16% disagree and 4% strongly disagree), indicating that not everyone's opinions on the matter may be greatly influenced by celebrity endorsements.

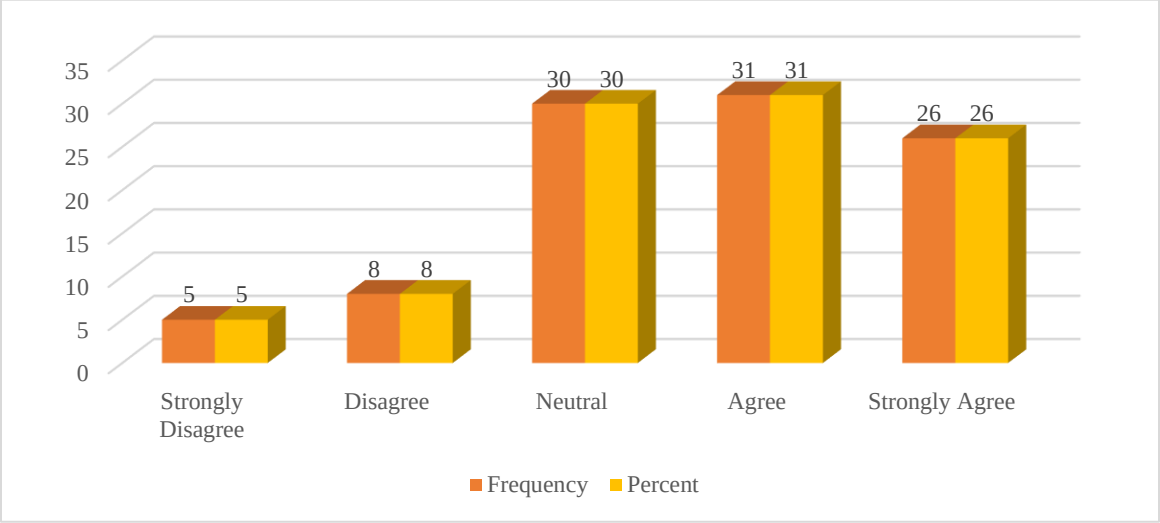


Figure 4.17: There is a general expectation in society to adopt carbon taxation measures for the future.

Above figure 4.17 indicates that **57%** of respondents (31% agree and 26% strongly agree) believe there is a general societal expectation to adopt carbon taxation measures in the future, suggesting significant support for this policy. However, **30%** are neutral, indicating uncertainty or lack of strong opinion on societal expectations. A smaller group, **13%** (8% disagree and 5% strongly disagree), do not feel that such an expectation exists, reflecting some divergence in views on the matter.

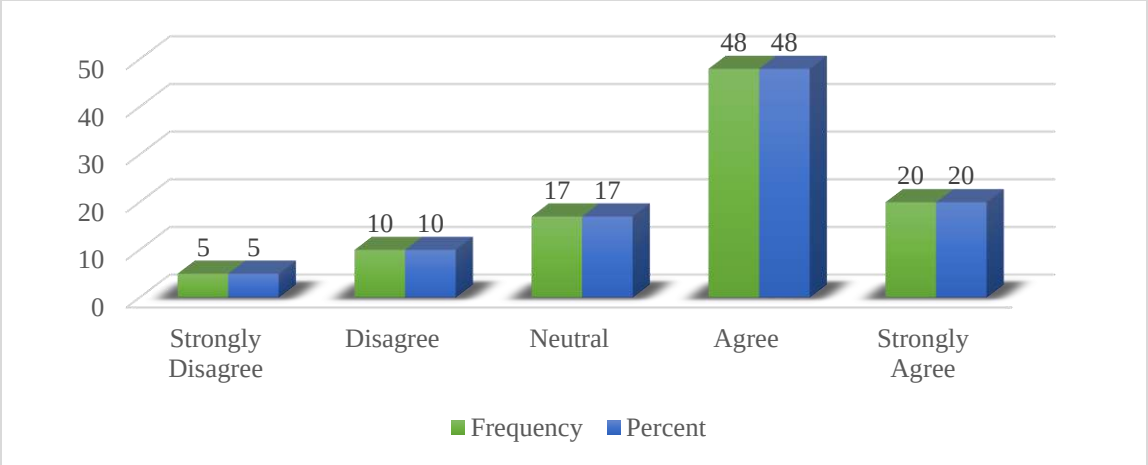


Figure 4.18: I feel that businesses supporting carbon taxes are viewed positively by society.

Figure 4.18 shows that 68% of respondents (48% agree and 20% strongly agree) believe that companies that support carbon taxes are seen favourably by society, indicating that there is a general consensus about the good social effects of such corporate actions. 17% are neutral, meaning they are unsure or unconcerned about this issue. A smaller percentage, 15% (10% disagree and 5% strongly disagree), do not hold this opinion, suggesting that not everyone thinks companies that support carbon taxes are socially beneficial. In general, most people have a favourable opinion of these companies.

Perceived Behavioural Control Over Renewable Energy Adoption

Table 4.5: Description of Participants responses on Perceived Behavioural Control Over Renewable Energy Adoption

Statement		**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
I feel that my personal efforts can contribute to reducing carbon emissions through renewable energy.	Frequency	8	12	17	34	29
	Percent	8	12	17	34	29
Financial constraints make it difficult for me to adopt renewable energy.	Frequency	6	11	24	35	24
	Percent	6	11	24	35	24

The installation process of renewable energy systems (e.g., solar panels) feels manageable to me.	Frequency	7	16	25	27	25
	Percent	7	16	25	27	25
I am not easily discouraged by potential challenges in adopting renewable energy.	Frequency	3	12	30	32	23
	Percent	3	12	30	32	23
I believe that external factors (like policies, availability) significantly influence my energy choices.	Frequency	6	8	17	40	29
	Percent	6	8	17	40	29
I feel that I can overcome any barriers to adopting renewable energy if I am determined.	Frequency	3	11	21	37	28
	Percent	3	11	21	37	28

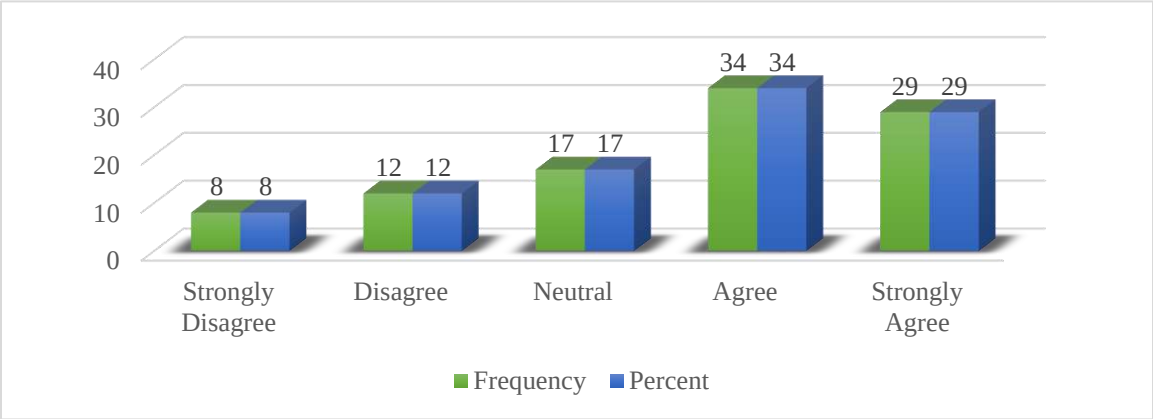


Figure 4.19: I feel that my personal efforts can contribute to reducing carbon emissions through renewable energy.

Figure 4.19 shows that 63% of respondents (34% agree and 29% strongly agree) believe that using renewable energy can help reduce carbon emissions through personal efforts. This shows a strong conviction in the impact of an individual. 17% are neutral, indicating considerable scepticism over the efficacy of individual acts. 20% of respondents disagree with this statement, with 12% disagreeing and 8% strongly disagreeing. This may be

because they are sceptical of the impact of individual contributions. In general, most people are confident that individual initiatives can help reduce carbon emissions.

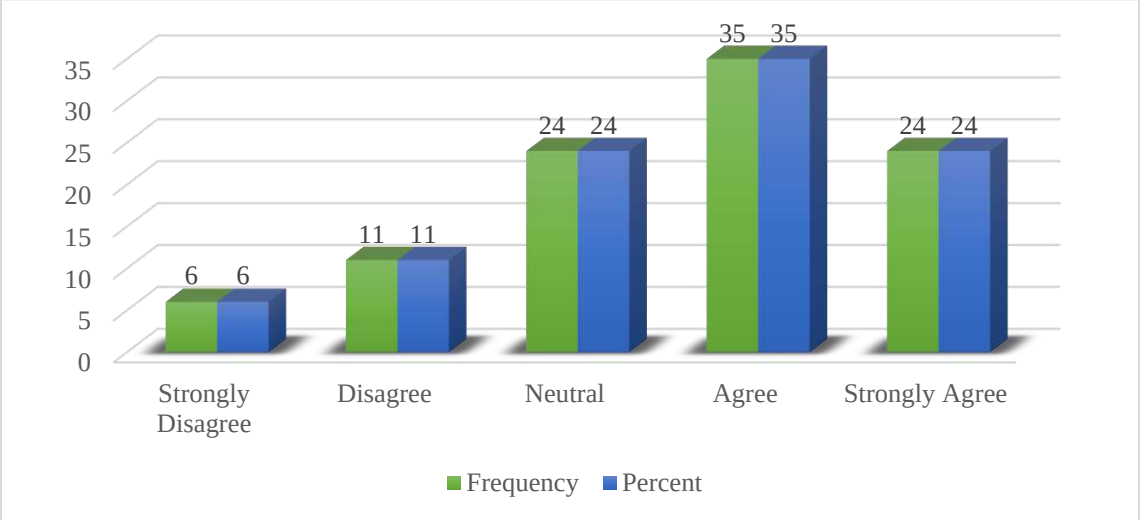


Figure 4.20: Financial constraints make it difficult for me to adopt renewable energy.

Above figure 4.20 shows that **59%** of respondents (35% agree and 24% strongly agree) believe financial constraints hinder their ability to adopt renewable energy, emphasizing cost as a critical challenge. **24%** are neutral, indicating they are unsure or do not have a strong opinion. Meanwhile, **17%** (11% disagree and 6% strongly disagree) feel financial constraints are not a significant barrier. These results underline affordability as a primary concern in transitioning to RES.

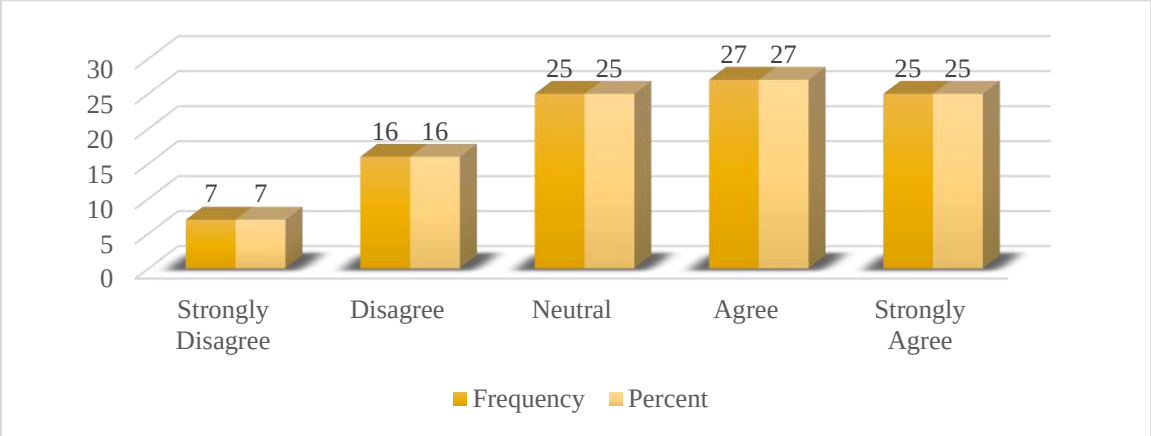


Figure 4.21: The installation process of renewable energy systems (e.g., solar panels) feels manageable to me.

According to figure 4.21 above, 52% of respondents (27% agree and 25% strongly agree) believe that installing renewable energy systems, like solar panels, is doable, indicating that they believe it is feasible. Nonetheless, 25% express no opinion, indicating a lack of clarity or insufficient understanding of the procedure. However, 23% of respondents find the installation process difficult, with 16% disagreeing and 7% strongly disagreeing, suggesting possible obstacles or issues. Overall, even though most people think the process is doable, a sizeable percentage either lack confidence or believe that implementing renewable energy systems will be challenging.

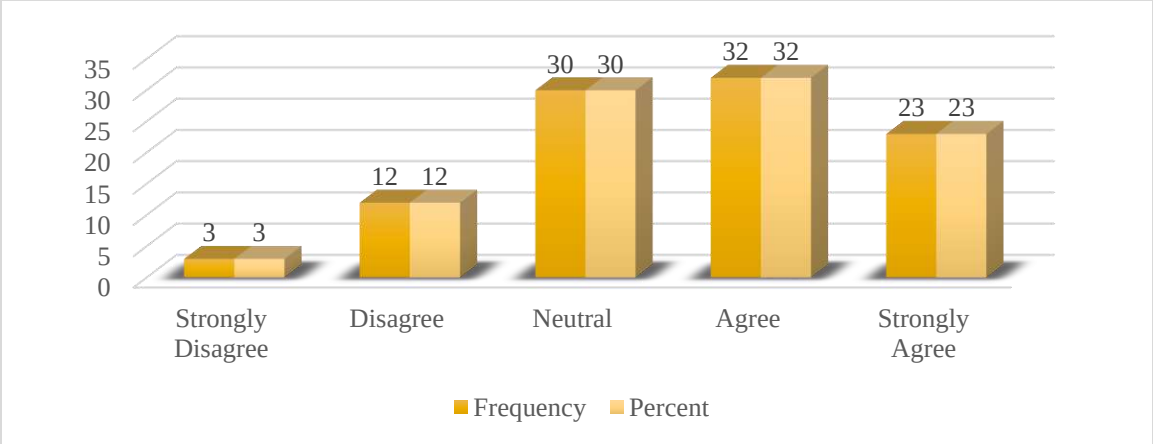


Figure 4.22: I am not easily discouraged by potential challenges in adopting renewable energy.

Figure 4.22 indicates that **55%** of respondents (32% agree and 23% strongly agree) are not easily discouraged by potential challenges in adopting renewable energy, demonstrating resilience and willingness to overcome obstacles. **30%** are neutral, suggesting uncertainty or lack of a strong stance. A smaller group, **15%** (12% disagree and 3% strongly disagree), feel discouraged by challenges, reflecting some apprehension. Overall, the majority exhibit a positive attitude towards adopting renewable energy despite potential difficulties.

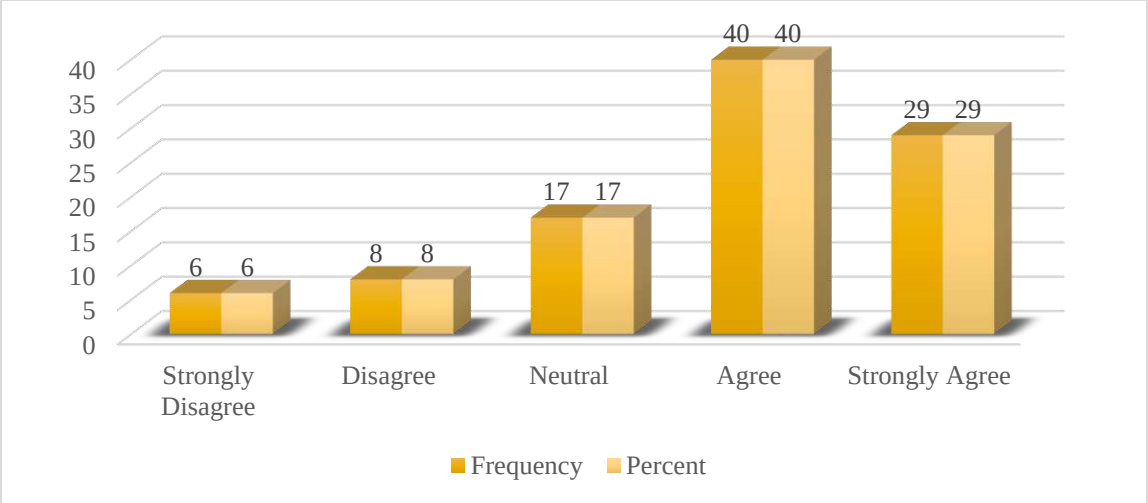


Figure 4.23: I believe that external factors (like policies, availability) significantly influence my energy choices.

Figure 4.23 reveals that 69% of respondents think that outside factors like availability and policies have a big impact on their energy decisions (40% agree and 29% strongly agree). This demonstrates how important outside factors are in influencing energy-related decisions. 17% express ambivalence or ambiguity regarding the influence of these factors by remaining neutral. Only 14% of respondents (8% disagree and 6% strongly disagree) believe that outside influences are important. In general, outside factors are thought to be a major factor in energy decisions.

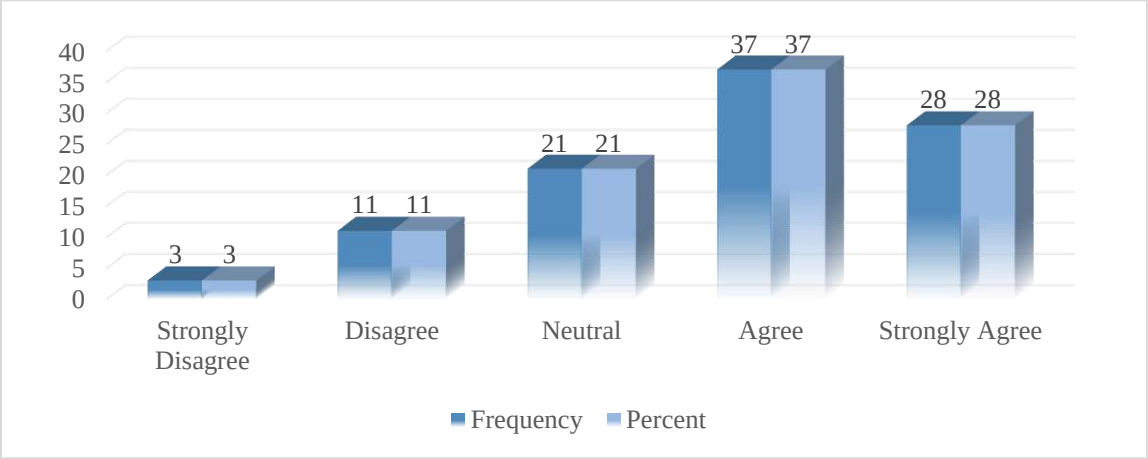


Figure 4.24: I feel that I can overcome any barriers to adopting renewable energy if I am determined.

Figure 4.24 indicates that **65%** of respondents (37% agree and 28% strongly agree) feel assured in their ability to overcome barriers to adopting renewable energy if determined, reflecting strong self-efficacy. **21%** remain neutral, indicating uncertainty about their capability to address challenges. A smaller portion, **14%** (11% disagree and 3% strongly disagree), lack confidence in overcoming such barriers.

Behavioural Intention to Adopt Renewable Energy

Table 4.6: Description of Participants responses on Behavioural Intention to Adopt Renewable Energy

Statement		**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
I am likely to choose RES if given the opportunity.	Frequency	6	8	11	36	39
	Percent	6	8	11	36	39
I am committed to making the switch to renewable energy as soon as possible.	Frequency	5	9	16	38	32
	Percent	5	9	16	38	32
I will actively seek out information about renewable energy options for my household.	Frequency	2	6	28	39	25
	Percent	2	6	28	39	25
I expect to include renewable energy in my long-term plans for home energy management.	Frequency	2	9	14	45	30
	Percent	2	9	14	45	30
I am confident that I will follow through with my intention to adopt renewable energy.	Frequency	2	12	16	35	35
	Percent	2	12	16	35	35

I believe that adopting renewable energy is a priority for me in the coming years.	Frequency	2	7	18	38	35
	Percent	2	7	18	38	35

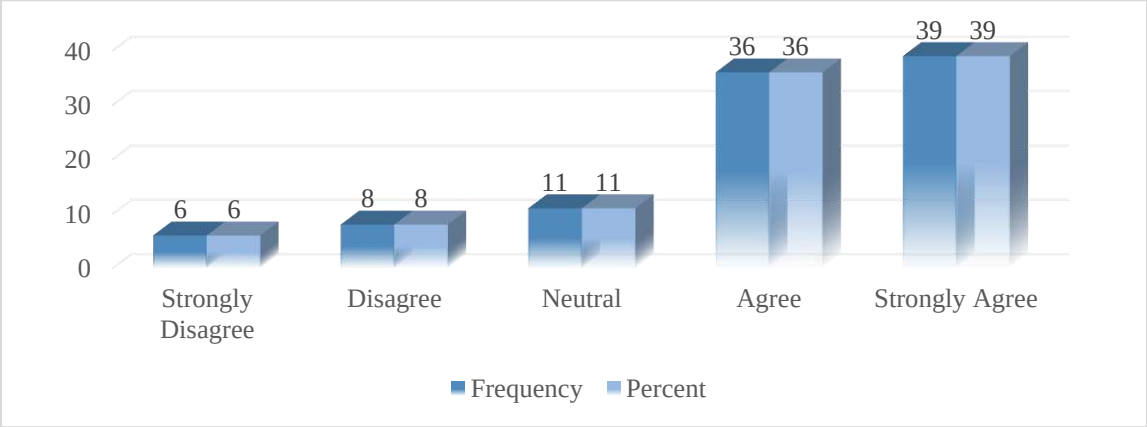


Figure 4.25: I am likely to choose RES if given the opportunity.

Figure 4.25 indicate that **75%** of respondents (39% strongly agree and 36% agree) would likely choose RES if available, indicating a strong willingness to adopt sustainable energy options. **11%** remain neutral, implying some indecision or lack of a firm stance. A smaller proportion, **14%** (8% disagree and 6% strongly disagree), are less inclined to choose renewable energy. In general, most respondents are open to adopting renewable energy when given the opportunity.

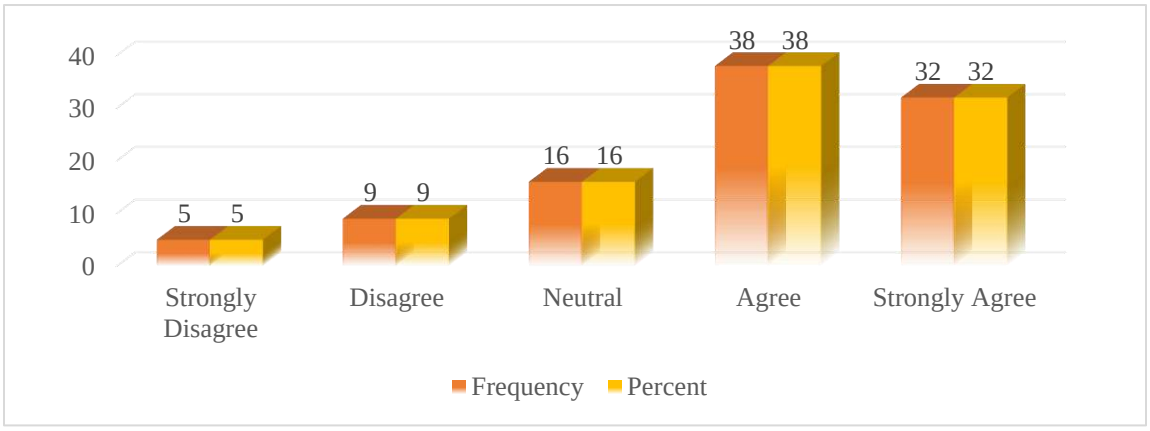


Figure 4.26: I am committed to making the switch to renewable energy as soon as possible.

Figure 4.26 indicates a significant willingness to transition to renewable energy, with 70% of respondents either agree or strongly agree with the statement, showing a strong commitment to making the switch. On the other hand, 16% of respondents remain neutral, suggesting some uncertainty or lack of clarity on the matter. A smaller portion, 14%, disagree or strongly disagree, reflecting a minority of individuals who are either resistant or less motivated to adopt renewable energy.

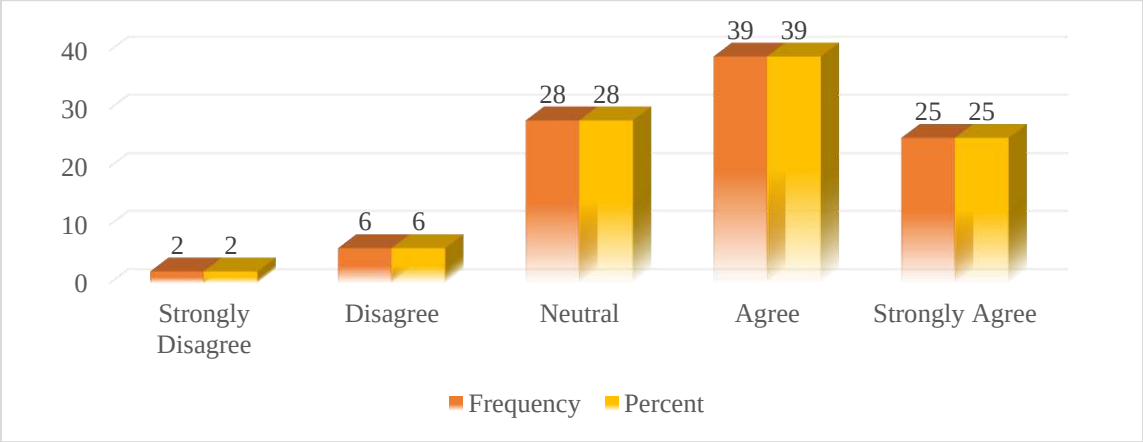


Figure 4.27: I will actively seek out information about renewable energy options for my household.

According to the figure 4.27, there is a moderate interest in learning more about household RES. A proactive approach to investigating renewable energy is demonstrated by the 64% of respondents who either agree or strongly agree. But 28% are neutral, indicating that a sizable percentage is unsure or unconvinced about seeking out more information. Just 8% of respondents disagree or strongly disagree, which represents a comparatively small percentage of people who are unlikely to actively look for knowledge about renewable energy. The findings point to a general increase in interest in RES.

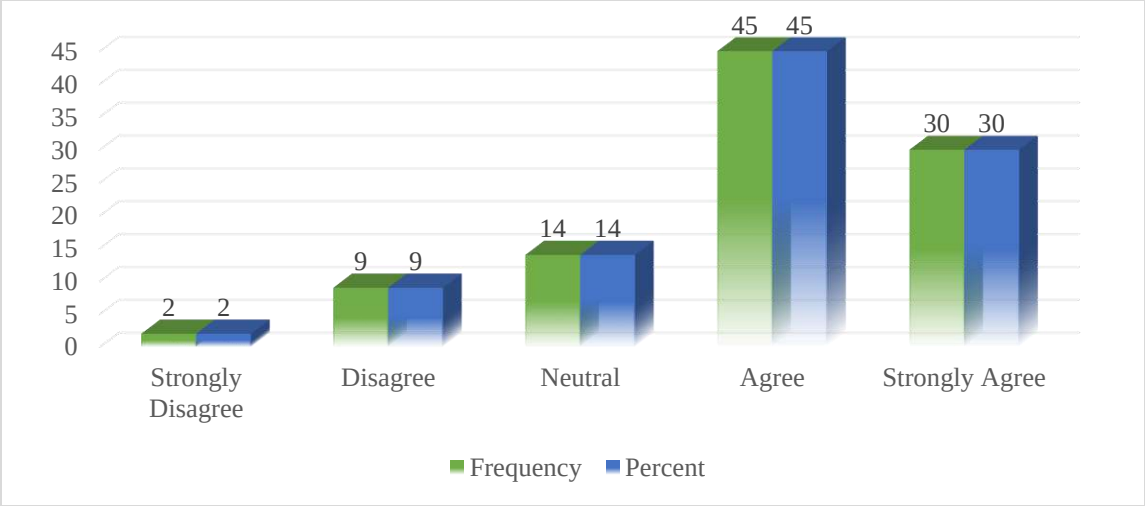


Figure 4.28: I expect to include renewable energy in my long-term plans for home energy management.

According to the above figure 4.28, the results show a positive attitude toward integrating renewable energy into long-term home energy plans. A total of 75% of respondents either agree or strongly agree, demonstrating a strong intention to include renewable energy in their plans. Meanwhile, 14% are neutral, possibly due to a lack of certainty or information. Only 11% disagree or strongly disagree, indicating a small portion of individuals who are not considering renewable energy for their long-term home management.

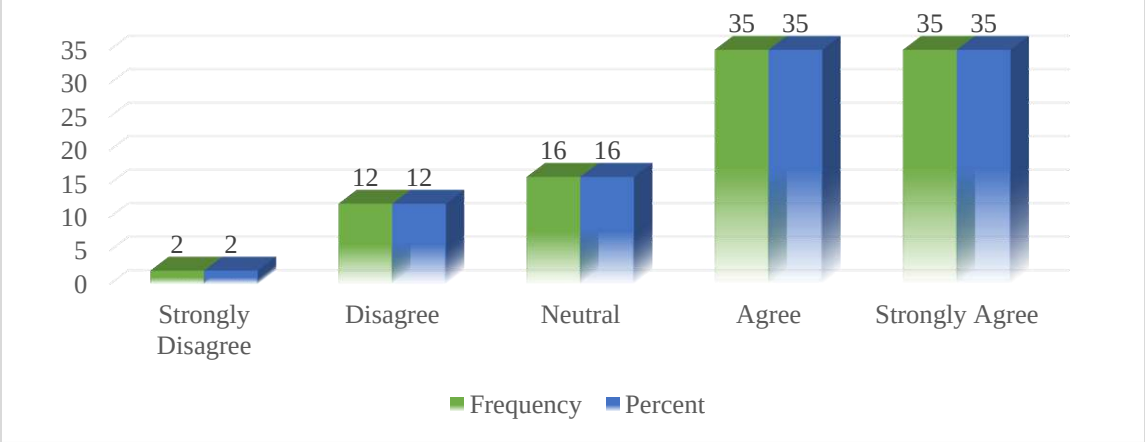


Figure 4.29: I am confident that I will follow through with my intention to adopt renewable energy.

Figure 4.29 indicates a strong level of confidence in adopting renewable energy, with 70% of respondents either agreeing or strongly agreeing that they will follow through with their intention. This suggests a high degree of commitment to renewable energy adoption. However, 16% of respondents remain neutral, possibly due to uncertainty about their ability to follow through. Only 14% disagree or strongly disagree, reflecting a small portion of individuals who are less assured in their ability to take action.

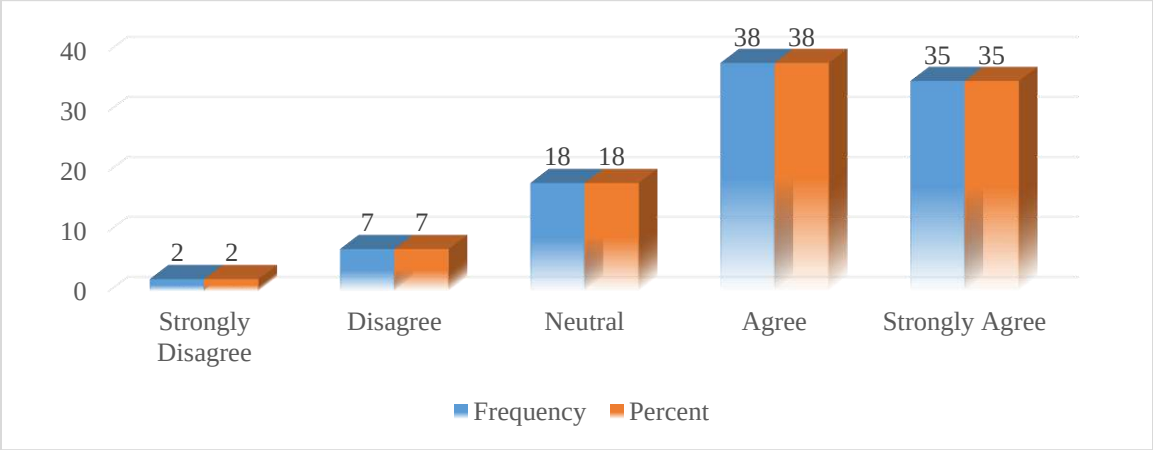


Figure 4.30: I believe that adopting renewable energy is a priority for me in the coming years.

Figure 4.30 shows that **73%** of respondents (38% agree and 35% strongly agree) view adopting renewable energy as a priority in the coming years, indicating a strong commitment to sustainability. **18%** remain neutral, suggesting uncertainty or a lack of urgency on the issue. A smaller group, **9%** (7% disagree and 2% strongly disagree), do not consider it a priority.

Perceived Effectiveness of Carbon Taxation in Achieving Environmental Goals

Table 4.7: Description of Participants responses on Perceived Effectiveness of Carbon Taxation in Achieving Environmental Goals

Statement		**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
	Frequency	6	9	25	29	31

Carbon taxation effectively reduces greenhouse gas emissions.	Percent	6	9	25	29	31
The environmental benefits of carbon taxation outweigh its economic costs.	Frequency	1	13	23	38	25
	Percent	1	13	23	38	25
Carbon taxes effectively incentivize businesses to reduce their carbon footprint.	Frequency	2	6	30	34	28
	Percent	2	6	30	34	28
The goals of carbon taxation align with the broader objectives of environmental sustainability.	Frequency	2	14	20	38	26
	Percent	2	14	20	38	26
Carbon taxation helps in achieving global climate agreements and targets.	Frequency	4	7	20	38	31
	Percent	4	7	20	38	31
I believe that carbon taxation will continue to be effective in addressing future environmental challenges.	Frequency	2	9	23	35	31
	Percent	2	9	23	35	31

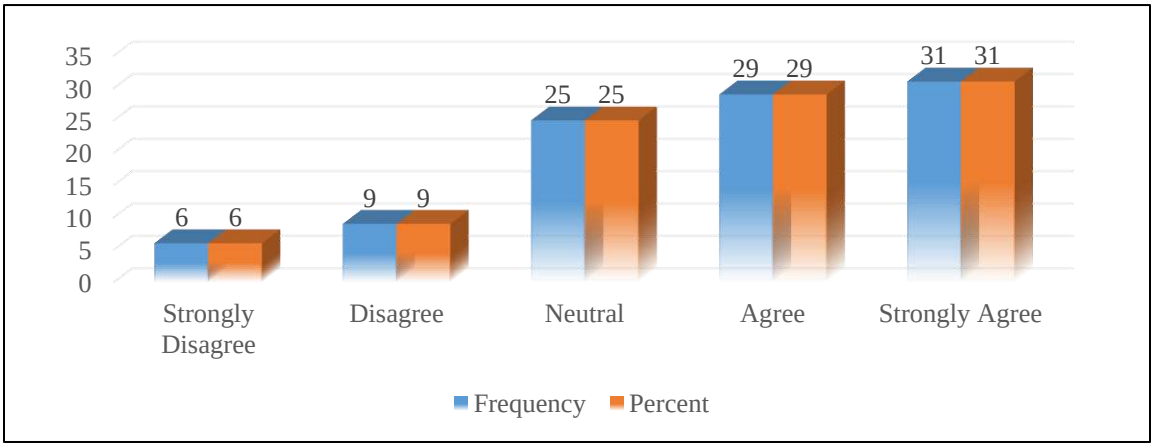


Figure 4.31: Carbon taxation effectively reduces greenhouse gas emissions.

The figure 4.31 shows that 60% of respondents have a good opinion of carbon taxation's influence on climate change, with 29% agreeing and 31% strongly agreeing that it successfully lowers greenhouse gas emissions. 25% express neutrality, which denotes hesitancy or a lack of conviction. 15% of respondents don't think it works, with 9% disagreeing and 6% strongly disagreeing.

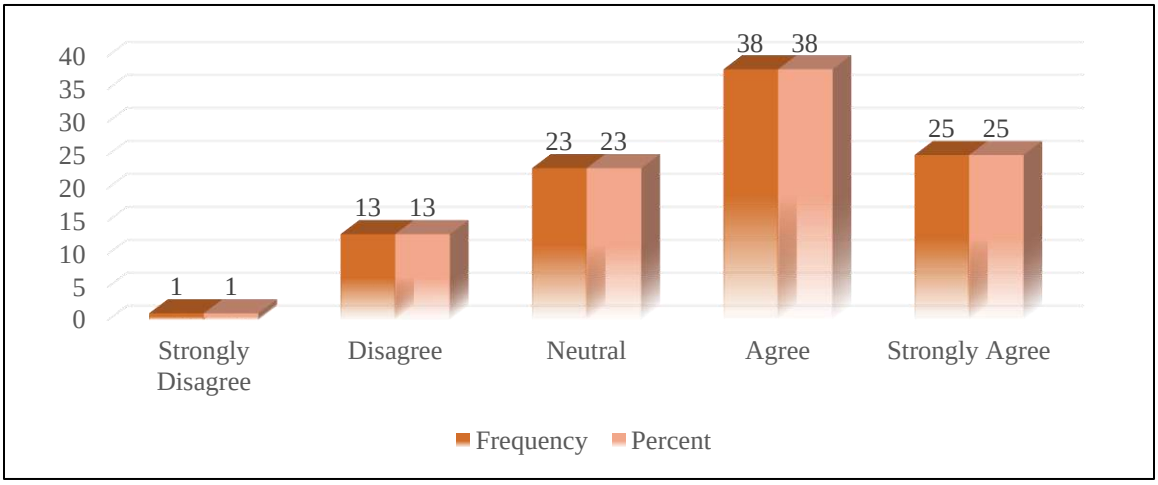


Figure 4.32: The environmental benefits of carbon taxation outweigh its economic costs.

Figure 4.32 indicates that **63%** of respondents (38% agree and 25% strongly agree) believe the environmental benefits of carbon taxation outweigh its economic costs, suggesting strong support for the policy's potential to address climate change. **23%** are neutral, indicating some indecision or lack of a clear stance. A smaller group, **14%** (13% disagree and 1% strongly disagree), do not think the environmental benefits justify the economic costs. Overall, a majority favor the environmental advantages of carbon taxation.

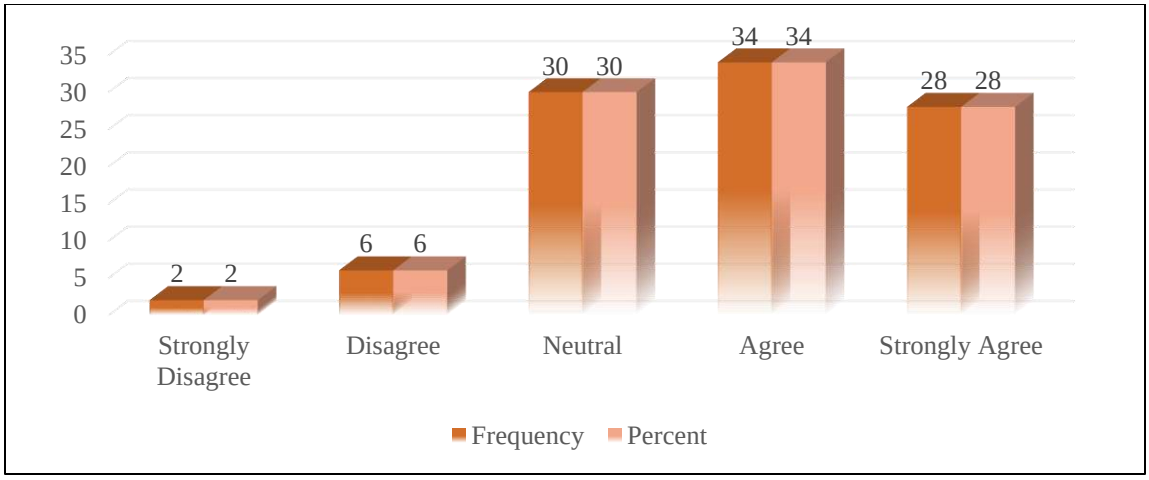


Figure 4.33: Carbon taxes effectively incentivize businesses to reduce their carbon footprint.

According to Figure 4.33, most people have a positive opinion of carbon taxes as a means of encouraging companies to lessen their carbon footprint. The usefulness of carbon taxes in promoting corporate sustainability initiatives is supported by the 62% of respondents who said they agree or strongly agree. Nonetheless, 30% are neutral, which can indicate hesitancy or a vague comprehension of the effects. Just 8% disagree or strongly disagree, suggesting that some people may not think carbon taxes are beneficial. Overall, the findings suggest that people are supportive of carbon prices as a corporate incentive.

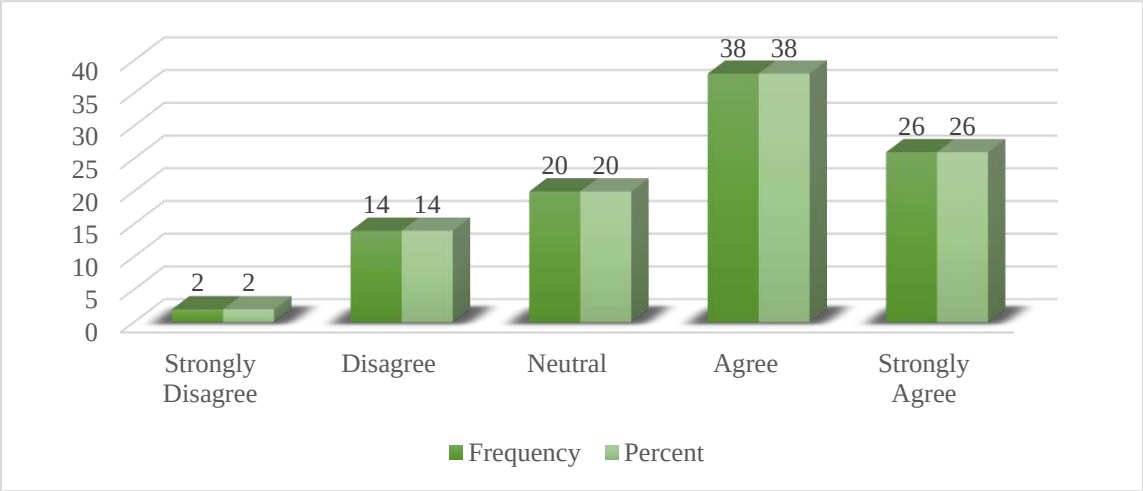


Figure 4.34: The goals of carbon taxation align with the broader objectives of environmental sustainability.

Above figure 4.34 shows that a generally positive perception of the alignment between carbon taxation goals and broader environmental sustainability objectives. A total of 64% of respondents either agree or strongly agree, indicating strong support for the idea that carbon taxes contribute to environmental sustainability. However, 20% remain neutral, possibly due to a lack of clear understanding or mixed views. A smaller portion, 16%, disagree or strongly disagree, reflecting a minority who do not see the connection.

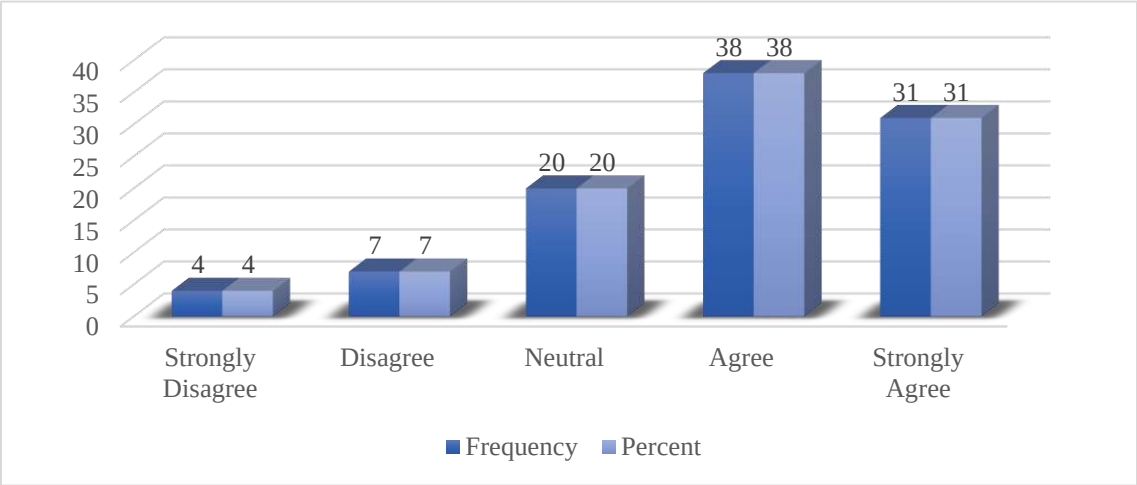


Figure 4.35: Carbon taxation helps in achieving global climate agreements and targets.

According to the figure 4.35, carbon taxes are seen favourably as a means of accomplishing international climate accords and goals. There is a strong belief in the efficacy of carbon taxes in promoting climate goals, as evidenced by the 69% of respondents who either agree or strongly agree. 20%, however, are neutral, presumably because they are unsure or have different views on the impact. A smaller percentage of respondents 11% disagree or strongly disagree that carbon taxes are an essential instrument for reaching climate goals.

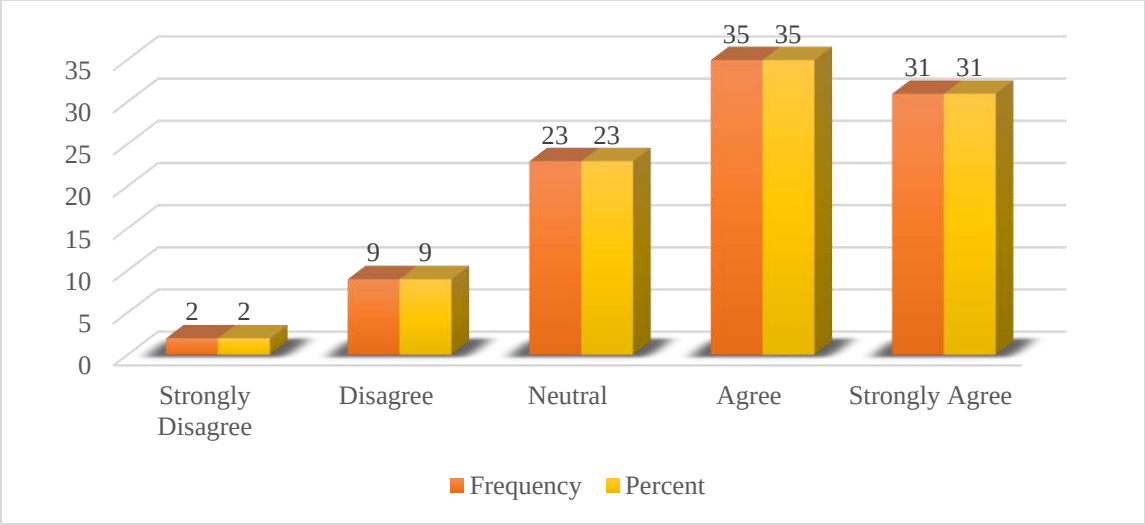


Figure 4.36: I believe that carbon taxation will continue to be effective in addressing future environmental challenges.

Figure 4.36 shows that a strong belief in the future effectiveness of carbon taxation in tackling environmental challenges. A combined 66% of respondents either agree or strongly agree, indicating confidence in its continued role in addressing environmental issues. Meanwhile, 23% are neutral, possibly due to uncertainty or varying opinions. Only 11% disagree or strongly disagree, representing a small group of skeptics.

4.3 Descriptive Statistics

Table 4.8: Descriptive Statistics

	N	Mean		Std. Deviation
	Statistic	Statistic	Std. Error	Statistic
Age	100	2.20	.098	.985
Gender	100	1.52	.050	.502
Educational Qualification	100	3.90	.107	1.068
Occupation	100	1.62	.095	.951
Attitude Towards Carbon Taxation	100	4.2100	.07823	.78232

Subjective Norms Regarding Carbon Taxation	100	3.9800	.07782	.77824
Perceived Behavioural Control Over Renewable Energy Adoption	100	4.0300	.07844	.78438
Behavioural Intention to Adopt Renewable Energy	100	4.1700	.08047	.80472
Perceived Effectiveness of Carbon Taxation in Achieving Environmental Goals	100	4.0900	.07797	.77973

The descriptive statistics provide a detailed overview of various aspects of the survey data, giving insights into respondents' demographics, attitudes, and perceptions regarding carbon taxation and renewable energy adoption. Here's a breakdown of each variable:

- **Age:** The respondents' age distribution appears to be biased towards younger people, as indicated by the mean age score of 2.20. The sample's comparatively moderate age variation is indicated by the standard deviation of 0.985. This suggests that, with some variance, the majority of responders fall into a particular age range.
- **Gender:** A coding system where 1 denotes one gender (male, for example) and 2 denotes another (female, for example) is probably reflected in the gender mean of 1.52. This implies that there is a reasonable gender balance in the sample. The sample's gender distribution varies somewhat, although not significantly, as indicated by the standard deviation of 0.502.
- **Education Qualification:** The respondents' educational backgrounds are biassed towards higher education levels, with a mean score of 3.90. This suggests that the majority of responders have a bachelor's degree or above. The respondents' educational backgrounds span from high school to post-graduate degrees or professional credentials, according to the standard deviation of 1.068, which indicates significant diversity.
- **Occupation:** A classification method where several occupational groups are given numerical values is probably reflected in the mean score of 1.62. According to the mean, the majority of respondents appear to be from a particular occupational

group, such as white-collar workers or those employed in particular sectors. The moderate variation in respondents' jobs, with a mix of persons from various fields, is indicated by the standard deviation of 0.951.

- **Attitude Towards Carbon Taxation:** Respondents' mean score of 4.21 indicates that they have a generally favourable opinion on carbon taxes. A score nearer 5 would suggest that people strongly believe that carbon taxes are necessary or effective. Although the majority of respondents support the idea of a carbon tax, there appears to be significant fluctuation in the degree of agreement, as indicated by the standard deviation of 0.782.
- **Subjective Norms Regarding Carbon Taxation:** The mean of 3.98 reflects a relatively positive perception of societal norms around carbon taxation. Respondents seem to perceive that carbon taxation is generally accepted or supported by society. Although the majority of respondents support a carbon tax, the standard deviation of 0.778 shows a moderate level of heterogeneity, opinions on its acceptance might differ.
- **Perceived Behavioural Control Over Renewable Energy Adoption:** Respondents' trust in their capacity to implement renewable energy solutions is moderate, as indicated by their mean score of 4.03. This implies that although people believe they have some control over their use of renewable energy, certain obstacles or unknowns may prevent them from doing so. There is moderate diversity in respondents' perceptions of their control over the adoption process, as indicated by the standard deviation of 0.784.
- **Behavioral Intention to Adopt Renewable Energy:** A mean score of 4.17 indicates that the respondents are very committed to utilising renewable energy alternatives going forward. This implies that although most people may not have made a complete commitment to renewable energy yet, they are inclined to do so. A substantial range is indicated by the standard deviation of 0.805, which indicates varying degrees of commitment to the use of RE.

- **Perceived Effectiveness of Carbon Taxation in Achieving Environmental Goals:** An optimistic view of carbon taxation's potential to accomplish sustainability objectives for the environment is indicated by a mean score of 4.09. Carbon taxes are a major tool for advancing environmental objectives, according to most respondents. The standard deviation of 0.780 shows a moderate difference in perceptions, suggesting that while many respondents see carbon taxation as effective, some may have differing opinions on its actual impact.

4.4 Correlation Analysis Between Variables

Table 4.9: Correlation Analysis between Variables

			Attitude Towards Carbon Taxation	Subjective Norms Regarding Carbon Taxation	Perceived Behavioural Control Over Renewable Energy Adoption	Behavioural Intention to Adopt Renewable Energy	Perceived Effectiveness of Carbon Taxation in Achieving Environmental Goals
Spearman's rho	Attitude Towards Carbon Taxation	Correlation Coefficient	1.000	.449**	.497**	.501**	.657**
		Sig. (2-tailed)	.	.000	.000	.000	.000
		N	100	100	100	100	100
	Subjective Norms	Correlation Coefficient	.449**	1.000	.505**	.413**	.363**

	Regarding Carbon Taxation	Sig. (2-tailed)	.000	.	.000	.000	.000
		N	100	100	100	100	100
	Perceived Behavioural Control Over Renewable Energy Adoption	Correlation Coefficient	.497**	.505**	1.000	.455**	.428**
		Sig. (2-tailed)	.000	.000	.	.000	.000
		N	100	100	100	100	100
	Behavioural Intention to Adopt Renewable Energy	Correlation Coefficient	.501**	.413**	.455**	1.000	.621**
		Sig. (2-tailed)	.000	.000	.000	.	.000
		N	100	100	100	100	100
	Perceived Effectiveness of Carbon Taxation in Achieving Environmental Goals	Correlation Coefficient	.657**	.363**	.428**	.621**	1.000
		Sig. (2-tailed)	.000	.000	.000	.000	.
		N	100	100	100	100	100
**. Correlation is significant at the 0.01 level (2-tailed).							

All of the important variables have strong positive connections, according to Spearman's correlation study. Subjective norms (0.449), perceived behavioural control over the adoption of renewable energy (0.497), behavioural intention to adopt renewable energy (0.501), and perceived effectiveness of carbon taxation (0.657) are all significantly correlated with attitude towards carbon taxation. This suggests that a positive attitude towards carbon taxation improves perceptions of societal support, confidence in the application of renewable energy, and belief in its efficacy. Additionally, subjective norms

have a positive association with behavioural intention (0.413) and perceived control (0.505), indicating that social effects influence energy adoption intentions. Additionally, there is a substantial correlation between the perceived efficacy of carbon taxation and both behavioural intention (0.621) and perceived control (0.428), suggesting that people who think carbon taxes are effective are more likely to use RE. These results demonstrate the important relationships that exist between attitudes, social factors, control perceptions, and intentions—all of which play a critical role in determining how people adopt RE.

4.5 Findings of Research Question 1

Hypothesis 1:

- **H01:** There is no significant impact of attitudes towards carbon taxation on the intention to adopt renewable energy.
- **H1:** There is a significant impact of attitudes towards carbon taxation on the intention to adopt renewable energy.

Table 4.10: Model Fitting Information

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	66.449			
Final	44.971	21.479	1	.000
Link function: Logit.				

The final model's prediction performance is much higher than that of the intercept-only mode, as evidenced by the model fitting information's Chi-Square value of 21.479 ($p < 0.001$). An improved match is indicated by the final model's -2 Log Likelihood (44.971) compared to the intercept-only model (66.449).

Table 4.11: Goodness-of-Fit

	Chi-Square	df	Sig.
Pearson	50.444	11	.000
Deviance	21.286	11	.031
Link function: Logit.			

The model fits the data fairly well, based on the goodness-of-fit results. A significant discrepancy between the actual and predicted values indicates a poor fit, as indicated by the Pearson Chi-Square score of 50.444 ($p < 0.001$). The model fits the data well, as evidenced by the Deviance Chi-Square score of 21.286 ($p = 0.031$), which is marginally significant.

Table 4.12: Pseudo R-Square

Cox and Snell	.193
Nagelkerke	.217
McFadden	.096
Link function: Logit.	

The values of pseudo-R-squared show the model's explanatory power. According to Cox and Snell, the model effectively explains 19.3% of the variance in the outcome variable, with an R-Square value of 0.193. With a Nagelkerke R-Square score of 0.217, the proportion of explained variation is slightly higher (21.7%). With a McFadden R-Square value of 0.096, the model fits the data moderately, but there is still a substantial amount of unexplained variance, indicating a lower explanatory power.

Table 4.13: Parameter Estimates

		Estimate	Std. Error	Wald	df	Sig.	95% Confidence Interval	
							Lower Bound	Upper Bound
Threshold	[BIARE = 1.00]	.415	1.331	.097	1	.755	-2.193	3.024
	[BIARE = 2.00]	1.141	1.174	.944	1	.331	-1.161	3.443
	[BIARE = 3.00]	3.676	1.109	10.981	1	.001	1.502	5.849

	[BIARE = 4.00]	6.051	1.224	24.443	1	.000	3.652	8.450
Location	ATCT	1.284	.276	21.625	1	.000	.743	1.826
Link function: Logit.								

The parameter estimates provide insight into the relationship between attitudes towards carbon taxation (ATCT) and intention to accept renewable energy (BIARE). The findings of Wald test demonstrate that the variable ATCT significantly increases the intention to use renewable energy, with a coefficient estimate of 1.284 ($p < 0.001$). This suggests that more favourable attitudes towards carbon taxation increase the likelihood of intending to adopt renewable energy. The significant p-values for the **Location** parameter (ATCT) confirm the hypothesis that attitudes towards carbon taxation significantly influence intention to adopt renewable energy (H1). Additionally, the **threshold estimates** indicate that the model distinguishes between different levels of intention to adopt renewable energy, with significant differences at higher intention levels (BIARE = 3 and 4). This supports the conclusion that attitudes towards carbon taxation are a significant factor in shaping renewable energy adoption intentions.

4.6 Findings of Research Question 2

Hypothesis 2:

- **H02:** There is no significant influence of subjective norms on the adoption of renewable energy technologies in response to carbon taxation.
- **H2:** There is significant influence of subjective norms on the adoption of renewable energy technologies in response to carbon taxation.

Table 4.14: Model Fitting Information

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	61.779			
Final	37.270	24.509	1	.000
Link function: Logit.				

A Chi-Square score of 24.509 ($p < 0.001$) for the resulting model shows that it performs significantly better than the intercept-only model based on the model fitting data. The resulting model's -2 Log Likelihood (37.270) is lower than that of the intercept-only model (61.779), suggesting a better match t data.

Table 4.15: Goodness-of-Fit

	Chi-Square	df	Sig.
Pearson	22.344	15	.099
Deviance	16.727	15	.335
Link function: Logit.			

The goodness-of-fit findings show that the model fits the data fairly well. The non-statistically significant Pearson Chi-Square value of 22.344 ($p = 0.099$) and the Deviance Chi-Square value of 16.727 ($p = 0.335$) show that there is no appreciable difference between the actual and expected values. This implies that the model accurately depicts the data.

Table 4.16: Pseudo R-Square

Cox and Snell	.217
Nagelkerke	.244
McFadden	.110
Link function: Logit.	

The pseudo-R-squared values demonstrate the model's ability to explain data. 21.7% of the variance in the dependent variable can be explained by the model, according to the Cox and Snell R-Square value of 0.217. With a substantially higher explanatory power of 0.244, the Nagelkerke R-Square value explains 24.4% of the variation. A moderate degree of explanatory power is indicated by the lower McFadden R-Square score of 0.110. These numbers show that the model can account for a sizable portion of the variability in the results.

Table 4.17: Parameter Estimates

		Estimate	Std. Error	Wald	df	Sig.	95% Confidence Interval	
							Lower Bound	Upper Bound
Threshold	[BIARE = 1.00]	.352	1.330	.070	1	.791	-2.255	2.958
	[BIARE = 2.00]	1.259	1.131	1.239	1	.266	-.958	3.475
	[BIARE = 3.00]	4.093	1.106	13.693	1	.000	1.925	6.262
	[BIARE = 4.00]	6.454	1.213	28.316	1	.000	4.077	8.832
Location	SNRTC	1.451	.290	24.982	1	.000	.882	2.019
Link function: Logit.								

According to the parameter estimates, the use of renewable energy technology is greatly impacted by subjective norms around carbon taxes (SNRTC). With a Wald value of 24.982, $p < 0.001$, and a coefficient of 1.451, SNRTC appears to have a significant positive influence. This implies that the chance of implementing renewable energy technology rises as subjective norms become more favourable. The model's capacity to distinguish across adoption levels is further supported by the strong thresholds for higher intention levels (BIARE = 3 and 4). Consequently, H2 is supported and the null hypothesis (H02) is rejected.

4.7 Findings of Research Question 3

Hypothesis 3:

- **H03:** Perceived behavioral control does not play a mediating role in the relationship between carbon taxation and renewable energy adoption.
- **H3:** Perceived behavioural control plays a mediating role in the relationship between carbon taxation and renewable energy adoption.

H3a: There is a significant relationship between perceived behavioural control over renewable energy adoption and perceived effectiveness of carbon taxation in achieving environmental goals.

Table 4.18: Correlations

			Perceived Behavioral Control Over Renewable Energy Adoption	Perceived Effectiveness of Carbon Taxation in Achieving Environmental Goals
Spearman's rho	Perceived Behavioural Control Over Renewable Energy Adoption	Correlation Coefficient	1.000	.428**
		Sig. (2-tailed)	.	.000
		N	100	100
	Perceived Effectiveness of Carbon Taxation in Achieving Environmental Goals	Correlation Coefficient	.428**	1.000
		Sig. (2-tailed)	.000	.
		N	100	100
**. Correlation is significant at the 0.01 level (2-tailed).				

The association analysis shows a statistically significant positive association between **perceived behavioural control over renewable energy adoption** and the **perceived effectiveness of carbon taxation in achieving environmental goals**, with a Spearman's rho of **0.428** ($p < 0.001$). This indicates a moderate positive association, meaning individuals who feel they have greater control over adopting renewable energy are more likely to perceive carbon taxation as actual in promoting environmental goals. Thus, hypothesis H3a is supported.

H3b: There is a significant relationship between perceived behavioural control over renewable energy adoption and behavioural intention to adopt renewable energy.

Table 4.19: Correlations

			Perceived Behavioural Control Over Renewable Energy Adoption	Behavioural Intention to Adopt Renewable Energy
Spearman's rho	Perceived Behavioural Control Over Renewable Energy Adoption	Correlation Coefficient	1.000	.455**
		Sig. (2-tailed)	.	.000
		N	100	100
	Behavioural Intention to Adopt Renewable Energy	Correlation Coefficient	.455**	1.000
		Sig. (2-tailed)	.000	.
		N	100	100
**. Correlation is significant at the 0.01 level (2-tailed).				

The findings indicate a strong and statistically significant correlation between the intention to utilise renewable energy and the perception that one may influence its adoption (Spearman's rho = 0.455; $p < 0.001$). According to this moderately positive association, people are more likely to have a strong intention to adopt renewable energy if they believe they have more influence over the process. As a result, hypothesis H3b is validated, demonstrating that behavioural intentions are influenced by perceived behavioural control.

H3c: There is a significant relationship between perceived behavioural control over renewable energy adoption and behavioural intention to adopt renewable energy.

Table 4.20: Correlations

	Behavioural Intention to	Perceived Effectiveness of

			Adopt Renewable Energy	Carbon Taxation in Achieving Environmental Goals
Spearman's rho	Behavioural Intention to Adopt Renewable Energy	Correlation Coefficient	1.000	.621**
		Sig. (2-tailed)	.	.000
		N	100	100
	Perceived Effectiveness of Carbon Taxation in Achieving Environmental Goals	Correlation Coefficient	.621**	1.000
		Sig. (2-tailed)	.000	.
		N	100	100
**. Correlation is significant at the 0.01 level (2-tailed).				

The results of the research indicate that the behavioural intention to utilise renewable energy is strongly positively correlated ($p < 0.001$) with the perceived effectiveness of carbon prices in accomplishing environmental goals. There is a strong positive correlation between the likelihood of using renewable energy and the belief that carbon prices are a good approach to achieve environmental goals. The results validate H3c by demonstrating a substantial association between these parameters.

Final Results for Hypothesis 3:

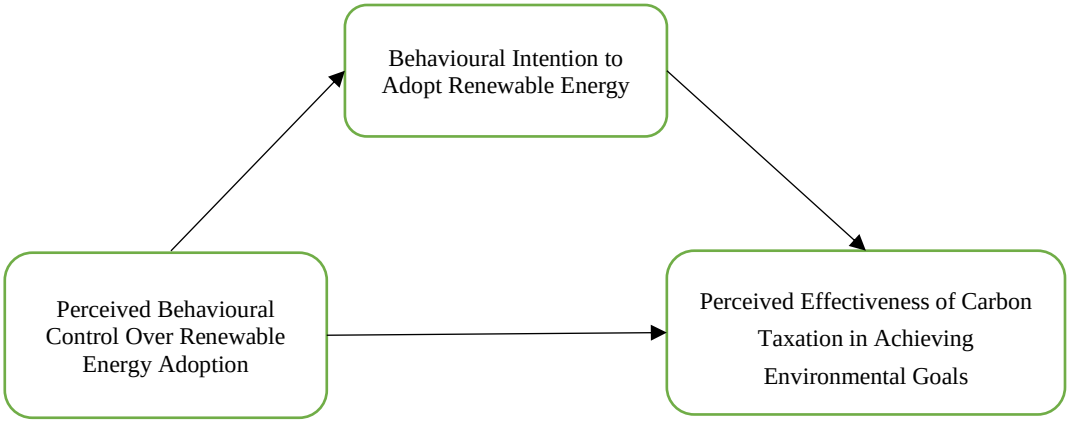


Figure 4.37: Mediation Framework

The study confirms the significant relationships between perceived behavioral control, behavioral intention, and implementation of renewable energy in context of carbon taxation. The correlations indicate that individuals who perceive greater control over renewable energy adoption are more likely to intend to accept renewable energy. Furthermore, those who view carbon taxation as effective in achieving environmental goals show stronger intentions to adopt renewable energy. These findings support hypotheses H3a, H3b, and H3c, suggesting that perceived behavioral control and perceived effectiveness of carbon taxation both play pivotal roles in influencing renewable energy adoption intentions.

4.8 Findings of Research Question 4

Hypothesis 4:

- **H04:** There is no significant relationship between perceived effectiveness of carbon taxation and the adoption of renewable energy.
- **H4:** There is a significant relationship between perceived effectiveness of carbon taxation and the adoption of renewable energy.

Table 4.21: Correlations

			Perceived Behavioural Control Over Renewable Energy Adoption	Perceived Effectiveness of Carbon Taxation in Achieving Environmental Goals
Spearman's rho	Perceived Behavioural Control Over Renewable Energy Adoption	Correlation Coefficient	1.000	.428**
		Sig. (2-tailed)	.	.000
		N	100	100
	Perceived Effectiveness of Carbon Taxation in	Correlation Coefficient	.428**	1.000

	Achieving Environmental Goals	Sig. (2-tailed)	.000	.
		N	100	100
**. Correlation is significant at the 0.01 level (2-tailed).				

The analysis shows a significant positive association between **perceived effectiveness of carbon taxation** and **perceived behavioral control over renewable energy adoption**, with a Spearman's rho of **0.428** ($p < 0.001$). This suggests that individuals who view carbon taxation as effective in achieving environmental goals are more likely to feel confident in their ability to adopt renewable energy. Thus, **H4** is supported, confirming a significant association between the perceived efficiency of carbon taxation and renewable energy adoption.

4.9 Findings of Research Question 5

Hypothesis 5:

- **H05:** There is no significant effect of behavioural intention on the actual adoption of renewable energy in the context of carbon taxation.
- **H5:** There is a significant effect of behavioural intention on the actual adoption of renewable energy in the context of carbon taxation.

Table 4.22: Model Fitting Information

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	75.395			
Final	21.999	53.396	1	.000
Link function: Logit.				

The model fitting information, with a Chi-square value of 53.396 ($p < 0.001$), indicates a considerable improvement from the intercept-only model (Log-Likelihood = 75.395) to the final model (Log-Likelihood = 21.999). This shows that, in comparison to the intercept-only model, final model offers a far better match.

Table 4.23: Goodness-of-Fit

	Chi-Square	df	Sig.
Pearson	4.077	11	.968
Deviance	4.979	11	.932
Link function: Logit.			

The Deviance Chi-Square (4.979, p = 0.932) and Pearson Chi-Square (4.077, p = 0.968) values are both non-significant, according to the goodness-of-fit statistics. Given that the p-values are higher than the 0.05 significance level, which indicates no poor fit, these results imply that model fits the data well.

Table 4.24: Pseudo R-Square

Cox and Snell	.414
Nagelkerke	.467
McFadden	.246
Link function: Logit.	

The explanatory strength of the model is indicated by pseudo-R-squared values. Cox and Snell's R-squared value is 0.414, Nagelkerke's is 0.467, and McFadden's is 0.246. These numbers point to a decent fit, with Nagelkerke offering a little better indicator of the explanatory capacity of model.

Table 4.25: Parameter Estimates

		Estimate	Std. Error	Wald	df	Sig.	95% Confidence Interval	
							Lower Bound	Upper Bound
Threshold	[PEOCTAEG = 1.00]	2.320	1.438	2.602	1	.107	-.499	5.139
	[PEOCTAEG = 3.00]	7.043	1.303	29.218	1	.000	4.489	9.597

	[PEOCTAEG = 4.00]	10.148	1.525	44.307	1	.000	7.160	13.136
Location	BIARE	2.151	.335	41.166	1	.000	1.494	2.808
Link function: Logit.								

The parameter estimates table suggests that behavioral intention (BIARE) has a significant outcome on actual implementation of renewable energy in response to carbon taxation. The Wald statistic of 41.166 ($p < 0.0001$) shows a strong relationship between intention and adoption. The threshold values for different levels of the dependent variable (PEOCTAEG) also show that the likelihood of adopting renewable energy increases significantly with higher behavioral intention. The confidence intervals for BIARE further confirms this positive influence.

4.10 Summary of Findings

The outcomes of the present research show the following important insights on the factors determining the renewed energy acceptance as the result of carbon taxation, it pointed out that perception on carbon taxation has a significant predictor on the deflection level towards renewable energy. Those who held a more favourable view about carbon taxation were more likely to report their willingness to install and use renewable energy technologies. Moreover, perceived behavioral control was necessary, alongside self-reported, perceived preferences regarding renewable energy adoption reflected by the views of others. This goes a long way in emphasising the social aspect of decision making about sustainability.

The study also showed that perceived behavioral control, the extent of the belief of the individual towards the ability to implement RES, is also attributable. In this study, the level of perceived control over the change to renewable energy seemed to be key in forming the intention to transition to renewable energy. This perception of control was further associated with the belief that carbon taxation was about achievement of environmental objectives, meaning that people who supported the opinion that carbon taxation worked on environmental objectives, supported the proposition that they could make use of RE.

Further, it was also discovered that behavioral intention does influence actual adoption of renewable energy hence supporting the thesis that behavioral intentions is a strong predictor of behavior. The study shows that carbon taxation strategies have the potential to shape people's behaviours regarding the adoption of RES technologies through perceptions of attitudes toward the selected policy instrument, awareness of social norms and expectations, perceptions of control and their readiness to act towards the adoption of RES technologies. All in all, the work highlights the multiple and intricate relationships of psychological, social and policy dimensions at the cause of the transition to renewable energy.

4.11 Conclusion

The current study demonstrates that carbon taxation has a potential to directly impact the number of renewable energies. The research clearly shows that there is a need to understand people's attitudes towards carbon taxation and taxation perceived control as well as perceived social norms to explain people's intention to adopt RE technologies. People who had positive attitudes towards carbon taxation were more likely to report their willingness to shift towards RES, policy evaluation threatened attitudes regulation effect. Moreover, the research also shows that perceived behavioural control regarding the implementation of RE has a significant influence on this change, which is moderated by beliefs in the validity of carbon taxation as a means of environmental change. Perceived behavioural control was equally significant in predicting the level of actual adoption, further affirming the theory that intention does predict behaviour. In sum, the research puts psychological, social, and policy paradigms at the centre of the change to RES.

CHAPTER V:
DISCUSSION

5.1 Discussion of Results

The findings reflect a positive attitude towards carbon taxation as one of the effective tools against environment change and utilized of RES (Umit and Schaffer, 2020). It will be seen as legitimate, efficient, and strictly necessary to ensure that polluters are punished and change their behaviour for the better (Gandhi and Cuervo, 1998). Endorsement of the notion that carbon taxation increases green technology investments and change in behaviour is consistent with the literature concerning its ability to decrease the dependence on fossil fuels and spur economic outcomes (Murray and Rivers, 2015b; Carattini, Carvalho and Fankhauser, 2018). This bears the policy on long-term environmental consequences and points to the fact that any policy needs complementary policies such as renewable subsidies and public awareness, amongst others, for its success (Parry, 2019).

The results on perceived behavioural control for carbon taxation also show that social factors greatly influence participants' attitudes towards environmental policies (Doğan *et al.*, 2022b). Again, large numbers of the respondents opined or strongly opined that their peers, people they respect, celebrities and known environmental nongovernmental organisations support the idea of carbon taxation (Qiao *et al.*, 2024). This supports theory of planned behaviour about impact of subjective norms on attitudes towards pro-environmental behaviour (Ajzen, 1991). Research by Mundaca, Román-Collado and Cansino (2022) examined influence of cultural standards on spread of carbon taxes and eco-friendliness. This suggests that injunctive norms are the only ones capable of influencing behaviour in the intended way, while first-order effects demonstrate that social norms have a small but favourable influence on intention to implement carbon taxes. Furthermore, the results disprove the validity of worries regarding possible substitution effects among low-carbon transportation options.

Relative to perceived behavioural control for renewable energy adoption Maestre-Andrés *et al.* (2021), respondents expressed perceived control on barriers and emissions.

but nonetheless, financing issues and the estimative of the complexities of the installation processes are still the biggest problems encountered. These are comparable to conclusions drawn by Jager (2006) wherein perceived behavioural control contributes to the confidence in its implementation but factors including cost and provision of structures posed as barriers to the implementation of renewable energy. Findings reveal that financial backing and overall problem awareness are crucial drivers, but they also highlight the (large) beneficial impacts of technical support meetings, information meetings, and social networks (Tu *et al.*, 2022).

The probability of using renewable energy was highly pronounced, with most of the respondents being likely to incorporate renewable energy into their plans and explore for more information. This is consistent with studies by Wyss, Knoch and Berger (2022), that stress the importance of pro-environmental sentiments as a predictor of pro-environmental behaviours when individual costs are little and environmental gains are big. One of the most important ways in which people can safeguard their pro-environmental aspirations over the long run is by exercising self-control, which allows them to behave according to their attitudes. The findings further align with work by (Drummond, States and Wong-Parodi (2020), who suggest that creating positive attitudes toward renewable energy is critical for encouraging adoption. Factors associated with renewable energy adoption were studied, and it was discovered that younger participants and those who had a positive experience with the RE supplier on-site were more inclined to move to RE (Hedegaard and Kongshøj, 2024).

Regarding perceived effectiveness of carbon taxation, participants recognized its potential in reducing GHGs, incentivizing businesses to approve greener practices, and aligning with global sustainability aims. These findings resonate with Carattini, Carvalho and Fankhauser (2018), who concluded that increasing public support for carbon taxes is critical since they deter emission of greenhouse gases. Put simply, carbon pricing forces polluters to consider the monetary and ecological costs of their activities and provides an incentive for them to reduce their carbon footprint (Shi and Wang, 2023).

These findings highlight the continued interplay between perceived norms, perceived control and behavioural intentions regarding specific pro-environmental behaviour and changes in policy support. Based on the current study's findings Naef, (2024), it is possible to extend support for carbon taxation and renewable energy use by reducing barriers such as financial constraints, complexity of the processes, and favourable socially shared norms. The findings of this study could be extended in future empirical studies focused on demographic and cultural factors that might moderate the effects of social networks on mental health (Carattini, Carvalho and Fankhauser, 2017).

The correlation analysis highlights significant interrelationships among the variables, reinforcing the theoretical foundations of pro-environmental behavior and RE adoption (Zhang, Abbas and Iqbal, 2021). The strong association between **Attitude Towards Carbon Taxation** and **Perceived Effectiveness of Carbon Taxation in Achieving Environmental Goals** indicates that positive attitudes are crucial for recognizing the benefits of carbon taxation in mitigating environmental challenges. This aligns with Ajzen (1991) "Theory of Planned Behaviour" (TPB), which highlights a practical theoretical framework for handling the intricacies of human social behaviour. The theory provides a framework for understanding and predicting specific behaviours in defined circumstances by integrating key ideas from fields of social and behaviour sciences and providing definitions for these notions.

The positive relationship between **Subjective Norms Regarding Carbon Taxation** and **Attitude Towards Carbon Taxation** reflect influence of societal norms and peer pressure on shaping individual perspectives (Fang and Innocenti, 2023). The moderate correlation between **Perceived Behavioural Control Over Renewable Energy Adoption** and **Behavioural Intention to Adopt Renewable Energy** suggests that individuals' perceived ease and ability to adopt renewable energy significantly influence their intentions (Burgos Espinoza *et al.*, 2024). This finding supports the framework of (Ogiemwonyi, 2024), according to which carbon taxes are favourably associated with perceived behavioral control. According to the results, getting people thinking about environmental issues and acting sustainably is crucial.

Furthermore, the significant link between **Behavioural Intention to Adopt Renewable Energy** and **Perceived Effectiveness of Carbon Taxation** underscores the interplay between policy perceptions and personal behavioural commitments, as supported by (Skulski, 2019), who highlights the motivational role of effective environmental policies in driving individual actions. This demonstrates that people are more inclined to have a positive attitude towards the system if they think it serves society well. Having said that, educating customers on the environmental and socioeconomic implications would be good to change their attitude towards carbon pricing (Bouaguel and Alsulimani, 2022). Last, the comparison between Subjective Norms and PBC established that social issues also influence people's confidence in overcoming barriers to RE.

Finally, the findings emphasize attitudes, normative beliefs, and perceived behavioural control in predicting behavioural intentions towards renewable energy and augmented carbon taxation (Daiyabu, Manaf and Mohamad Hsbollah, 2023). The insights presented in this framework can help policymakers and relevant stakeholders develop appropriate strategies that improve public perceptions, harness social norms, and overcome perceived barriers to increase wide adoption of sustainable approaches (Kioupi and Voulvoulis, 2019).

5.2 Discussion of Research Question One

RQ1: How do attitudes towards carbon taxation influence the intention to adopt renewable energy?

Understanding nature of the link between the perceived attitudes towards carbon taxation and the level of interest in the use of RES provides a general premise for examining the performance of pro-environmental behaviour (Sommer, Mattauch and Pahle, 2022). The study shows that the perception of carbon taxation is a central component exhibiting significant influence over the intended shift towards RES. Civil liability reflects a belief in the ability of carbon taxation to eradicate environmental deleterious effects and promote sustainability (Ott, Farsi and Weber, 2021). This is consistent with the theory of planned behaviour that rightly canvases premise that positive attitudes towards a policy or action contribute significantly to behavioural intentions.

Beliefs about carbon taxation probably affect how people view carbon taxation regarding its equity, indispensability, and effectiveness in achieving environmental objectives. When people realize that carbon taxation works to promote environmentally friendly energy solutions and claim the need to reduce carbon emissions, they can embrace RE (Maestre-Andrés *et al.*, 2021b). This underlines the significance of informational approaches as the foundation for developing common opinion concerning the necessity of using carbon taxation for sustainable development.

Further, it is indicated that as the existing attitudes towards the carbon taxation positive, the barriers to the adoption of renewables such as costs or uncertainties are likely to be overcome. This is in accordance with previous literature focusing on the motivational function of policy frameworks towards sustainable behavior change (Batool, Zhao and Irfan, 2024). The policies should leave basis for positive transformation of the attitudes towards renewable energy transitions so as to foster overall sustainable environmental change.

These findings imply the importance of undertaking efforts to improve the public knowledge on carbon taxation and its advantages (Hartmann, Marcos and Barrutia, 2023). Perceived benefits such as environmental and economic benefits and follow-up visibility may bolster the existing favourable attitude and make the intention of adopting renewable energy stronger. Therefore, this research underscores the importance of attitudes as a tool in closing the policy action gap to facilitate coherent implementation of sustainable energy policies.

5.3 Discussion of Research Question Two

RQ2: To what extent does the subjective norms regarding the carbon taxation affect the behavioural intention to adopt renewable energy?

In particular, impact of subjective norms is exposed as a major determinant of behavioural intention regarding utilization of renewable energy technologies about carbon taxation. The psychology concept of perceived behavioural control is based on the idea that behaviour is influenced by perceived social pressure. is an important set of conditions that promote or discourage the performance of pro-environmental actions (Köppl and

Schratzenstaller, 2023b). The outcomes reveal that if an important referent like the family, peers or any other group in society supports the use of RE, the user is likely to conform.

This is in concordance with a theory of planned behaviour proposing that perceived norms, relying on influence, impact behavioural intentions. When members of a society or peers support renewable energy as a way of responding to carbon taxation it triggers a pressure that leads to positive attitudes towards behavior (Yin *et al.*, 2024). When sprung with popular sensitization campaigns, policy lobbying, and community mobilization drives on the gains of adopting green power, such norms can go a long way.

Moreover, a direct, significant connection between subjective norms and renewable energy transitions emphasizes the need for a positive social context of the transformation (Muwanga *et al.*, 2024). Subjective norms might be enhanced by increasing the promotion of renewable energy among targeted stakeholders, including political leaders, environmental activists and the media. Such efforts can cause a chain of effects whereby social acceptance and endorsement of renewable energy enhances individual intentions.

The findings also indicate that subjective norms act as intermediaries between policy interventions such as carbon taxation and behaviour (Chan, Udall and Tam, 2022). It emerging that subjective norms create harmony between/correlate societal expectations and policy objectives/carry out, and therefore, improve the implementation of environmental policies. In general, the study asserts that promoting positive social environment and mobilizing collective power are essential to increasing the propensity for adopting renewable energy technologies.

5.4 Discussion of Research Question Three

RQ3: How does perceived behavioural control (i.e., the perceived ease or difficulty of adopting renewable energy) mediate the relationship between carbon taxation and actual adoption of renewable energy technologies?

The study establishes perceived behavioural control as an important moderator of carbon taxation and utilized of RE technologies. PBC captures the notion of the extent to which a person believes that a behaviour will be easy or difficult and this aspect influences both behavioural intentions and behaviour (He and Veronesi, 2017). The results indicate

that knowledge of control over the RES is associated with higher perception of carbon taxation as an efficient tool for the environmental goals achievement. This is, therefore, an important aspect of the call for the creation of an empowering and accessible environment for the use of renewable energy in society.

Further, PBC supports that perceived behavioural control embraces the construct of perceived autonomy and capability (Claudy, Peterson and O'Driscoll, 2013). In a situation where people think that they have enough finance, information or assistance to use renewable energy, then their actual plan to use it becomes more determined. This is made even stronger, if carbon taxation is seen as a valid policy, linking individual incentives with overall environmental goals. Such perceptions help to sustain aspirations that efficient individual endeavours applied together with outside forces could lead to results, which can significantly influence the state of the surrounding environment (Gandhi and Cuervo, 1998).

Further, these results also suggest a high degree of interaction between PBCs, behavioral intentions, and perceived efficacy of carbon taxation. Thus, those that have favorable perceptions regarding the accomplishment of intended goals by carbon taxation are likely to develop strong intention to opt for renewable energy but mediated by PBC (Zanni, Bristow and Wardman, 2013). It is for these reasons to stress both the need for developing sound methodologies for carbon taxation policies and the need for providing circumstances that increase the perceived sense of control.

Therefore, PBC plays the role of connecting different factors that influence the renewable energy adoption. By minimizing barriers that hamper control — budget constraints, lack of expertise, or accessibility — policy makers and stakeholders will enhance the potential benefits of carbon taxation on the renewable power sector (Wall *et al.*, 2021b). This result underscores the challenges that require both policy appropriateness and people's ability to adopt renewable power sources across the board.

5.5 Discussion of Research Question Four

RQ4: What is the perceived effectiveness of carbon taxation in achieving environmental sustainability, and how does this perception affect the adoption of renewable energy technologies?

The study also verifies that people's opinions about how effective carbon taxes are affect their decision to choose RES. By determining the monetary and ecological costs of carbon emissions, carbon taxes can be used as an efficiency policy tool to incentivise businesses and individuals to practise environmentally responsible behaviour (Povitkina *et al.*, 2021). The results suggest that where people think that carbon taxation is an appropriate approach to environmental protection, they are more likely to undertake environmentally friendly practices like installing RES.

This perception promotes commitment and identification between micro level behavior and macro environmental objectives. This study shows that when people follow carbon taxation policies with the understanding that such practices will make a real positive impact to the environment, more people would support the initiatives that are in line with such goals. The study also as much emphasises how this belief is associated with perceived behavioural control, evidence that people who think that carbon taxation can work also feel capable of switching to renewable solutions. (Lucas, Jr., 2015)

The policy perception-attitude integration highlights the need for effective communication and dissemination of policy information. Policymakers need to communicate the goals and purpose of carbon taxation alongside the benefits of its implementation and practical impacts in the right manner to society (Ghazouani *et al.*, 2020). This also can increase the level of confidence in the policy and strengthen the social construction of the policy, which will prompt the citizens to embrace the use of RE technologies.

More importantly, there is an implication in this relationship of adequate support infrastructure and tools to accompany carbon taxation. When policymakers aim to remove hindrances to renewable energy utilization including access, cost, and implementation difficulties, people will be more encouraged on the shift to sustainable power supply systems (BEISER-McGRATH and BUSEMEYER, 2023).

In conclusion, it found that the efficacy that is associated with carbon taxation is an important feature in the promotion of environmental sustainability (O'Mahony, 2020). Positive policy perceptions thus must be encouraged through policy implementation, public interaction and supportive steps in order to promote the uptake of such technologies and support overall environmental goals.

5.6 Discussion of Research Question Five

RQ5: What is the effect of behavioural intention on the actual adoption of renewable energy in the context of carbon taxation?

In the context of carbon taxes, the presented results demonstrate critical role of behavioural intention in uptake of renewable energy technology. As a concept derived from the TPB, behavioural intention gives a measure of motivation to perform a particular action (Spandagos, Tovar Reaños and Lynch, 2022). The findings of this research show that there exists a positive association between intention and behaviour with people who have high levels of intention to adopt renewable energy more likely to act on these intentions.

As the findings highlighted, intention plays an essential role in predicting behaviour in regard to environmental policies such as carbon taxation (Hakam *et al.*, 2024). This study posits that when ordinary people construe the use of RES as consistent with their perceived personal and communal interest as well as national and worldwide mission of sustainability, their readiness to embrace the cause intensifies. This intention also acts as a psychological link between abstract environmental intentions and concrete mobilisation.

The strong direct correlation between behavioural intention and effectiveness of adoption also suggests that carbon taxation works in eliciting appropriate green behaviours (Grieder *et al.*, 2020). By setting the right perception regarding renewable energy as a viable and necessary solution, the carbon taxation policies may cement the need for action. They are not only aiming that the adoption of renewable energy is more profitable economically but also that the avoidance of climate change is non-optional.(Grieder *et al.*, 2020)

Furthermore, the study implies that the study underlines the necessity of enabling structures that promote movement from the intended behaviors to actual behaviors. This

relationship can be supported and enhanced through such factors as availability of facilities of renewable energy technologies, cost of implementation, and policy support (Jaiswal *et al.*, 2022). Campaigns and community endeavors build on behavioral intention by making people aware of the specific change as well as mobilizing the community to embrace it.

Therefore, the study validates the hypothesis that behavioural intention is an important predictor of renewable energy usage, given carbon taxation (Masrahi, Wang and Abudiyah, 2021b). Policymakers and other stakeholders should build upon this insight to foster further development intention and ensure that individuals within societies have what it takes to transform their intentions into effective pro-sustainable energy behaviours.

CHAPTER VI:
SUMMARY, IMPLICATIONS, AND RECOMMENDATIONS

6.1 Summary

Focusing on function of carbon taxes, this research examines the psychological, social, and policy factors that interact to motivating use of RES. It investigates how carbon taxation policies impact people's motivation to switch to RES, taking into account their attitudes, perceived behavioural control, subjective norms, and behavioural intentions. The findings reveal critical visions into the factors that shape renewable energy implementation, emphasizing the complex relationships between perceptions, social influences, and policy effectiveness.

One of the major studies sheds light on the importance of carbon taxation attitudes. It is also important to note that a positive perception of carbon taxation is significantly and positively related to the formation of a strong intention to adopt renewable energy technologies. Such attitudes are Entail from the view that carbon taxation is a corrective policy tool to deal with environmental issues. The study also found that subjective norms—the perceived influence of the community—are influential. Individuals are always inspired by the attitudes of the individuals in our culture; therefore, individuals' decisions concerning sustainability and RES depend on actions of the individuals around them.

The other influential component highlighted in the research is "perceived behavioural control" (PBC), which measures an individual's readiness to embrace renewable energy. PBC is not only found to affect behavioural intention directly but also moderates the effects between attitude to carbon taxation and the use of RE. This suggests that people who perceive that they have the resources, expert information, or social capital required to 'switch' to renewable power are more likely to make the move, and that is the reality in Western countries.

This study also brings into focus the perceived effectiveness of carbon taxation in achieving environmental goals. The study finds that individuals who consider carbon taxation a significant and effective policy are significantly likely to consider themselves capable of implementing RE technologies. This view enhances both their attitude and

behaviour, showing that optimism regarding policy efficiency correlates well with long-term activities.

Behavioral intention turns out as a significant determinant of actual levels of renewable energy ingesting. This study supports need for the provision of the necessary prerequisite tools that enable translating attitude to behaviour through positive attitudes, perceived behavioural control and social norms. Perceived behavioural control, which results from prior experience of the behaviour or what constitutes the outside world, prepares people with concrete plans to respond towards adopting renewable energy, hence guaranteeing action.

The implication of the research for policymakers and stakeholders seeking to advance the use of RE is therefore crucial. Carbon taxation policies must therefore be formulated to reflect on the environmental objectives and the attitude of people toward such programs. To improve perceived control, relevant communities should increase public awareness of the advantages of carbon taxation, subsidize related activities, or otherwise ease the shift to low-carbon sources of energy. Moreover, the use of social pressure and developing perceptions of people about togetherness can complement such policies.

Therefore, this research outlines the multiple factors persuading the uptake of renewable energy within backdrop of carbon taxation. Thus, by understanding and working with the psychological and social factors combined with the policy context of switching to renewable energy, governmental and organizational actors can develop the most suitable interventions for the concerned societies to foster change toward sustainable development.

6.2 Implications

The information gained from this study will be helpful to the government, environmental groups/conservation agencies, and firms interested in promoting renewable energy technologies. In this respect, the results point to the need to build more suitable carbon taxation policies based not only on the impact on people's actions but also on the cognition level in which people understand the taxes. There is a possibility to change people's attitudes toward carbon taxation, which are in most cases negative, to positive ones if the main arguments in its support are explained, like potential lowering of the

negative impact on environment, as well as appearance of opportunities for development of RES. This study lends credence to the importance of perceived behavioural control by showing that providing individuals with the option to choose RES boosts their confidence and makes the transition simpler. The liberalisation of the market for RE technology and provision of subsidies, grants, and incentives for their installation are two ways to achieve this goal.

Additionally, subjective norms prove that social factors are important in determining responsible behaviour. Community policing that demonstrates community support, effective demand, or popular individuals supporting renewable energy can contribute positively toward changing the social acceptance of sustainable electricity.

Thus, presenting the psychological and social factors mentioned above can help policymakers better approach the problem and devise more efficient intervention methods that minimize the intention-behavior gap. The results indicate that a complex intervention policy, education, and support—is an optimal solution for achieving faster changes among countries.

6.3 Contribution of the Study

This study meaningfully enhances knowledge on how psychological, social, and aggressive policy elements may combine to support RES adoption under carbon taxation. Through sharing of attitudes, subjective norms, "perceived behavioral control" (PBC) and behavioral intentions, it pulls off the curtain and reveals the integrated complex and dynamic factors that shape change towards sustainable energy practices. One of the deepest findings of the study is the significance of positive attitudes to carbon taxation as a remedial measure in overcoming environmental problems driving the need to enhance intention towards the adoption of RES. In addition, the study also focuses on the importance of subjective norms to capture social constraints or community beliefs that affect decisions in sustainable practices. Recognition of the moderating role of perceived behavioral control, whereby program designers must equip people with the tools, education, and

encouragement required to effect the change, clearly demonstrates that PBC has a moderating role in amplifying the relationship between the identified attitudes and adoption behavior. Further, the result on perceived effectiveness as an argument on the carbon taxation also supports its ability to change both perception and behaviour towards using renewable energy resources. The study's goals are to promote evidence-based decisions regarding policy formulation and development, environmental sensitisation, and awareness creation for entities representing potential social enablers for change toward sustainable energy solutions.

6.4 Recommendations for Future Research

There are some recommendations for future research, which are as follows:

- **Exploration of Cultural Variations:** Future studies should investigate how cultural contexts influence perceptions of carbon taxation and renewable energy adoption. Perceptions, norms, and behavioral control across regions demands the creation of culturally erected sound polices.
- **Longitudinal Studies:** Launch longer studies in order to investigate the patterns of attitude and behaviour concerning carbon taxation and renewable energy integration over time. This approach could shed light on sustained efficacy of policy intercessions.
- **Broader Population Samples:** It is crucial to extend the research to embrace different populations, provided by rural areas, low income homes and junior residents to diagram how various channels influence renewable energy producer carbon taxation.
- **Role of Technology and Innovation:** Investigate how advancements in renewable energy technology influence perceptions of ease and control over adoption. This could include discussing the effects of more new technologies such as smart grids and energy storage technologies.
- **Behavior-Intention Gap:** Review the literature between behavioral intention and usage (Brazilian case) concerning essence of identified barriers to the implementation of RE technologies.

- **Technological Awareness Campaigns:** Evaluate the impact of polls on the effectiveness of amassing community knowledge on carbon taxation and disruptive renewable technologies and how this affects individual change.

6.5 Conclusion

This research stresses the use of carbon taxation through adopting renewable energy technologies on its appropriateness as an important policy instrument. Through the psychological, social, and policy-oriented analysis of the behaviour, Researchers can learn more about what factors impact people's openness to and engagement with RES. Strong antecedents of renewable energy usage include attitudes towards carbon taxes, importance of subjective standards, and perception of one's behavioural control, according to the study. Such conclusions prove that carbon taxation is a tool not only in terms of conventional economic adjustment but also as a means to change the behaviour of society to become sustainable.

The study also establishes perceived behavioural control and perceived efficacy of carbon taxation as moderating factors of adoption behaviours. Those who believe that carbon taxation is effective in attaining environmental objectives are more likely to notice control over the adoption of renewable energy and, therefore, take subsequent action on their attitudes. Furthermore, enhancing the study's validity through assessing actual adoption based on behavioural intentions underlines psychology’s readiness for renewable energy policies and sufficient measures for dismantling barriers in terms of the structural model.

This research complements the existing literature by providing a bridging link between psychological concepts and policy research that is helpful to policymakers, environmentalists, and stakeholders in the renewable energy sector. It entails that complex solutions that go beyond mere economic incentives and need to incorporate elements of a social and psychological nature are useful in promoting the large-scale adoption of sustainable energy alternatives.

Despite its significant outcome, this study also suggests that future research is required to investigate regional, cultural and technological influences on the utilization of

RES. In sum, carbon taxation presents a complex approach capable of advancing environmentalism by harmonizing monetary, sociopsychological, and sociopolitical drivers

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APPENDIX A:

DATASET

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
1	**Age**	**Gender**	**Educational Q**	**Occupation**	I believe	Implemen	Carbon ta	Carbon ta	Carbon ta	I believe	Carbon ta	I believe	I feel pre	Most peo	Environm	I feel enc	There is	I feel that	I feel that	Financial	The insta	I am not e	I believe	I feel that	I am likely	I am com
2	26-35 years	Female	Professional De	Employed (Priv	5	5	5	5	5	5	4	5	1	4	3	3	4	4	3	3	4	5	4	3	4	4
3	18-25 years	Female	Bachelor's Deg	Employed (Pub	3	4	4	5	3	4	4	4	3	4	4	4	3	4	4	4	3	2	4	4	4	4
4	36-45 years	Male	Professional De	Employed (Priv	3	3	4	3	3	4	4	4	2	2	2	3	2	3	4	4	2	3	4	4	4	3
5	36-45 years	Male	Professional De	Employed (Priv	5	5	5	5	5	5	5	5	1	5	5	5	3	1	5	3	3	5	5	3	5	5
6	26-35 years	Male	Other	Employed (Priv	5	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	5	4	4	4	4
7	36-45 years	Male	Bachelor's Deg	Employed (Priv	5	5	5	5	5	5	5	5	4	4	4	4	4	4	5	5	5	5	3	3	4	4
8	36-45 years	Male	Professional De	Employed (Priv	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
9	36-45 years	Male	Bachelor's Deg	Employed (Priv	5	5	4	5	3	4	3	5	2	4	2	3	4	5	5	1	5	5	4	5	5	5
10	26-35 years	Male	Professional De	Employed (Priv	5	5	5	5	5	5	5	5	4	4	3	4	3	4	4	5	5	4	5	5	4	4
11	26-35 years	Female	Professional De	Employed (Priv	5	4	4	5	5	5	5	5	3	5	4	5	5	4	5	5	5	4	5	5	4	4
12	36-45 years	Male	Professional De	Employed (Pub	1	3	2	1	3	3	4	1	1	2	2	2	3	3	5	4	2	4	4	1	5	4
13	26-35 years	Female	Bachelor's Deg	Employed (Pub	2	3	4	3	2	4	4	4	1	2	5	5	5	4	1	3	3	3	5	5	5	4
14	36-45 years	Male	Professional De	Employed (Pub	3	4	4	4	4	5	4	3	5	4	4	4	3	4	4	2	2	4	4	4	4	4
15	46-55 years	Male	Professional De	Employed (Pub	3	3	4	4	4	3	3	4	3	3	3	3	3	2	3	5	3	2	4	4	5	5
16	36-45 years	Female	Post Graduate	Employed (Priv	4	4	5	3	5	5	3	4	1	5	4	5	3	4	4	2	5	5	4	5	5	4
17	46-55 years	Female	Post Graduate	Self-Employed	5	5	5	5	5	5	5	5	5	5	4	4	3	4	5	5	5	5	4	5	5	5
18	26-35 years	Female	Other	Employed (Priv	4	3	4	5	3	4	3	4	3	2	4	2	4	3	4	4	4	3	4	3	4	3
19	26-35 years	Female	Bachelor's Deg	Employed (Priv	5	5	5	5	5	5	5	5	1	4	5	5	5	5	5	5	5	5	5	5	5	5
20	18-25 years	Male	Bachelor's Deg	Employed (Priv	5	5	5	5	5	5	5	4	2	5	4	4	4	4	5	5	5	5	5	5	4	4
21	36-45 years	Female	High Secondar	Unemployed	4	3	4	4	3	3	4	3	4	3	4	3	3	2	3	2	3	4	1	4	4	3
22	36-45 years	Male	Professional De	Employed (Priv	3	3	3	4	3	4	3	3	3	3	3	3	3	3	4	3	4	3	3	3	4	4
23	36-45 years	Male	Bachelor's Deg	Employed (Priv	5	5	5	5	5	5	4	4	3	4	4	5	5	5	2	3	2	3	3	5	5	5
24	36-45 years	Male	Other	Employed (Priv	5	5	5	5	5	5	5	5	3	3	4	2	3	4	4	5	3	3	3	2	4	4
25	26-35 years	Female	Bachelor's Deg	Employed (Pub	5	5	5	5	5	5	5	5	5	5	5	5	5	5	1	1	5	5	5	5	5	5

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
1	**Age**	**Gender**	**Educational Q**	**Occupation**	I believe	Implemen	Carbon ta	Carbon ta	Carbon ta	I believe	Carbon ta	I believe	I feel pre	Most peo	Environm	I feel enc	There is	I feel that	I feel that	Financial	The insta	I am not e	I believe	I feel that	I am likely	I am com
26	36-45 years	Male	Post Graduate	Employed (Priv	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	4	3	4	4	4	5	4
27	36-45 years	Male	Professional De	Employed (Priv	4	5	5	5	4	4	4	5	3	4	4	5	4	4	5	5	2	3	5	4	5	5
28	36-45 years	Male	Professional De	Self-Employed	3	4	2	5	4	5	5	4	3	4	4	4	3	3	4	4	2	3	4	4	4	4
29	36-45 years	Female	Professional De	Employed (Priv	4	3	3	4	4	3	3	4	4	3	3	1	2	2	4	5	1	3	3	3	5	4
30	56 years and	Male	Professional De	Employed (Priv	3	3	3	3	3	4	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3
31	36-45 years	Male	Professional De	Employed (Priv	4	3	3	5	4	5	3	5	1	3	2	5	3	3	5	5	4	5	5	4	5	5
32	18-25 years	Female	High Secondar	Employed (Priv	3	4	3	4	4	3	4	3	2	2	3	2	3	4	4	3	3	4	3	4	3	3
33	26-35 years	Female	Bachelor's Deg	Employed (Pub	4	4	4	4	4	4	3	4	3	4	3	4	4	4	4	4	4	4	4	4	4	4
34	26-35 years	Female	High Secondar	Employed (Priv	5	5	5	5	5	4	4	4	1	1	2	5	4	4	5	4	3	4	3	4	5	5
35	18-25 years	Female	Other	Self-Employed	5	4	5	4	5	5	4	5	4	4	5	5	4	5	5	4	4	4	4	5	5	5
36	36-45 years	Male	Professional De	Employed (Pub	3	4	4	3	4	4	4	3	1	2	3	2	4	4	3	4	1	3	5	4	5	5
37	36-45 years	Male	Bachelor's Deg	Employed (Pub	4	4	4	4	4	5	5	4	4	3	4	5	5	4	4	4	5	4	4	5	4	5
38	36-45 years	Female	Professional De	Employed (Pub	5	4	5	4	4	5	5	4	1	4	4	3	3	4	4	3	3	4	4	4	5	5
39	26-35 years	Male	Professional De	Employed (Priv	4	5	4	5	4	5	5	5	3	4	3	4	4	4	4	3	4	4	5	4	5	4
40	36-45 years	Female	Post Graduate	Other	3	2	1	1	2	1	2	2	1	2	2	3	2	4	4	2	2	2	4	2	5	5
41	26-35 years	Female	Bachelor's Deg	Self-Employed	4	4	4	4	4	4	4	4	3	4	3	3	3	4	5	3	4	4	4	4	4	4
42	36-45 years	Male	Professional De	Employed (Priv	1	4	2	4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
43	26-35 years	Female	Professional De	Employed (Priv	2	2	1	1	3	3	3	4	3	3	3	3	3	3	3	3	3	3	3	1	5	5
44	18-25 years	Male	Professional De	Self-Employed	4	5	5	4	3	5	4	5	3	4	5	3	4	4	3	3	4	5	3	2	5	5
45	26-35 years	Female	Post Graduate	Employed (Priv	3	3	3	3	3	5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	5	5
46	26-35 years	Male	Professional De	Employed (Priv	2	2	2	2	2	3	3	1	3	2	2	2	1	2	2	1	1	2	2	2	3	3
47	26-35 years	Male	Professional De	Self-Employed	4	5	3	5	5	5	4	4	2	4	4	4	3	5	4	3	5	3	4	4	5	4
48	36-45 years	Male	Bachelor's Deg	Employed (Priv	4	5	4	5	3	4	4	3	3	4	3	3	3	4	4	3	2	3	4	4	4	4
49	26-35 years	Female	Professional De	Employed (Priv	5	5	4	5	5	5	4	4	1	3	4	4	5	5	5	4	5	4	4	4	5	5

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
1	**Age**	**Gender**	**Educational Q**	**Occupation**	I believe	Implemen	Carbon ta	Carbon ta	Carbon ta	I believe	Carbon ta	I believe	I feel pre	Most peo	Environm	I feel enc	There is	I feel that	I feel that	Financial	The insta	I am not e	I believe	I feel that	I am likely	I am com
50	26-35 years	Male	Post Graduate	Employed (Priv	4	4	3	3	4	3	4	3	4	4	3	4	4	3	3	4	4	3	4	4	4	4
51	18-25 years	Female	Bachelor's Deg	Unemployed	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
52	26-35 years	Female	Professional De	Unemployed	1	1	1	2	2	2	2	2	5	5	5	5	5	5	5	5	5	5	5	5	5	3
53	18-25 years	Female	Professional De	Employed (Priv	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
54	36-45 years	Female	High Secondar	Employed (Priv	5	5	5	5	5	5	5	5	5	5	4	5	5	5	5	5	4	5	5	5	5	5
55	36-45 years	Male	Post Graduate	Employed (Priv	5	5	4	4	4	4	4	4	4	3	4	3	3	3	3	3	4	4	3	4	5	5
56	26-35 years	Female	Professional De	Employed (Priv	4	4	4	4	4	4	4	4	4	4	4	4	4	4	5	4	3	4	5	4	4	3
57	46-55 years	Male	Bachelor's Deg	Employed (Priv	5	5	5	4	5	5	4	4	5	5	5	4	4	2	5	4	2	4	4	5	5	5
58	36-45 years	Male	High Secondar	Employed (Priv	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3	4	4	4	4	3
59	36-45 years	Female	High Secondar	Employed (Pub	4	4	4	4	5	5	4	5	5	5	5	3	4	4	4	4	5	5	5	5	4	4
60	26-35 years	Male	Bachelor's Deg	Self-Employed	3	4	4	5	5	5	4	4	3	3	3	4	3	5	4	4	3	3	4	3	4	4
61	18-25 years	Female	Bachelor's Deg	Employed (Priv	5	5	5	5	5	5	5	5	3	3	3	5	3	5	5	5	2	5	3	5	5	3
62	26-35 years	Female	Bachelor's Deg	Employed (Priv	5	5	5	5	5	5	5	5	1	1	1	1	1	1	5	1	5	5	5	5	5	5
63	26-35 years	Female	Bachelor's Deg	Self-Employed	4	4	3	5	5	5	4	3	3	4	3	3	3	3	3	3	4	3	3	3	3	3
64	26-35 years	Male	Bachelor's Deg	Employed (Priv	3	4	2	3	3	4	4	3	2	1	2	2	2	3	3	3	4	3	5	2	4	3
65	26-35 years	Male	Professional De	Employed (Pub	4	4	2	2	4	4	2	4	4	3	2	2	4	4	4	5	4	2	2	4	4	2
66	26-35 years	Female	Post Graduate	Self-Employed	4	2	3	4	4	2	4	4	4	4	2	2	4	4	4	4	2	3	4	4	4	4
67	26-35 years	Male	Post Graduate	Employed (Priv	4	4	5	4	4	5	3	4	3	4	4	3	3	4	3	4	3	3	3	2	4	4
68	18-25 years	Female	Post Graduate	Employed (Priv	2	4	5	3	3	1	3	5	5	3	1	2	5	4	4	2	5	1	5	3	1	2
69	18-25 years	Male	Bachelor's Deg	Employed (Priv	3	5	4	4	5	3	5	4	4	5	4	3	5	3	3	5	4	3	5	4	5	3
70	18-25 years	Female	Post Graduate	Employed (Priv	4	3	4	5	4	3	3	4	3	5	5	2	4	2	3	4	5	4	4	5	5	5
71	18-25 years	Female	Post Graduate	Employed (Priv	4	5	4	5	5	4	3	3	4	5	5	3	3	4	5	5	3	4	4	3	4	5
72	18-25 years	Male	Bachelor's Deg	Employed (Priv	2	3	4	3	2	3	4	3	2	4	3	2	3	4	2	3	4	3	2	3	2	4
73	26-35 years	Male	Bachelor's Deg	Employed (Priv	4	3	4	3	4	3	4	3	4	5	4	5	4	5	4	5	4	5	4	5	4	5

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
1	**Age**	**Gender**	**Educational Q**	**Occupation**	I believe	Implemen	Carbon ta	Carbon ta	Carbon ta	I believe	Carbon ta	I believe	I feel pre	Most peo	Environm	I feel enc	There is	I feel that	I feel that	Financial	The insta	I am not e	I believe	I feel that	I am likely	I am com
74	18-25 years	Male	Bachelor's Deg	Employed (Pri	4	3	4	3	4	3	4	5	2	3	4	4	5	4	1	2	3	4	5	4	2	3
75	18-25 years	Female	High Secondar	Self-Employed	4	3	4	3	4	5	4	5	3	4	5	3	4	5	5	4	5	4	4	5	3	4
76	18-25 years	Female	Post Graduate	Employed (Pri	4	5	4	5	4	3	3	2	4	5	3	2	4	3	4	5	5	3	4	3	4	5
77	18-25 years	Male	Bachelor's Deg	Unemployed	4	3	5	3	2	1	5	2	4	3	2	3	5	4	2	3	4	2	1	3	5	3
78	26-35 years	Male	High School	Employed (Pri	3	4	5	3	1	2	3	3	4	3	1	3	4	5	4	3	1	2	3	4	5	4
79	18-25 years	Female	Post Graduate	Employed (Pri	4	3	5	3	4	5	5	3	4	5	3	3	4	5	5	4	3	3	4	4	3	5
80	18-25 years	Female	Post Graduate	Employed (Pri	3	5	3	4	4	3	5	3	5	4	3	4	3	5	3	4	2	4	5	3	3	5
81	18-25 years	Female	Post Graduate	Employed (Pri	2	3	3	2	3	4	2	3	1	2	2	2	1	2	1	2	1	2	1	2	1	2
82	18-25 years	Female	Bachelor's Deg	Employed (Pri	5	5	4	4	4	4	3	5	5	3	5	3	5	4	5	5	1	3	5	5	5	4
83	18-25 years	Male	Bachelor's Deg	Employed (Pri	3	4	3	3	4	5	4	5	5	4	4	5	5	4	4	5	4	5	2	2	5	1
84	26-35 years	Female	Post Graduate	Employed (Pri	4	5	4	4	5	4	5	4	4	5	4	5	5	4	4	4	5	5	4	5	3	4
85	26-35 years	Female	Post Graduate	Employed (Pri	1	2	3	4	5	3	4	5	1	2	3	4	5	4	1	2	3	4	5	4	1	2
86	18-25 years	Male	Bachelor's Deg	Employed (Pri	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3
87	18-25 years	Female	Bachelor's Deg	Employed (Put	4	5	4	3	2	4	3	4	3	5	4	4	5	4	3	4	3	5	4	5	3	4
88	18-25 years	Female	Post Graduate	Employed (Pri	5	4	3	3	4	5	4	5	4	4	3	2	5	4	4	4	5	3	3	4	4	4
89	18-25 years	Female	Bachelor's Deg	Employed (Put	3	4	4	4	4	4	5	3	4	5	4	3	4	4	5	4	4	5	4	5	3	4
90	18-25 years	Female	Post Graduate	Employed (Pri	4	4	5	3	3	4	3	5	4	5	5	3	5	4	5	4	4	3	5	5	3	4
91	18-25 years	Male	Bachelor's Deg	Employed (Pri	2	4	2	2	3	2	2	2	4	2	3	2	1	4	2	4	3	2	1	3	2	1
92	26-35 years	Female	Post Graduate	Employed (Put	2	4	5	4	2	1	5	4	2	1	5	3	2	5	2	2	5	3	1	3	2	4
93	26-35 years	Female	Bachelor's Deg	Self-Employed	4	2	4	2	4	3	2	5	4	3	2	4	2	4	2	4	2	1	4	3	4	2
94	36-45 years	Female	Post Graduate	Employed (Put	5	3	2	4	4	2	5	4	2	3	5	4	2	1	2	4	4	2	5	3	2	1
95	46-55 years	Female	Post Graduate	Employed (Put	4	2	4	4	4	2	2	1	2	4	2	4	4	2	2	1	4	4	2	2	4	2
96	46-55 years	Male	Professional D	Employed (Pri	3	2	1	5	4	2	4	3	2	4	2	4	4	2	4	3	2	4	4	2	4	2
97	56 years and	Male	Post Graduate	Employed (Put	5	4	2	4	4	3	2	4	4	2	4	5	3	2	2	4	2	2	2	4	2	5

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
1	**Age**	**Gender**	**Educational Q**	**Occupation**	I believe	Implemen	Carbon ta	Carbon ta	Carbon ta	I believe	Carbon ta	I believe	I feel pre	Most peo	Environm	I feel enc	There is	I feel that	I feel that	Financial	The insta	I am not e	I believe	I feel that	I am likely	I am com
98	26-35 years	Female	Post Graduate	Employed (Put	1	2	3	4	5	4	3	2	1	2	3	4	5	4	1	2	3	4	5	4	1	2
99	36-45 years	Male	Post Graduate	Unemployed	3	2	5	3	2	4	4	2	2	2	1	4	2	1	2	4	2	4	2	2	2	1
100	46-55 years	Female	Professional D	Self-Employed	3	2	4	2	5	3	1	3	2	4	2	1	5	3	2	5	3	2	2	4	2	4
101	36-45 years	Male	Post Graduate	Employed (Pri	1	2	3	4	5	4	3	2	1	2	3	4	5	4	1	2	3	4	5	4	1	2