

## Attitudes of Gen Z Germans towards Renewable & Sustainable Investments

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# **Attitudes of Gen Z Germans towards Renewable & Sustainable Investments**

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# List of Abbreviations

EU : European Union

ESG : Environmental, Social, Governance

GenZ : Generation Z (Born between 1997 and 2012)

CDU : Christian Democratic Union

CSU : Christian Social Union

SPD : Social Democratic Party

AfD : Alternative for Germany

FDP : Free Democratic Party

WVS : World Value Survey

GIFA : German Investment Funds Association

SME : Small and Medium Enterprises

RESA (EEG) : Renewable Energy Sources Act

ANOVA : Analysis of Variance

NRW : North Rhein Westphalia

ROI : Return on Invest

VS Code : Visual Studio Code

IQR : Interquartile Range

CAGR : Compound Annual Growth Rate

VIF : Variance Inflation Factor

# 1. Introduction

## 1.1 Background and Context

The global consensus has shifted from viewing the utilisation of renewable energy sources as an optional strategy for combating climate change to a fundamental necessity. This is because the scientific community is in almost unanimous agreement that unless we wish to avoid the most catastrophic consequences of global warming, there must be significant reductions in greenhouse gas emissions (Intergovernmental Panel on Climate Change [IPCC], 2021). This can only be achieved if we reduce our dependence on fossil fuels such as coal, oil, and gas for electricity generation. Instead of tapping into clean energy options such as wind farms, solar panels, or geothermal where applicable not only help save planet earth but also fosters sustainable growth by striking balances across various sectors including but not limited to economy, environment, and social equity (United Nations, 2020).

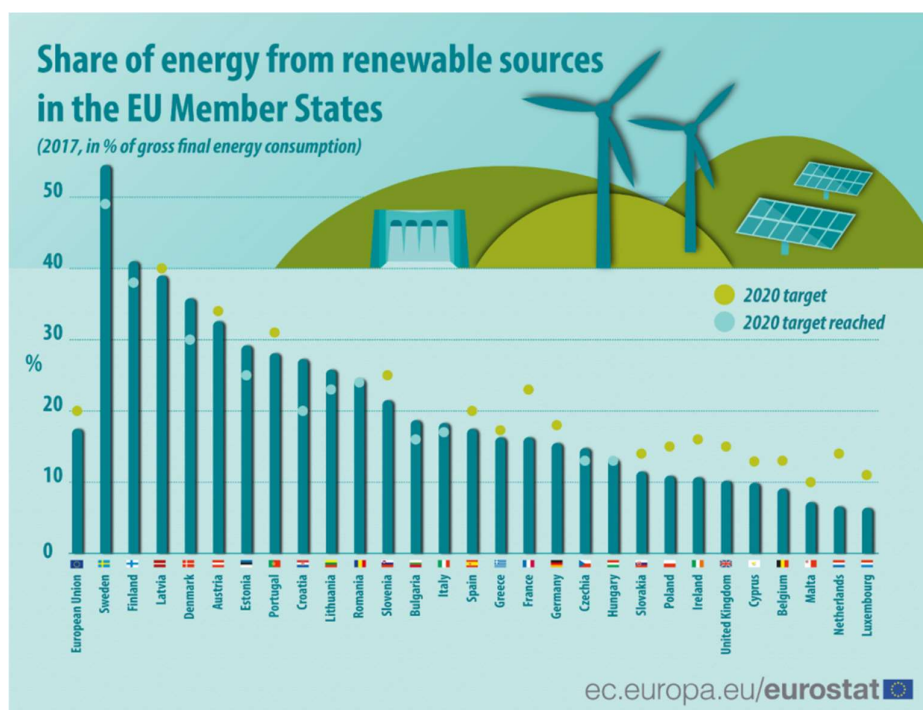


Figure 1 Share of Renewables in the EU

Europe has led this transition, especially through its laws like those set by European Union (EU) member countries who have also campaigned widely among their citizens through advertisements while at the same improving technology used in harnessing these green powers as seen within different regions. The EU's goal to become carbon neutral by 2050 reflects how serious they are about adopting renewables (European Commission, 2019). Additionally, other schemes such as The Green New Deal and Renewable Energy Directive are good examples of how effective policymaking can speed up adoption rates throughout continents (European Commission, 2020). These undertakings will attract huge sums from public funding bodies and private investors driven mainly by the increased awareness that is vital for our future survival (Eurostat, 2021). Sustainability offers significant economic prospects since it creates jobs locally which might even boost international relations between nations, thereby acting as a catalysts towards worldwide peacebuilding efforts (International Renewable Energy Agency [IRENA], 2020).



Amid this scenario, it is necessary to emphasize why it is important to explain the reasons for the investment activity in the field of renewable energy, especially when the representatives of the new generation of investors, Generation Z, begin to appear. Generation Z or Gen Z represents one of the last generations born between the mid-1990s and early 2010s and it has been said that this generation possesses more environmental consciousness as well as social relatedness (Francis & Hoefel, 2018). People of this generation could significantly influence and direct current and future energy investment trends, especially in a country like Germany, which is striving for a shift towards renewable energy as a core objective of its nation (Federal Ministry for Economic Affairs and Energy, 2020).

There has been minimal literature on the co-relating parameters among Generation Z in Germany and their inclinations towards investing in sustainable options in the renewable energy sector. This study will also assess connected factors such as risk tolerance, financial returns or importance given to Environmental, Social and Governance (ESG) criteria, that mediate this attitude-behaviour relation. Thus, the question, what are the factors that influence the Gen Z Germans to invest in Renewable energy sector compared to traditional energy sector. It is expected that the study findings would fill the gap of knowledge in sustainable finance by outlining the disproportionate involvement of younger generations in energizing the development of sustainable economy.

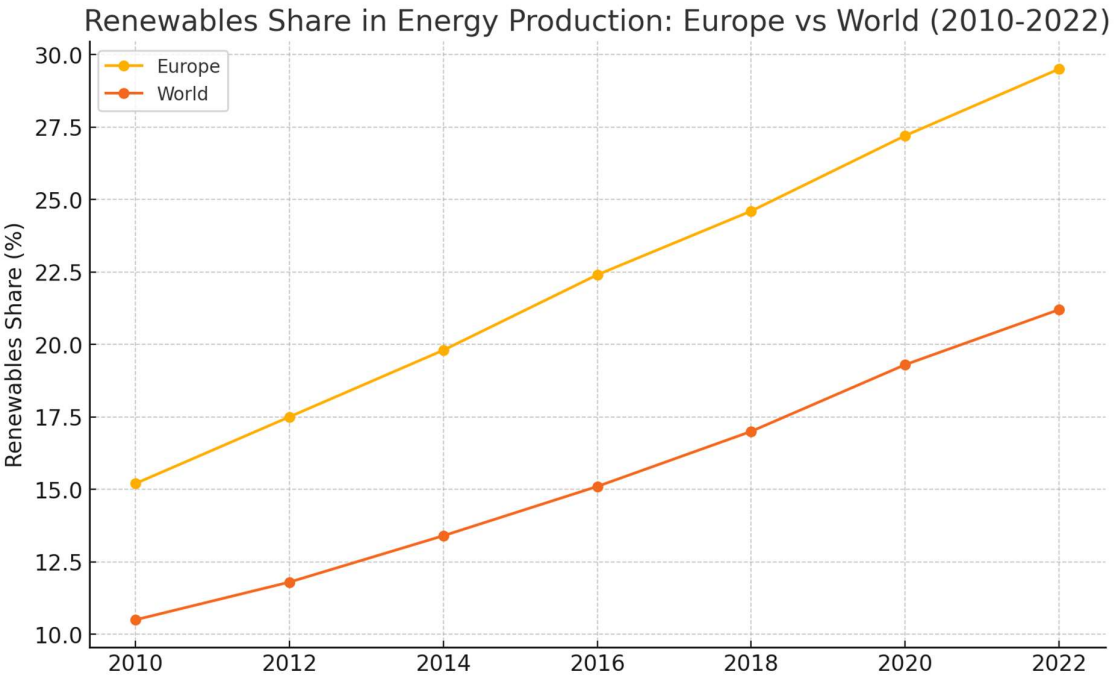


Table 1 Renewables Share - Europe vs World

### 1.2 Generation Z: A New Force in Sustainability

Within this wide energy revolution, the Gen Z has become a major force that will define how we consume and invest energy in the days to come. They were born between 1997 and 2012, making them the first group of people to grow up in a digitally connected world where information is readily available and social problems are globalized events (Francis, T., & Hoefel, F, True Gen: Generation Z and its Implications for Companies, 2018).

This digital nativeness not only affected their communication styles or consumption patterns but also made them more conscious about worldwide issues especially those related with climate change. Several studies have shown that compared to earlier generations, Gen Z is more likely to incorporate

sustainability into their buying choices as well as use platforms such as Facebook or Twitter among others for advocating environmental causes (Seemiller C., & Grace, M., Generation Z: Educating and Engaging the Next Generation of Students, 2017).

For Gen Z, being sustainable does not stop at being consumers. It also informs how they view investments as individuals who make money work for them. As these individuals join employment and start earning disposable incomes, there will be significant shifts witnessed within capital markets because many of them will become players within these systems too. Traditional investors used financial returns as their major yardstick when judging which investments were worthy or not but now things have changed since most young people want everything around them including banks or companies they work with should be environmentally friendly hence expecting higher standards from firms they invest in. The move towards green finance can be seen through increased interest towards ESG funds alongside growing demands for greater corporate accountability on matters environmental impact (Morgan Stanley Institute for Sustainable Investing, 2019).

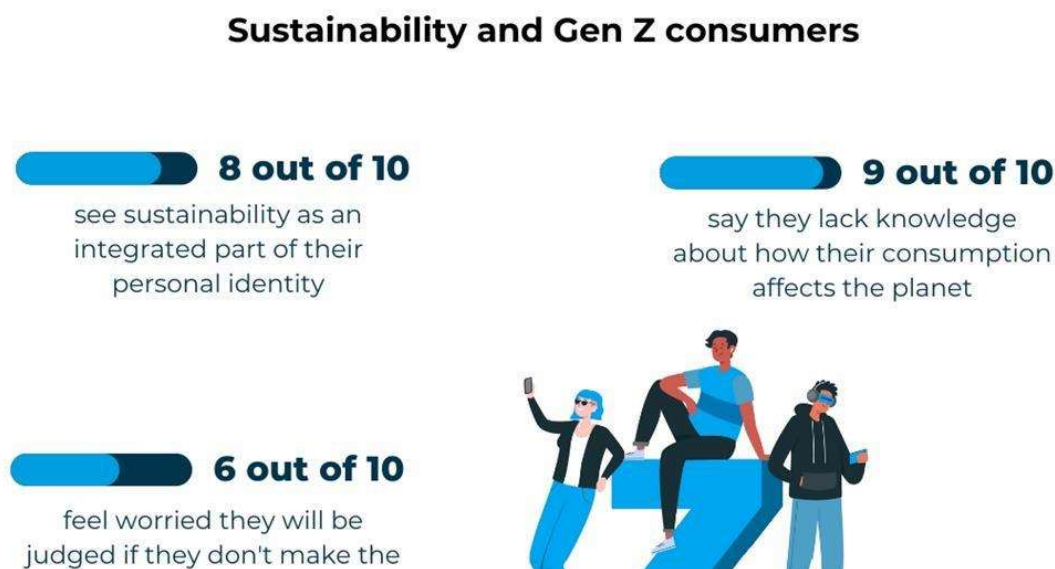


Figure 2 Gen Z & Sustainability

### 1.3 Why Germany? The Significance of Choosing Germany for this Study

As one looks at the attitude of Generation Z towards renewable energy and the returns on stocks of alternative energy sources in Europe, Germany appears as an exemplary case. Being the largest economy in Europe and among the leading industrial nations globally, Germany has been a pioneer in the worldwide drive for green power. Energiewende is a national policy program aimed at switching Germany's energy system from fossil fuels and atomic energy to renewable sources of power referred to as "energy turnaround". This puts Germany at a global front position when it comes to renewable energy, making it suitable for studying renewable energy adoption and associated investment trends (The Energy of the Future: Fourth 'Energy Transition' Monitoring Report, BMWi, 2015).

Germany's dedication to greening is exemplified through bold objectives met by its government. In 2020 nearly 46% of the country's electricity consumption was generated from renewables. The expansion of wind, solar, and biomass contributed to this rise (Germany 2020: Energy Policy Review, IEA, 2020). Supported by robust policies put forth by its government and public investments,

Germany’s renewable energy infrastructure offers an opportunity for understanding how today’s youngest generations, especially Gen Z people see clean energy transition.



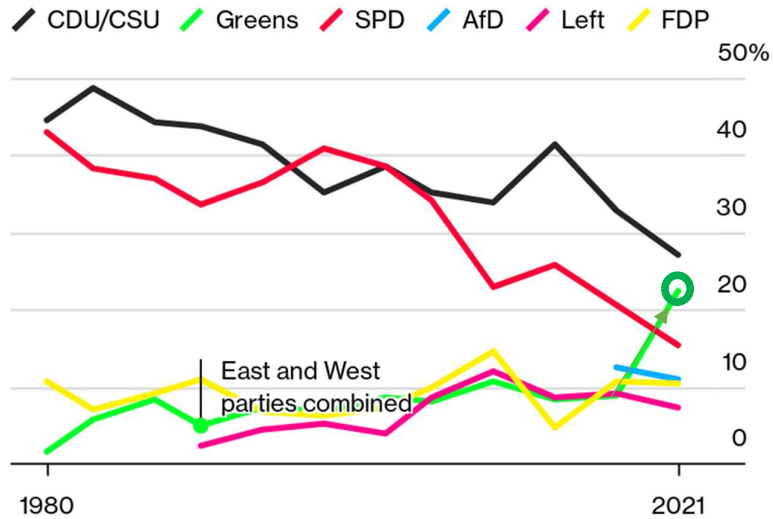
Figure 3 Germany & Sustainability

Germany also stands out due to its economic and political influence within EU which portrays it as a critical actor defining European market dynamics and policies on energy. Leadership provided by this country encouraging sustainable power has had far reaching impacts including shaping EU laws in regard to power6 thereby emphasizing what Gen Z thinks about sustainability in general terms. Meanwhile, Germany remains influential in driving EU climate objectives within which it acts as a centre for new technology development geared towards renewables6 thus increasing its significance beyond German borders across Europe (Climate Paths for Germany, BDI, 2018).

1.4 Political Policy-Making Significance

The Green Party has played a major role in Germany’s renewable energy agenda, which is why the country’s political landscape has always been significant for this sector. Over the last few decades, the popularity and strength of the Green party have grown substantially as it has become one of the largest advocates for environmental issues including clean power transition. This influence can be seen at all levels of government; from municipalities up to federal authorities where it helps shape policies meant to support Energiewende (Environmental Policy and Renewable Energy, Green Party, 2020).

Germany's Greens have labored in the main parties' shadows for decades



Source: German Bundestag, Wahlrecht.de  
 \* 2021 figures based on an average of the latest polls as of April 22

**Bloomberg**

Figure 4 Performance of Green Party

However, not only does green politics mean lots of votes but also great policy-making achievements in terms sustainable energy use too. These include but are not limited to strict rules on carbon emissions reduction, subsidies benefiting renewable projects and incentives targeting energy conservation among others. Policy makers should therefore seek insights into what Gen Z Germans think about renewables because they will be instrumental in determining future investments towards climate change mitigation driven by such organizations like Bündnis 90/Die Grünen (Green Party) (Bundestag Publications, 2021).

### 1.5 Investment and Business Policy Significance

This topic is relevant not just within political realms but also when viewed from business angles as well as those related with investment decisions making process too. Being an economic giant of Europe coupled with being world leader on green power adoption rates positions Germany at crossroads where companies want to tap into lucrative sustainable energy market opportunities while investors seek safe heaven assets which aligns with ESG principles (Germany's Green Finance Transformation, Frankfurt School, 2021).

| Company    | Market Valuation (Billion €) | ESG Score 2020 | ESG Score 2021 | ESG Score 2022 | ESG Score 2023 | Stock Return 2020 | Stock Return 2021 | Stock Return 2022 | Stock Return 2023 |
|------------|------------------------------|----------------|----------------|----------------|----------------|-------------------|-------------------|-------------------|-------------------|
| Volkswagen | 82                           | 54             | 55             | 56             | 58             | -4.60%            | 25.80%            | -23.30%           | 10.70%            |
| Siemens    | 127.5                        | 63             | 65             | 67             | 69             | 13.60%            | 25.50%            | -12.10%           | 17.90%            |
| Allianz    | 88.1                         | 62             | 63             | 64             | 66             | 0.40%             | 22.40%            | -8.10%            | 8.50%             |
| BASF       | 46                           | 60             | 61             | 63             | 65             | -14.10%           | 13.50%            | -21.30%           | 14.20%            |
| Daimler    | 84.6                         | 52             | 53             | 55             | 57             | -9.90%            | 42.50%            | -18.70%           | 6.30%             |
| BMW        | 67.5                         | 57             | 58             | 59             | 60             | -9.30%            | 16.10%            | -14.70%           | 11.50%            |

|                      |       |    |    |    |    |         |        |         |        |
|----------------------|-------|----|----|----|----|---------|--------|---------|--------|
| <b>Deutsche Bank</b> | 22.5  | 49 | 51 | 53 | 54 | -14.60% | 25.40% | -10.10% | 9.70%  |
| <b>SAP</b>           | 159.7 | 64 | 66 | 67 | 70 | 11.70%  | 19.40% | -16.00% | 20.20% |
| <b>Bayer</b>         | 49.5  | 55 | 57 | 58 | 59 | -32.60% | 27.10% | -5.70%  | 12.30% |

Table 2 Top German Listed Companies with their ESG scores and Stock Market Return from 2020 - 2023

For businesses targeting products or services meant for individuals falling under generation Z bracket then understanding their standpoints towards green electricity becomes very necessary. As they start entering job markets, accumulating wealth through different channels like inheritance or personal savings; this group's alternative fuel preferences could determine success or failure for various industries over time. It means that any enterprise that wants maximum profits should consider what these young people care about most when developing its strategies especially if such moves involve ecological soundness (The Future of Sustainable Finance in Europe, ECB Economic Bulletin, 2021).

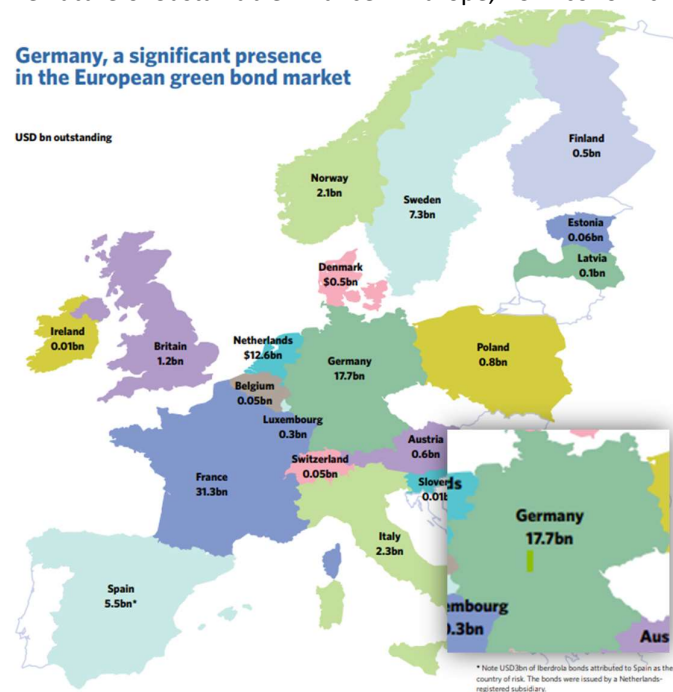


Figure 5 European Green Bond Market (Source : [www.climatebonds.net](http://www.climatebonds.net))

Additionally, Frankfurt Stock Exchange has become a popular destination for those looking to buy green bonds or invest in ESG funds; thus indicating increased focus by financial sector players on sustainable investments within Germany. Asset managers along with other players within the finance industry are therefore interested in knowing how values held by Gen Z will affect their choices related to where money should be put to ensure the long-term success of any business venture involved with such portfolios that cater for future needs (Sustainability in the Capital Markets, Deutsche Börse Group, 2020).

## 2. Literature Review

### 2.1 Gen Z and Environmental Attitudes

Gen Z has an extreme awareness about environmental matters, this can be seen in many different studies that have been carried out in various places. It is said by Seemiller and Grace (2017) that Gen

Z shows more concern for environmental sustainability than any other age group before them, largely motivated by the immediacy of climate change impacts which they see happening around them on a daily basis (Generation Z: A Century in the Making, Routledge, 2017). Another thing is stated by Francis and Hoefel (2018), who say that it isn't just another fad but rather part of who we are as people – affecting what we buy or don't buy and how we interact with one another (True Gen: Generation Z and its Implications for Companies, McKinsey & Company, 2018).

Within Germany alone there has been research conducted showing this belief system among young people towards renewables, reflecting wider societal attitudes towards sustainable development within the country. For example: According to WVS (2020) 70% of German respondents aged 18-24 years old believe renewable energy is one most important issue facing their nation at present (WVS Report, 2020). This is consistent with findings from the German Federal Ministry for the Environment (2021), which reported that young Germans are more likely to support policies promoting renewable energy than older generations (German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety. Youth Environment Awareness Study. BMU, 2021).

## 2.2 Sustainable Investment Behaviour of Generation Z

With Generation Z beginning work & accumulating wealth, their investment choices will become increasingly significant within financial markets over time. Therefore, it's critical now more than ever before to understand what types of things matter most when choosing where this money goes? For example one such country based research is in Australia, where behaviour of Gen Z has shown that sustainable investments rank high on many lists compiled by these young investors world-wide but also closer to home. In fact Morgan Stanley did a study back in 2019 which found over 85% of Australian customer base under 30 years old were interested investing sustainably even if could result lower returns (Sustainable Signals: New Data from the Individual Investor, Morgan Stanley Institute for Sustainable Investing, 2019).

In Germany sustainable investing is becoming very popular especially amongst Gen Zs because they want their investments align with personal values towards environmental protectionism among others this was highly evident from results obtained during survey carried out by German Investment Funds Association last year 2020 showed that there has been strong growth in demand for sustainable investment funds by young people, with Generation Z leading the way (German Investment Fund Annual Report, 2020).

Moreover Deloitte conducted research recently where it was discovered that more than half of all young Germans would be willing to put money into companies who show commitment to ESG principle (The Future of Sustainable Investing: Perspectives from Generation Z, Deloitte Insights, 2021).

However, there is a gap in the literature on how Gen Z's investment behaviours particularly relate to the alternative energy sector. Although enough evidence exists to show Gen Z's inclination for sustainable investments, very little research has been done regarding their attitudes towards renewable energy stocks given market volatility and financial returns especially in Germany.

This lacuna creates an opening for future studies that could examine the specific factors affecting Gen Z's investment choices within the alternative energy sector in Germany.

## 2.3 Renewable Energy Adoption in Germany

There is a lot of research both in policy and academic literature on Germany's shift to renewable energy known as "Energiewende". This commitment by the country to halt nuclear power usage and reliance on oil products has portrayed it as the world leader in adopting renewable energy. Notably, Germany has made significant strides towards increasing its solar and wind capacity for renewable energy (Germany 2020:Energy Policy Review, IEA, 2020).

Several factors have been pointed out as being behind Germany's successful transition to renewable energies among which include strong government policies, public support and technological innovation. Among these factors is the Renewable Energy Sources Act (EEG) of 2000 which introduced feed-in tariffs for renewable energy sources which is often referred to as one of the major drivers for such an extensive expansion of renewable energies in this country (The Renewable Source Act (EEG): A Success Story, BMWi, 2020). Furthermore, Germany's commitment to Paris agreements, European Union climate goals and so forth has further strengthened its leadership position in terms of adoption of renewable energy sources.

The literature also shows that there are some challenges facing the German transition towards renewables despite its achievements. For instance, scholars like Burger and Weinmann (2020) argue that the economic sustainability of Energiewende may be questionable due to costs involved in grid extension and storage (The Economic Challenges of the German Energiewende, Energy Economics, vol.87, pp 104735, 2020). Moreover, the social acceptance of renewables particularly in rural areas remains controversial with some communities opposing projects such as wind farms or solar parks for environmental, agricultural or aesthetic reasons (Wüstenhagen, Rolf, and Emanuela Menichetti, Strategic Choices for Renewable Energy Investment: Conceptual Framework and Opportunities for Further Research, Energy Policy, vol. 40, 2012, pp. 1-10).

## 2.4 The Intersection of Environmental Attitudes and Investment Behaviour in the Alternative Energy Sector

The intersection between peoples' environmental attitudes towards investment behaviour within alternative energy sector has not received much attention from scholars especially when it comes to Gen Z in Germany. There has been increasing interest on sustainable investing as well as adoption of renewables but very few studies have sought to find out how young people's ecological values influence their decisions concerning putting money into this industry.

One study which touches on these two aspects was conducted by Roe & Pelant (2020) whose main aim was investigating whether there exists any correlation between environmental attitudes among Gen Zers and their willingness to buy shares from companies dealing with renewable energy stocks (Roe, Robert, and Annika Pelant, Generation Z and the Future of Renewable Energy Investment: An Exploratory Study. Journal of Sustainable Finance & Investment, vol. 10, no. 3, 2020, pp. 307-324). Their findings reveal that although majority of them express support for such sources of electricity supply, what actually determines whether or not an individual will invest in them is more complex than expected because other factors like financial literacy, perceived risk, trust in financial institutions also come into play. Similarly, Schmidt (2021) carried out a master thesis at University of Hamburg which focused on barriers hindering young Germans' participation within renewable energy investments market hence calling for easily reachable and clear-cut investment products designed for such group (Schmidt, Leonie. Barriers to Renewable Energy Investment for Generation Z: A German Perspective. Master's thesis, University of Hamburg, 2021).

The literature however fails to show adequately how far these individuals balance their love for environment against making money while venturing into alternative energy sector. It is true that some evidence suggests that they might be willing to accept lower returns on investments so long as positive ecological impact is achieved but we do not know whether or not this trade-off affects their actual choices.

Furthermore, the effects of market volatility and the long-term predictability of green stocks on Gen Zer's investment decisions have received little attention.

## 2.5 Gaps in the Literature and Future Research Directions

The existing research gives valuable insights into the ecological interests of the German youth and their emerging interest in environmental impact investing, and thus are of value. However, the literature has yet to fully explore how these interests translate into actionable investment decisions, particularly within the realm of renewable energy projects in Germany. This gap highlights the appropriateness of further research, especially on how a single vector of ecological interests can change into a specific direction of a particular sector, including systems only oriented at producing clean electricity. There is an urgent need to explore how Generation Z's ecological interests translate into specific investment actions within these distinct sectors (Wüstenhagen & Menichetti, 2012).

An additional noteworthy gap in the existing literature is a substantial shortcoming regarding the specific challenges and opportunities that Gen Z encounters when investing in renewable energy stocks. Some important research aspects are market sensitivity, financial return on investment, and risk perception, understanding of which would assist in assessing the attitude of Gen Z towards green investment. Research that investigates how Generation Z's attitudinal approach to ecology relates to investment in renewable energy generation from their behaviour will be helpful (Sadorsky, 2012).

There is still a need for further study about how Gen Z's attitude and mindset can shape their choices regarding their finances, more so on renewable energy ventures. For example, who or what influences their investment behaviour and how is it likely to be different from older generations? Longitudinal research could observe how investment behaviours change over the years, identifying how mixture of facts came to be in the current investment drivers' factor (Friede, Busch & Bassen, 2015).

This study hopes to close the existing void by investigating in detail the investment behaviour of Gen Z towards renewable energy in Germany, the reasons for such investment choices, and the wider economic effects. The results would be useful to the policy makers, investors and educators who want to nurture more sustainable investments in the future. Such insights would have wadded the existing academic literature and at the same time help crafting particular strategies aimed at enhancing an encouraging environment for sustainable investment for the upcoming breed of investors.

## 3. Methodology

### 3.1 Quantitative Research Methodology

A quantitative research approach is selected for this master thesis to evaluate the perceptions of Generation Z Germans concerning renewable energy sources and returns on stocks in the alternative energy industry. The reason why quantitative research was chosen is because it involves collecting numerical data which can be used for identification of patterns, correlations as well as possible causal relationships between variables. Such an undertaking becomes advantageous when trying to come up



with generalizations across large populations like Gen Z throughout Germany (Creswell, John W., and J. David Creswell, 2017).

Quantitative methods are preferred over qualitative ones in this context due to their ability to provide more objective measures of Gen Z's attitudes and behaviours. Qualitative approaches such as interviews or focus groups may offer deep insights but they are limited in scope and might not adequately represent diverse views from a large population like Gen Z. Moreover, such surveys of individuals in the financial sector are difficult to collect as they contain information on the personal behaviours of clients that are under data protection and cannot be and cannot be shared.

That being, on the other hand, through surveys and statistical analysis among others, quantitative methods enable researchers to reach wider audiences and get data that can be statistically analysed leading to more generalized conclusions (Bryman Alan, Social Research Methods, 2016).

### 3.2 Data Collection Strategy

Data for this study will be collected through an e-survey which is a very efficient and effective way of reaching a big chunk of people like Gen Z in Germany. An array of factors will be captured through this survey. We will delve deeper into this topic in Chapter 3.3. Data to be included and the processing of this data under 4. Planned data collection and processing.

This research will target the Gen Z population from different backgrounds and regions; therefore, it will be distributed across educational institutions as well as social media platforms via email lists to guarantee maximum coverage. The survey will have closed-ended questions (e.g., Likert scale items) to quantify how strongly people feel about something (Dillman, Don A., Jolene D. Smyth, and Leah Melani Christian, Internet, Phone, Mail, and Mixed-Mode Surveys: The Tailored Design Method, 2014).

The survey will be pre-tested with a small group of 12 respondents to guarantee the reliability and validity of the information collected. This pre-test is necessary for identifying any concerns that may arise due to misspellings, survey structure, or response format to provide room for improvements before data collection on a wider scale (Fowler Floyd J, Survey Research Methods, 2013). Other than that, provision will be made to reduce the presence of partiality by making sure that the survey is without names or email id's and at the same time making respondents understand the need for honesty in giving their answers.

### 3.3 Data to be Included

The data that will be collected in the survey covers a range of dependent variables necessary to understand Gen Z's perceptions and behaviours. ([Appendix 1: Questionnaire – Google Form](#))

- **Demographic Information:** Age, gender, level of education and location shall be captured to examine how these factors can shape attitudes towards renewable energy and investment decisions.
- **Attitudes Towards Renewable Energy:** Questions would inquire about the general view of respondents on alternative sources of energy; the importance they attach to renewable energy concerning climate change mitigation; and their support for the country's implementation of renewable policies.
- **Investment Preferences:** This part of the survey aims at knowing Gen Z's investment choices including their interest in investing in sustainable funds, familiarity with ESG criteria as well as views on investing in alternative energies.
- **Risk Tolerance:** In respect to volatile sectors like renewable energy, respondents will have to rate their tolerance for risk when it comes to investments. This is important for understanding how risk perception influences investment behaviour among Gen Z.

- **Perceptions of Financial Returns:** The questionnaire will include questions about respondents' expectations of financial returns from investments in the alternative energy sector compared to traditional energy sectors.

### 3.4 Data Analysis

Once collected, the data will be first described and then it will be analysed to bring to light any relationships or patterns among variables. Descriptive statistics are used in summarizing data thus giving a general picture of what Gen Z thinks and does regarding certain areas of interest. Key variables will have measures of central tendency and dispersion if needed (Andy Field, *Discovering Statistics Using IBM SPSS Statistics*, 2018).

Inferential statistics such as correlation and regression analysis will be conducted to examine the relationships between different variables.

With correlation analysis, one can determine strength as well as directionality between two given variables like attitude towards renewables versus preference on investments (Tabachnick Barbara G., and Linda S. Fidell, *Using Multivariate Statistics*, 2019).

A regression analysis tool is used for modelling and analysing relationships between variables. It is used to make predictions, test hypotheses, understand relationships, and inform decision-making across various fields related to sustainable investments amongst young people (Gen Z). In this research, we aim to provide insights into the drivers of Gen Z preferences for investments in renewable energy. All quantitative findings will be interpreted alongside existing literature to provide actionable insights for policymakers, managers, and financial institutions (Joseph Hair F., *Multivariate Data Analysis*, 2019).

### 3.5 Justification for the Methodology

The selection of quantitative research methodology is justified by its ability to provide generalizable conclusions that can guide policymakers, businesses, and financial institutions on wider Gen Z's attitudes towards renewable energy and sustainability investments. Transitioning into green technologies will require massive amounts of money; therefore, it calls for reliable statistical data representing many different views held among large numbers of people. Through statistical analysis of survey data, one can gain a holistic understanding about these matters which will help in making informed decisions while formulating policies or adopting business strategies (Mark Saunders, Philip Lewis, and Adrian Thornhill, *Research Methods for Business Students*, 2019).

Also, another reason for using quantitative methods is because they are good at establishing patterns and predicting behaviours which are important when assessing the impact that Gen Z may have on the non-conventional power sector. Such kind of research looks more into numerical figures thus enhancing an evidence-based approach towards promoting clean energy use within Germany coupled with sustainable finance practices (David De Vaus, *Surveys in Social Research*, 2013).

## 4. Planned Data Collection & Processing

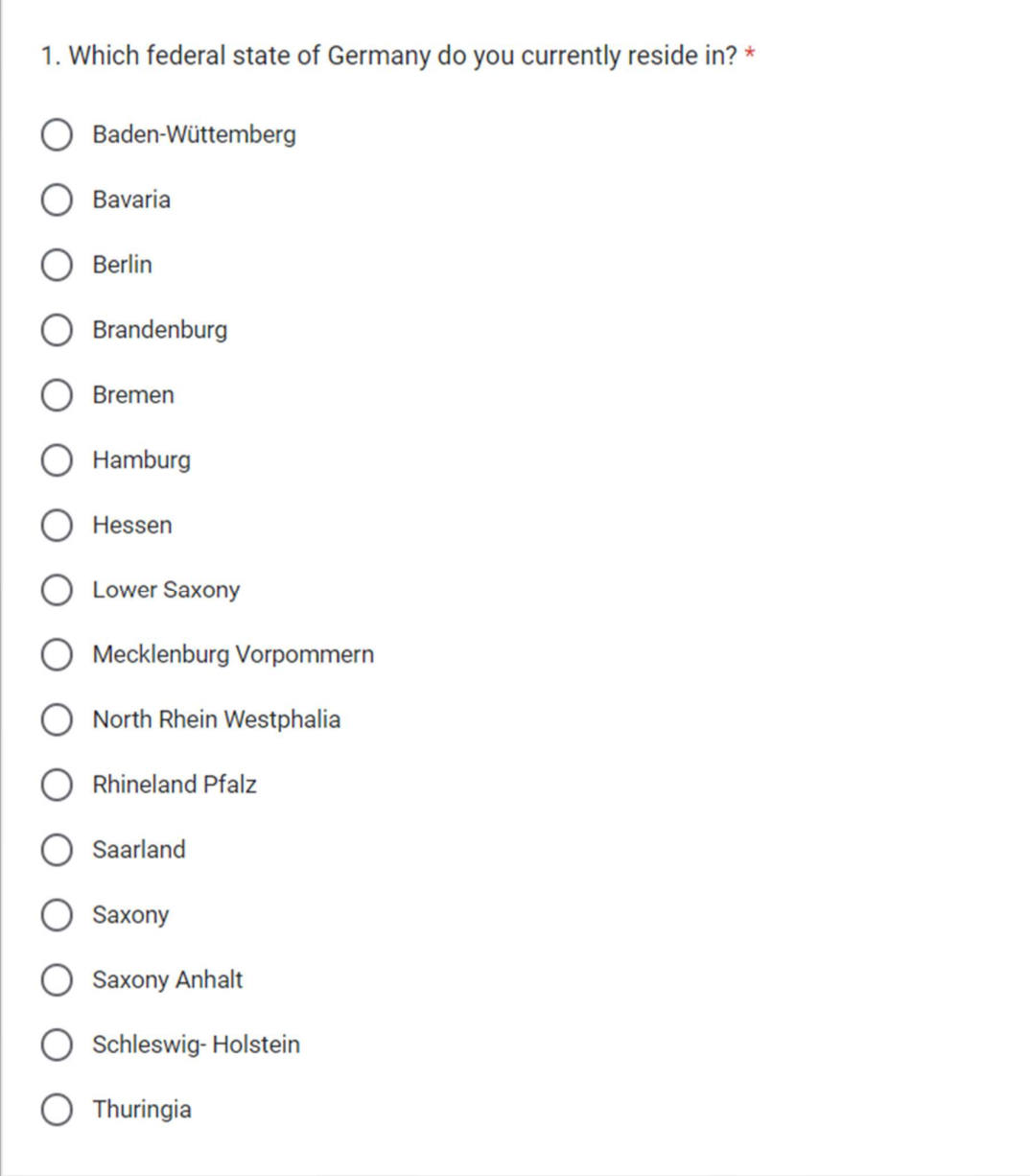
In this chapter, the methodology that will be used in collecting information to ascertain the attitudes of Generation Z towards renewable energy for investment decisions in Germany and their influences on investment decisions especially in alternative energy sector are analysed. The structured questionnaire is intended to cover important areas such as demographics, attitude towards renewable energy, investment preferences, risk tolerance and perception of financial returns. Each section of the

questionnaire is methodically developed to gather data that is both comprehensive and suitable for detailed analysis.

#### 4.1 Demographics

The first four questions aim at collecting the demographic background information related to the respondents. These include location, age gender and level of education that play an important role in our analysis. The questions relating to demographics and how they will be analysed will be discussed in detail below.

##### Question 1:

A screenshot of a survey question. The question is "1. Which federal state of Germany do you currently reside in? \*". Below the question is a list of 16 German federal states, each preceded by an empty radio button. The states listed are: Baden-Württemberg, Bavaria, Berlin, Brandenburg, Bremen, Hamburg, Hessen, Lower Saxony, Mecklenburg Vorpommern, North Rhein Westphalia, Rhineland Pfalz, Saarland, Saxony, Saxony Anhalt, Schleswig- Holstein, and Thuringia.

1. Which federal state of Germany do you currently reside in? \*

- ☐ Baden-Württemberg
- ☐ Bavaria
- ☐ Berlin
- ☐ Brandenburg
- ☐ Bremen
- ☐ Hamburg
- ☐ Hessen
- ☐ Lower Saxony
- ☐ Mecklenburg Vorpommern
- ☐ North Rhein Westphalia
- ☐ Rhineland Pfalz
- ☐ Saarland
- ☐ Saxony
- ☐ Saxony Anhalt
- ☐ Schleswig- Holstein
- ☐ Thuringia

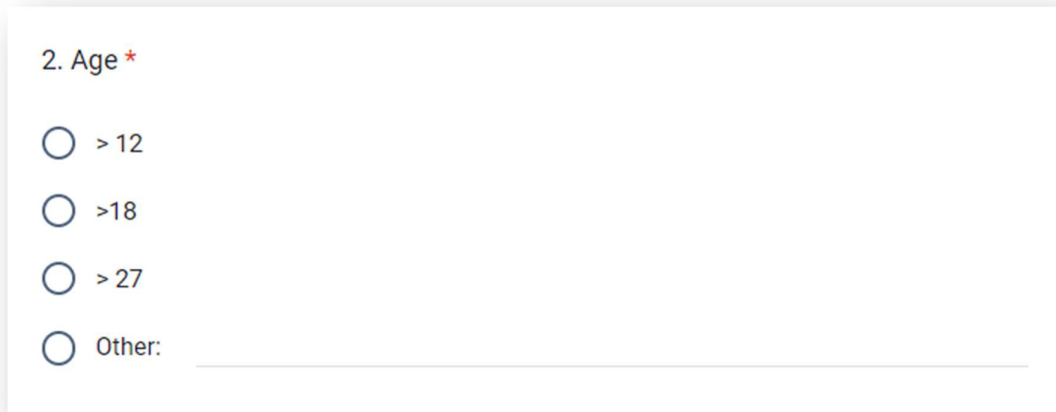
Figure 6 Question 1 Related to Residence of the Respondent

#### Data Analysis:

A frequency distribution analysis is to be done here to have a clear indication on distribution of the respondents based on states. This will help in understanding regional variations. This data will be visually represented as pie chart or bar diagrams.

In addition, the use cross-tabulation with other variables such as investment behaviour in the later stages can be used to explore regional differences in attitudes or behaviours.

#### Question 2:



2. Age \*

☐ > 12

☐ >18

☐ > 27

☐ Other: \_\_\_\_\_

*Figure 7 Question 2 Related to the Age of the Respondent*

#### Data Analysis:

The focal point of this research is on Generation Z hence the primary use of this question is as a filter to get rid of data that is not part of this research question (only Gen Z). The reasons for the choice of options are as follows:

- Evidently all individuals born between 1997 and 2012 belong to Gen Z. By the time of this study (2024), people born on 2012 will have attained twelve years of age and people born on 1997 will have attained 27 years of age. Hence the reason for first option > 12 and third option > 27.
- The legal age in Germany is eighteen years old. At which point an individual becomes full legal capacity and can undertake financial transactions including stock trading. Hence the second option >18.

Like in the previous question, this data will also be visually represented as pie chart or bar diagrams.

**Question 3:**

3. Gender \*

☐ Male

☐ Female

☐ Prefer not to say

*Figure 8 Question 3 Related to the Gender of the respondent*

**Data Analysis:**

The data collected here can be used to analyse gender based differences and similarities. It gives us an insight into the attitude and behaviour based on gender. This data will be represented as a pie chart.

A cross tabulation with other variable like location can provide us information on variation of gender based preferences across the various states. This however might hold true when the sample size collected is large enough.

**Question 4:**

4. Educational Qualification \*

☐ Primary School (Grundschule)

☐ Lower Secondary School (Hapt / Realschule)

☐ Upper Secondary School (Gymnasium / Gesamtschule)

☐ Vocational Training (Berufsausbildung)

☐ Bachelor

☐ Master

☐ Doctorate

☐ Other: \_\_\_\_\_

*Figure 9 Question 4 Related to the Educational Qualification of the Respondent*

#### Data Analysis:

Educational Qualification data collected can have 2 primary functions. The first primary function is as a data filter. For example

- The respondent on providing the age as > 12 but educational qualification as Master then this data would not be considered on the basis of false negative data.
- The respondent on providing the age as > 27 but educational qualification as Primary school , then this data would be considered for the analyses on the basis of false positive data.

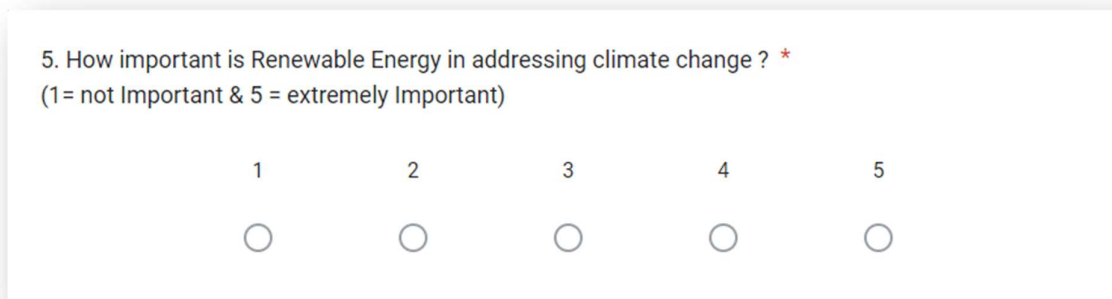
Thereby essentially filtering out unusable / incorrect data. This data will be represented in form of a pie chart.

The secondary function is to explore correlations between educational background and other variables such as attitudes towards ESG or investment behaviours using regression analysis, correlation matrices or ANOVA (Polyxeni Vassilikopoulou, Journal of Cleaner Production, 2018).

#### 4.2 Attitudes Towards Renewable Energy

The question under this chapter is primarily focused on the most important aspect of the study relating to the attitude of the respondents towards renewable energy.

##### Question 5:



5. How important is Renewable Energy in addressing climate change ? \*

(1= not Important & 5 = extremely Important)

1      2      3      4      5

☐    ☐    ☐    ☐    ☐

*Figure 10 Question 5 Respondent Mindset on the Link between Renewable Energy & Climate Change*

#### Data Analysis:

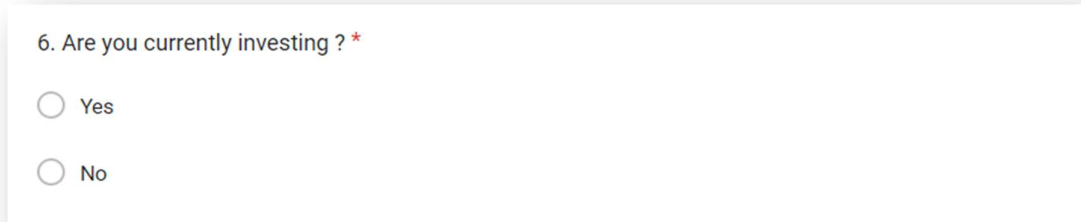
The information collected here is based on Likert scale of rating where 1 being not important and 5 being extremely important. This provides a measure of respondents attitude towards the importance of renewable energy in addressing climate change. This data can be used to gain insights into the overall perception towards renewable energy and by combining it with other variables, insights on other variables like demography, education or investment behaviour can be inferred.

A bar graph can be plotted here with the number of respondents at each rating to have an overview of the tendency. A correlation matrix would further enable to understand the relationship of this variable in relation to other variables.

### 4.3 Investment Preferences

The next set of 3 questions not only focus on inferring the investment preferences of the respondents but one of them also act as a data filter that can be used in addition to our previously used questions that were used to filter out the false negative data.

#### Question 6:



6. Are you currently investing ? \*

☐ Yes

☐ No

*Figure 11 Question 6 Current Investment Behaviour of the Respondent*

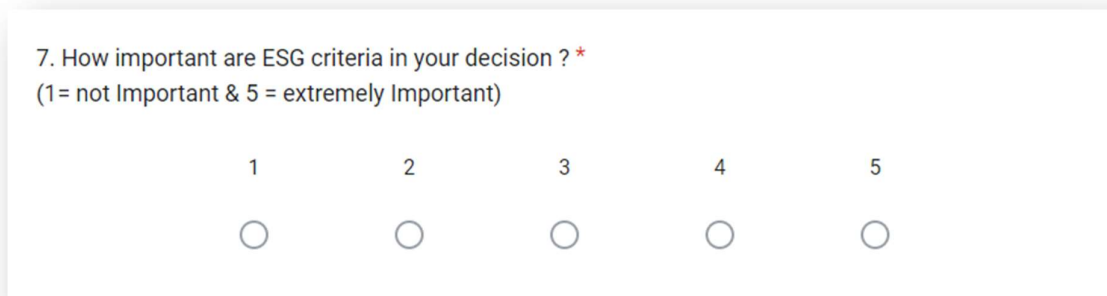
#### Data Analysis:

This question is primarily used as a filter to filter out false negative data. This information in combination with the information from question 2 related to the age can help in filtration of false date.

- The respondent on providing an age of > 12 but chooses ``Yes`` for investing currently can be considered as false negative data and be can filtered out. This is because the minimum legal age in Germany for undertaking financial transactions is 18.

There data is represented in a form of pie chart indicating current investors vs non investors.

#### Question 7:



7. How important are ESG criteria in your decision ? \*

(1= not Important & 5 = extremely Important)

|                       |                       |                       |                       |                       |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| 1                     | 2                     | 3                     | 4                     | 5                     |
| <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

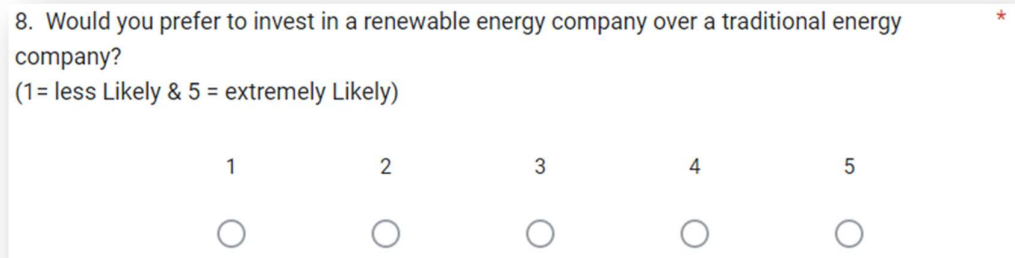
*Figure 12 Question 7 ESG Preference of Respondents*

#### Data Analysis:

The ESG preference of the respondents are provided also on a Lickert rating scale of 1 to 5. 1 being not important and 5 being extremely important decision criteria. The mean at each rating criteria could help to gauge the importance of ESG criteria in respondents' decision-making processes. This can be

represented in form of a box plot graph across states to provide a ESG preference on regional basis. In addition a correlation matrix of this information across other variables like age, preference, risk tolerance and acceptance to lower returns could provide insights on preferences towards ESG and help identify potential trends (Andreas Hoepner G., Journal of Risk Finance, 2017) .

**Question 8:**



8. Would you prefer to invest in a renewable energy company over a traditional energy company? \*

(1= less Likely & 5 = extremely Likely)

|                       |                       |                       |                       |                       |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| 1                     | 2                     | 3                     | 4                     | 5                     |
| <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

*Figure 13 Question 8 Preference of Renewable Energy Stocks vs Traditional Energy Stocks*

**Data Analysis:**

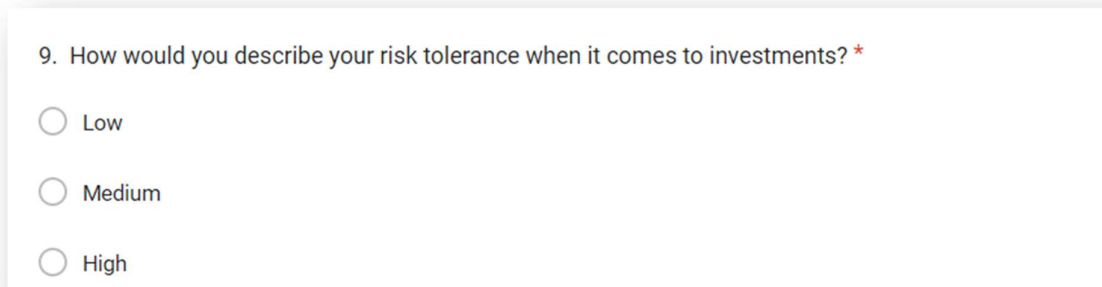
The preference of the respondent towards renewable energy stock over traditional energy stocks could be directly inferred here also using a Likert rating scale where, 1 being not important and 5 being extremely important. The number of respondents at each rating is represented as a bar graph.

Correlating this data available at hand can provide significant insights. Like in the previous case a correlation matrix could be handy for such comparisons. For example, it can be used to explore the relationship between this variable and the importance of ESG criteria (Rolf Wüstenhagen and Emanuela Menichetti, Strategic Choices for Renewable Energy Investment, 2012).

#### 4.4 Risk Tolerance

The next couple of questions help to provide insights into the risk taking appetite of the respondents.

**Question 9:**



9. How would you describe your risk tolerance when it comes to investments? \*

☐ Low

☐ Medium

☐ High

*Figure 14 Question 9 Respondent's Risk Appetit Level*



#### Data Analysis:

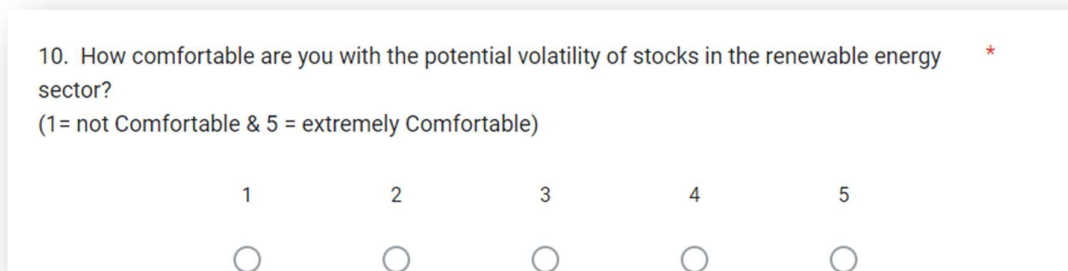
The observations from this response helps identify the risk appetite level of the respondents. The risk tolerance levels that the respondents could choose from include low, that can be represented as -1, medium, that can be represented as 0 and high that can be represented as 1. This helps in numerical calculations to derive at a relationship. This helps us to identify what type of investments are foreseen by the respondents. The data is represented in form of a pie chart.

Cross-tabulation of risk tolerance with investment behaviour and preferences for renewable energy investments to helps to identify potential patterns (Elke Weber U., Psychological Science, 2007).

As always, a cross tabulation across various German federal states provide information on the risk taking readiness across the spread across the 16 German federal states.

The comparison of risk tolerance and potential stock volatility can also be a useful comparison criteria.

#### Question 10:



10. How comfortable are you with the potential volatility of stocks in the renewable energy sector? \*

(1= not Comfortable & 5 = extremely Comfortable)

1 2 3 4 5

☐ ☐ ☐ ☐ ☐

*Figure 15 Question 10 Adaptability to Stock Volatility*

#### Data Analysis:

The ability of the respondents to adapt to the potential volatility of the renewable stocks is witnessed here. The Likert scale of rating is used here evaluate the adaptability of the respondents, here being 1 not comfortable and 5 being extremely comfortable. A correlation analysis of this data along with the risk tolerance can help validate the sample set. The mean calculated across various German federal states account for adaptability on a state wise scale.

A regression analysis can be used to determine if comfort with volatility predicts investment in renewable energy stocks (Richard Koestner, Journal of Consumer Research, 2013).

#### 4.5 Perceptions of Financial Returns

The final question here answers the perception of the respondents towards financial returns.

**Question 11:**

11. How likely are you to invest in renewable energy stocks if they offered lower returns than traditional energy stocks? \*

(1= Not important & 5 = extremely important)

|                       |                       |                       |                       |                       |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| 1                     | 2                     | 3                     | 4                     | 5                     |
| <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

*Figure 16 Question 11 Perception of Financial Returns of the Respondents*

**Data Analysis:**

The data from the respondents about their perception of financial returns are also collected using Likert's rating scale, where 1 represents highly unlikely and 5 represents extremely likely. This data helps to analyse the likelihood of investment in renewable energy despite lower returns using descriptive statistics. Correlating this likelihood with attitudes towards renewable energy and ESG criteria to explore how values influence investment decisions. Performing a regression analysis to assess whether the importance of ESG criteria and comfort with volatility predict this investment decision (Gunnar Friede, Timo Busch, and Alexander Bassen, Journal of Sustainable Finance & Investment, 2015).

## 5. Key Variables & Comparisons

### 5.1 Distribution of Survey Responses

The questionnaire was circulated via online platforms like Facebook, Instagram and What's app groups of educational institutions and universities that could help reach the target respondents. The aim was to collect a workable sample size of 800 inputs. The duration of the circulation was for a period of 8 weeks. During this period a total of 711 entries were collected. The information collected from each respondents under each question are as follows:

#### Question 1:

1. Which federal state of Germany do you currently reside in?

711 responses

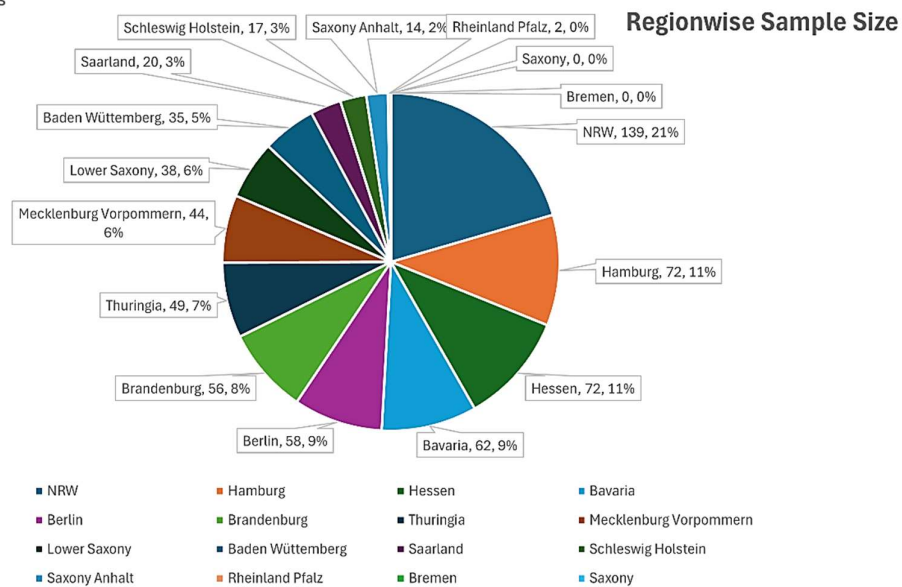


Figure 17 Pie Chart Indicating Location Spread of the Respondents

It can be seen that the respondents are majorly located from North Rhein Westphalia (NRW) with a sample size of 144, followed by Hessen and Hamburg with 77 each, Bavaria with 63, Brandenburg with 60 and Berlin with 69 taking the top 6 spots. The lowest sample size are Bremen with 0, Rheinland Pflaz with 3, Saxony with 14, Schleswig Holstein with 17, and Saarland with 20 taking the bottom spots. These states having low sample sizes might have too less data for certain considerations.

## Question 2:

### 2. Age

711 responses

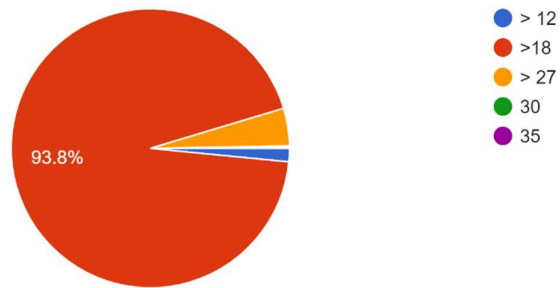


Figure 18 Pie Chart Showing Age Spread of the Respondents

The majority of the respondents (95.3%) out of the sample size of 711 respondents lie within the wished range of 12 to 27 years of age. The rest 4.7% of the respondents data that are not within the required range and will be filtered out. Cross tabulation of Age with education helps to eliminate false negative data.

## Question

3:

### 3. Gender

711 responses

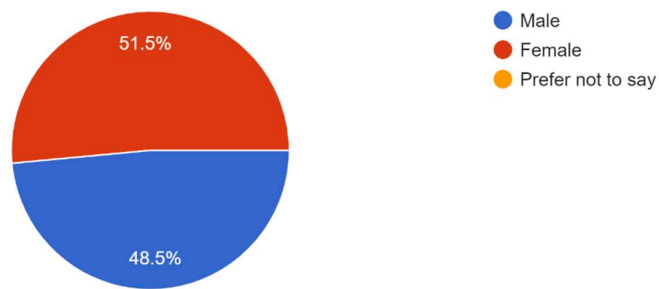


Figure 19 Pie Chart indicating Female & Male Respondents

It can be seen that the ratio of Female to Male respondents are almost equal. However, the statewise gender ratio could be analysed to see if there is preference or change in responses between male and female respondents if required.

## Question

4:

### 4. Educational Qualification

711 responses

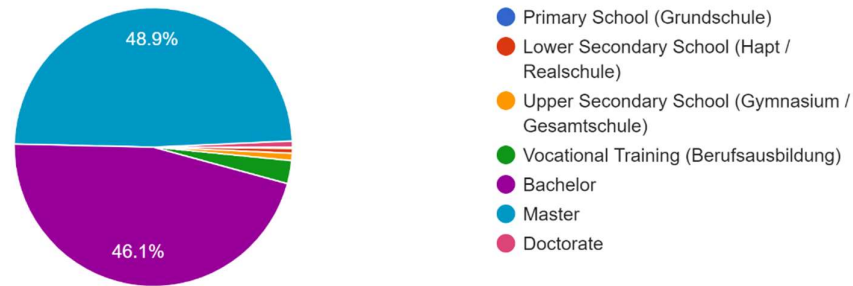


Figure 20 Pie Chart representing the Educational background of the Spread

This pie chart represents the educational background of the respondents. 49% of the respondents are Master Graduates, 46% of the respondents Bachelor Graduates. Thereby comprising 95% of the entire sample size. Therefore categorizing the data based only on Bachelor and Master spread would be possible if required. Further education based classification would not be required as the sample set with other qualifications are too small or not suitable.

## Question 5:

### 5. How important is Renewable Energy in addressing climate change ? (1= Not important & 5 = extremely important)

711 responses

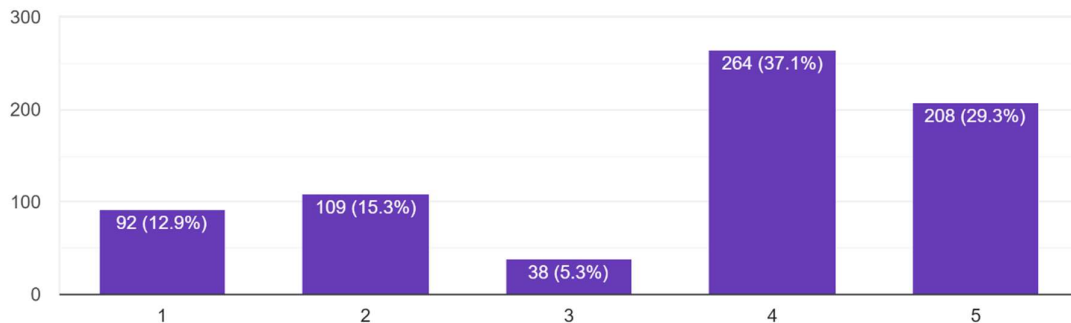


Figure 21 Bar Graph representing Respondent Attitudes

The bar graph indicates that 66.4% of the total respondents have rated 4 or 5 on Likert scale of rating inferring that renewable energy according to them plays a role in addressing climate change . It can be interesting to see it's correlation with other variables and parameters collected using a correlation matrix.

### Question 6:

6. Are you currently investing ?

711 responses

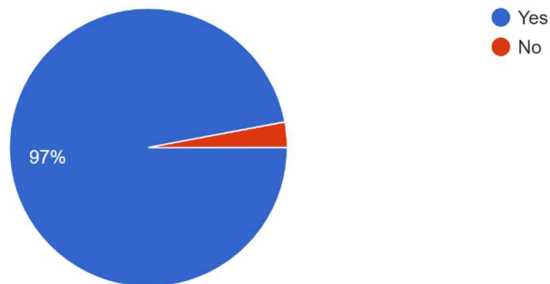


Figure 22 Pie Chart indicating Current Investors among Respondents

From the total 711 respondents, 97% of the respondents are currently investing and only 3% of the respondents are not investing currently. These responses from the respondents in correlation with Age is used to remove false negatives from the datasets.

### Question 7:

7. How important are ESG criteria in your decision ?

711 responses

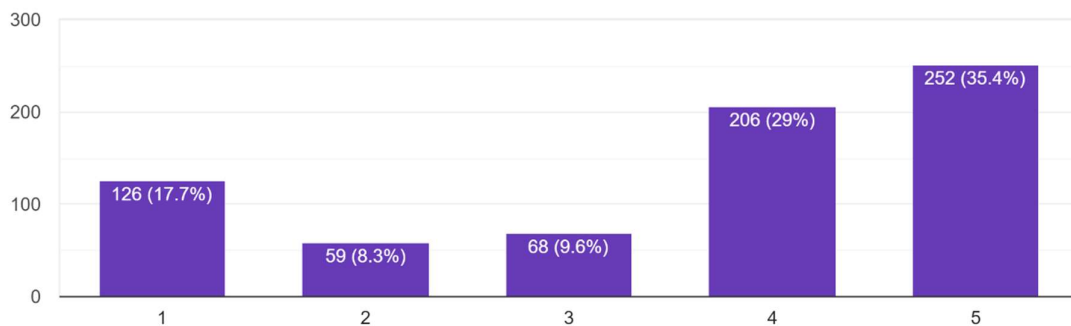


Figure 23 Bar Graph representing ESG preferences of Respondents

The ESG preferences of the respondents can be seen clearly on this bar graphs. It can be clearly seen here that 64,4% have rated either 4 or 5 on Likert scale of rating. This also corresponds to responses from the attitude of the respondents. A box plot graph across the German federal states and the correlation matrix with other variables will provide a deeper insight on ESG and its relationship to them.

### Question 8:

8. Would you prefer to invest in a renewable energy company over a traditional energy company?

711 responses

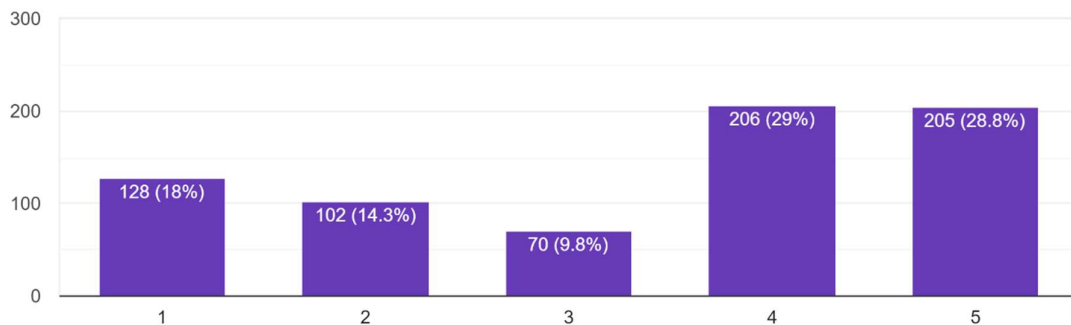


Figure 24 Bar Graph showing Investment Tendency towards Renewable Energy vs Traditional Energy

The bar graph represents respondent investment preference towards renewable energy over traditional energy companies. On a Likert scale of 1 to 5, 57.8% of the respondents have rated 4 or 5 (meaning they prefer to invest in renewable energy over traditional companies). When compared to the attitude of respondents towards renewable energy as a factor of climate change, there were about 66%, so this can roughly mean that for both cases, the number of respondents is almost the same, even though it is not the exact number. This shows that sample sizes in both cases are similar hence allowing a better analysis or comparison between them. But since the numbers do not exactly match, there may be minor changes in the outcomes due to difference in respondent count. between these two factors.

### Question 9:

9. How would you describe your risk tolerance when it comes to investments?

711 responses

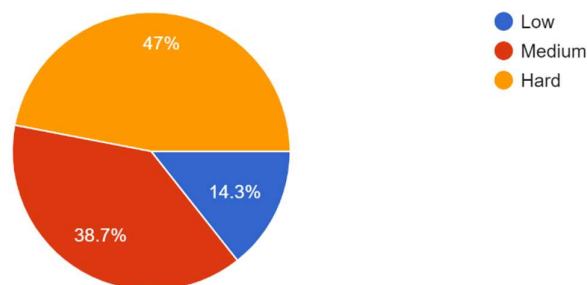


Figure 25 Pie Chart indicating Risk taking Appetite of Respondents

The pie chart indicates the risk appetite of respondents. It can be clearly seen that 47% of respondents are ready to take up high risks. 38.7% prefer medium risk while only 14.3% of respondents have a low risk preference. This data can be interpreted in 2 different ways. In general, higher ESG preference can mean, the respondents tend towards safer bets and hence low risk makes sense. As in this case, the respondents have chosen, higher ESG preferences as well as higher risk taking intentions. This can mean that they are ready to take on riskier bets based on ESG preferences. Here, ESG combined with adaptability to potential volatility can help validate the data.

### Question 10:

10. How comfortable are you with the potential volatility of stocks in the renewable energy sector?

711 responses

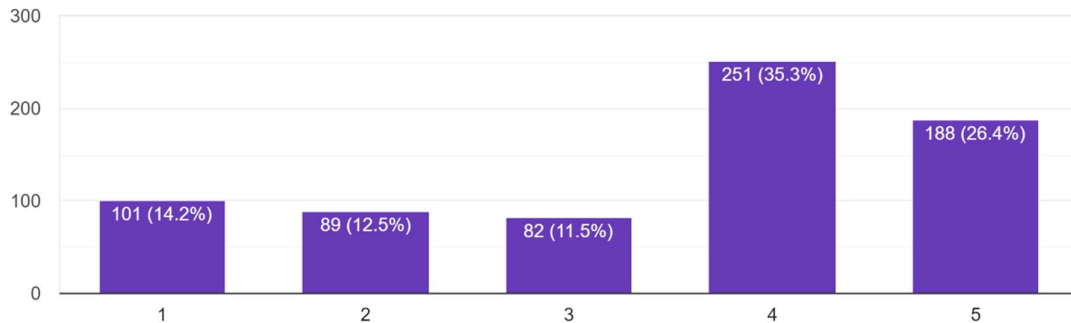


Figure 26 Bar Graph indicating Respondent's Risk Tolerance Level

In addition to the risk preferences of the respondents, the preferences to adaptability to potential volatility could indicate if the respondents have a clear view on their risk taking appetite. In addition, the comparison of this data could also help in data validation. A distribution of the data collected spread over the location of the data collection can give valuable insight into location wise risk taking appetite. A regression analysis of this parameter with the rest of the variables can help derive to a potential relationship between the various variables.

### Question 11:

11. How likely are you to invest in renewable energy stocks if they offered lower returns than traditional energy stocks?

711 responses

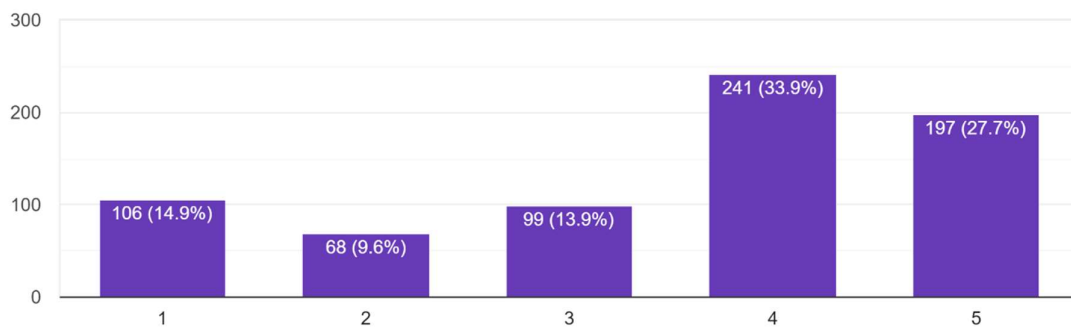


Figure 27 Bar Graph Representing the Perception of Financial Returns of the Respondents

The bar graph indicates the response from the respondents on their perception of their financial returns. The aim here is to find out if the respondent would still be interested in investing in renewable energy stocks even if they were giving lower yields compared to the traditional energy stocks. It was again based on Likert scale. 1 being less likely to invest and 5 being extremely likely to invest. It can be seen from the responses that 61.6% were ready to invest in renewable energy stocks even when the yield was lower than the traditional energy companies, here approximately 14% voted neither likely



nor unlikely. The remaining 24.6% were less likely to invest. Analysing this data with correlation matrix and performing a regression analysis will give further insights into the inter-dependencies.

## 5.2 Summary of Collected Data & Data Filtration

In summary, the questionnaire was distributed across various online platforms to gather insights from respondents regarding their demographics, attitudes, and behaviour related to renewable energy investments. With a sample size of 711 respondents, the data reveals key trends and preferences across different variables. The majority of respondents are from NRW, with the sample showing a balanced gender distribution and a predominant age range of 12 to 27 years. Educationally, the sample is largely composed of Bachelor and Master graduates.

After applying the necessary filters, the usable data set has been refined to include only respondents aged between 12 and 27 years, focusing on the Gen Z demographic. Additionally, respondents under the age of 18 who indicated that they are currently investing were removed, as the legal age for investing in Germany is 18. These filters were essential to eliminate false negatives and irrelevant data. Following this process, the usable data set now consists of 678 respondents. The gender ratio remains nearly unchanged, with an almost equal distribution of male and female participants, as observed before the filtering.

## 5.3 Comparison of Variables & Key Takeaways

The following comparisons are done using python programming via Visual Studio Code. Python is a versatile and powerful programming language that is famous for its simple and readable codes. This programming language has dynamic typing and an ecosystem with many libraries like NumPy and pandas, enabling it to serve as a tool for data processing. Python makes comparing variables easier, even for beginners given its simple syntax style. The existence of good resources within the developer's community enhances this language's usability.

Visual studio code (VS Code) is a lightweight but powerful code editor widely employed in Python development. Notably, it includes an integrated debugger and supports extension as well as seamlessly integrating into version control operations. Additionally, VS Code offers extended functionality through Python extension like linting and variable inspection capabilities coupled with debugging tools that allow for proper comparison of variables in Python among others tasks. Its popularity among developers lies in its cross-platform compatibility and ease of use even in writing small scripts or handling big jobs.

In each case the program used have been attached to the appendix for further details.

### 5.3.1 Location wise Attitude towards Renewable Energy & impact on Climate Change

The stacked bar chart presents the distribution of respondents' attitudes towards the importance of renewable energy in addressing climate change, segmented by location. The Y-axis represents the German federal states, while the X-axis indicates the number of respondents from each location. The legend depicts the Likert scale ratings (from 1 to 5) used to measure the perceived importance of renewable energy, with "1" indicating the lowest importance (light blue) and "5" the highest (intense orange). The intensity of the colours correlates with higher ratings.

#### Key Takeaways:

- NRW: This region has the highest number of respondents, with a significant majority rating the importance of renewable energy as "4" or "5" on the Likert scale. This indicates a strong consensus among respondents from this area regarding the critical role of renewable energy in addressing climate change.
- Hessen and Hamburg: Both states demonstrate similar distribution patterns, with an emphasis on higher ratings (4 and 5). These regions also contribute a moderate number of respondents, further supporting the notion of strong regional support for renewable energy.
- Berlin and Bavaria: Respondents from these locations also show a tendency towards higher ratings, though the distribution is slightly more even across the rating scale. This suggests that while there is substantial support for renewable energy, there is a broader range of opinions within these states.
- Lower Saxony, Mecklenburg-Vorpommern, Brandenburg, and Bremen: These states have respondents with ratings leaning towards lower side. The distribution is concentrated in the middle to low, indicating a more lesser perspective on the role of renewable energy in climate change mitigation.
- Rhineland-Palatinate, Saarland, Saxony-Anhalt, Schleswig-Holstein, and Thuringia: Most of these regions have the smallest number of respondents except Thuringia but they all have data with a more dispersed distribution across levels. The broader distribution of responses in these states may reflect a more scarce range of opinions, might also be potentially influenced by the smaller sample sizes except Thuringia .

#### Summary:

The whole thing portrays a positive trend across the data that is obvious in most of the answers provided by a majority of respondents. However, regional differences manifest as NRW, Hessen and Hamburg show stronger and more uniform consensus on importance of renewable energy. In contrast Mecklenburg-Vorpommern, Lower Saxony, Brandenburg, Thüringen and Saarland indicate otherwise.

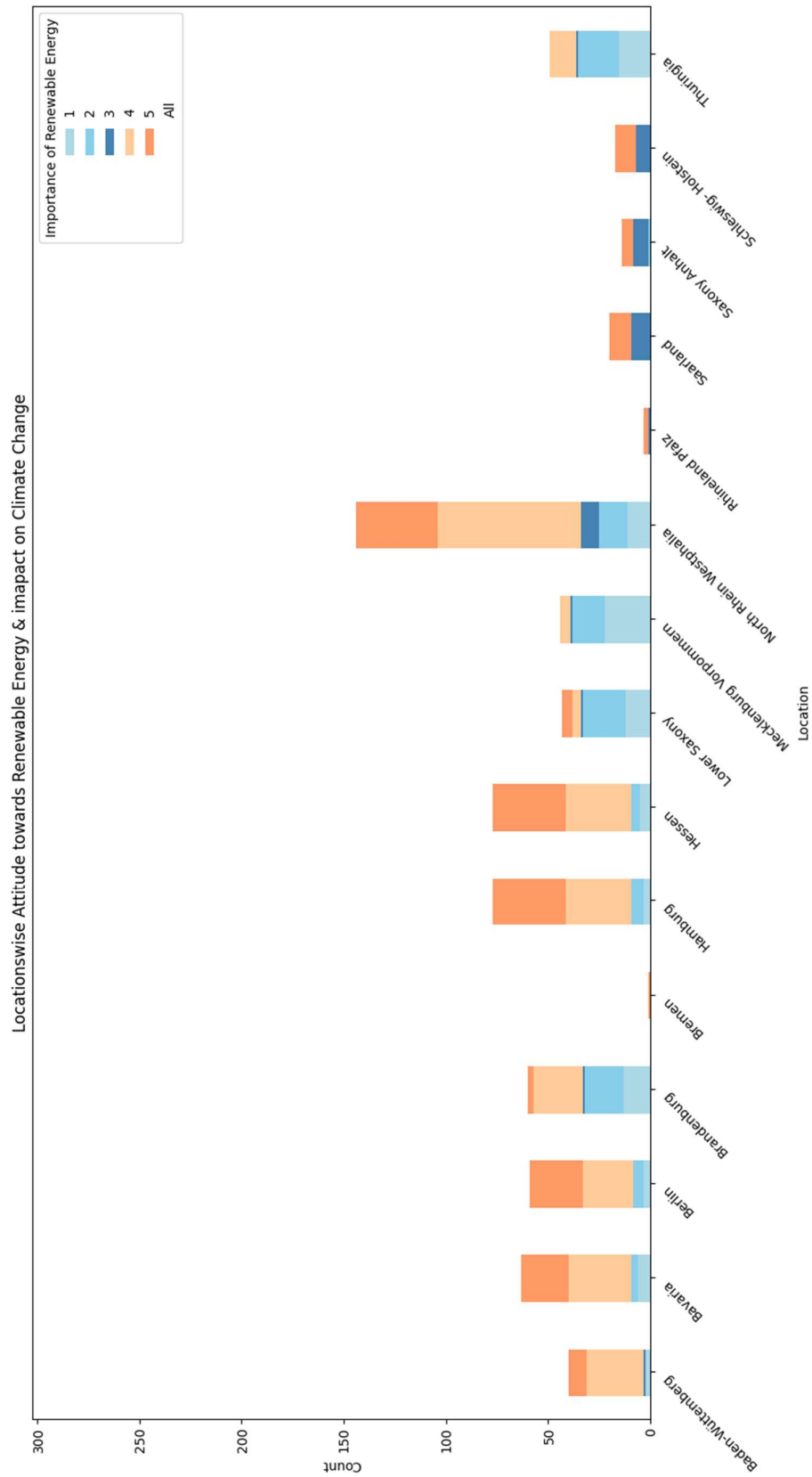


Figure 28 Location wise Attitude towards Renewable Energy & impact on Climate Change

### 5.3.2 Comparison of Geographical Trends in ESG Preferences

The box plot graph shown compares ESG preferences given by respondents from different German states. The states are listed on the Y-axis and the ESG preferences are represented on the X-axis from scale of 1 to 5, where 1 indicates least preference and 5 indicates highest preference. The boxes in the box plots contain vital statistical markers such as interquartile range (IQR), median, and potential outliers.

#### Key Takeaways:

- NRW, Hessen, Hamburg, Berlin, Bavaria; Baden-Württemberg: These regions exhibit a narrower grouping together of ESG scores compared to others because they have shorter boxes which implies less variability from respondent perceptions. Generally speaking these regions tend to have higher median score signifying that there could be higher convergence towards positive ESG factors in these areas. Smaller IQRs and fewer/no outliers imply common opinions among respondents in the states on ESG, which could indicate more established regional policies or cultural views of ESG issues.
- Mecklenburg-Vorpommern, Lower Saxony: Their medians are well placed towards the upper end of the scale even with their relatively wide distribution of scores. The presence of both positive skew (where majority lower but few much higher) and negative skew (the opposite) show that regional perspectives on ESG might be affected by local economic, cultural or environmental factors.
- Schleswig-Holstein, Saxony Anhalt and Saarland: These states have large spreads of ESG score distributions, suggesting that their respondents have varying views on ESG factors but mostly their scores were averaging around 3.0 or below. This meant even though there is a wide IQR with boxes extending both ways indicating significant variance in regards to perception of importance accorded to ESG within its borders its mostly tending towards the lower levels.
- Thuringia and Brandenburg: They have the highest variability in their ESG scores as seen from the big box plot which almost spans across the entire scale. The high IQR value indicates that there is no consensus among survey participants concerning ESG. This may be explained by different levels of awareness about ESG topics or variation in socio-economic aspects within the region. Some participants assigned a large importance to ESG factors while others did not, meaning they are divided between those who care for ESG and those who do not.

#### Summary:

A box plot analysis of ESG scores for various German federal states revealed considerable geographical diversity with regards to ESG factors. NRW, Hessen and Hamburg had higher medians indicating greater agreement. On the other hand, Mecklenburg-Vorpommern, Lower Saxony, Schleswig-Holstein, Saxony Anhalt and Saarland were characterized by distributions concentrated on the lower levels. The diverse spreads imply multiplicity and sometimes even opposition of views reflected in their responses to key questions on this topic.

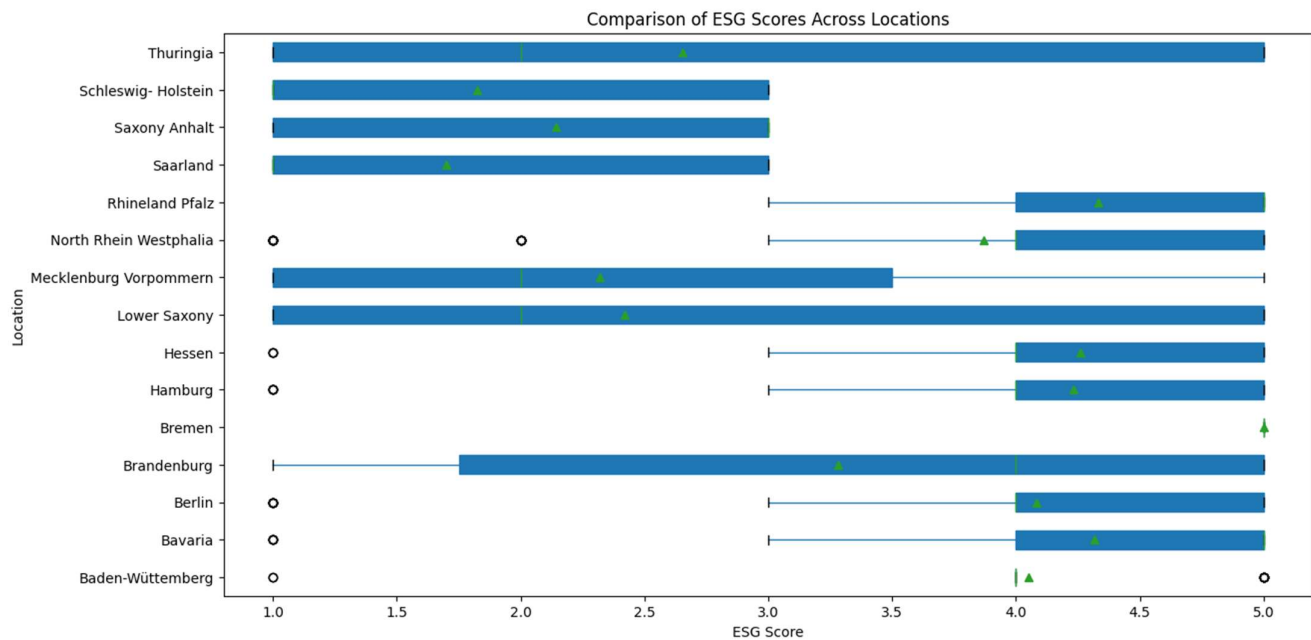


Figure 29 Comparison of ESG Scores Across Locations

### 5.3.3 Comparison of Risk Tolerance across Locations

The stacked bar chart gives a visual representation of the distribution of risk tolerance across German federal states. The federal states are listed on Y-axis while the X-axis represents the number of respondents. The legend categorizes risk tolerance into three levels: low (-1), medium (0), and high (1), each represented by distinct colours.

#### Key Takeaways:

- NRW, Hamburg, Hessen, Bavaria and Berlin: NRW has highest number of respondents, with significant diversity in riskiness. While most show low risk preference as indicated by light blue portions; however, a considerable segment shows high willingness to take risks as indicated by dark green colour while some show moderate level of tolerance as shown by orange shade. By this distribution, it means that such a population has different approaches towards danger with many willing to bear higher risks. Whereas Hessen and Hamburg have a similar dominance of low-risk takers but also contain substantial numbers having high-risk appetite just like NRW. These categories indicate that although majority are risk-averse there still exist significant proportion who can engage in risky investments or activities. Bavaria and Berlin also exhibit wide range of acceptance for taking risks albeit with fewer respondents compared to NRW. Even though most people have little appetite for risk in these areas, however, sizeable proportions embrace it indicating that attitudes towards danger are more polarised among them.
- Mecklenburg-Vorpommern, Lower Saxony,: In these areas there is equal distribution between low and high-risk groups though mostly they have less appetite for danger than other German federal states do. This equilibrium points at average approach to hazards amongst interviewed persons from those states.
- Baden-Württemberg, Brandenburg, and Thuringia: Baden-Württemberg and Thuringia have majority of people with low willingness to take risks and the rest with medium and high-risk.

However, Brandenburg has a fair distribution between low and medium risk tolerance. Indicating a general tendency in these states to have little to no risk taking interest.

- Schleswig-Holstein, Saxony-Anhalt, Saarland and Rhineland-Palatinate: The number of respondents from these regions is lowest. Majority of them are not willing to take higher risks. Their medium and high-risk propensity is hardly seen showing that those areas are generally afraid of any kind of risks.

#### Summary:

In Germany, NRW has an outstanding position with the high number of respondents and a diverse range of risk preferences not only because of its higher sample size but also in comparison. While most respondents in NRW, Hessen, and Hamburg chose high risk, indicating that the respondents are willing to take higher risks. Bavaria and Berlin showed polarized attitudes toward risk, though with fewer respondents compared to NRW. In contrast, Mecklenburg-Vorpommern and Lower Saxony display an even distribution between low and high-risk groups, indicating an average approach to risk. Baden-Württemberg, Thuringia, and Brandenburg generally lean toward low risk-taking, with Brandenburg showing a fair distribution between low and medium risk tolerance. Finally, Schleswig-Holstein, Saxony-Anhalt, Saarland, and Rhineland-Palatinate have the fewest respondents, predominantly risk-averse, with minimal interest in high-risk activities.

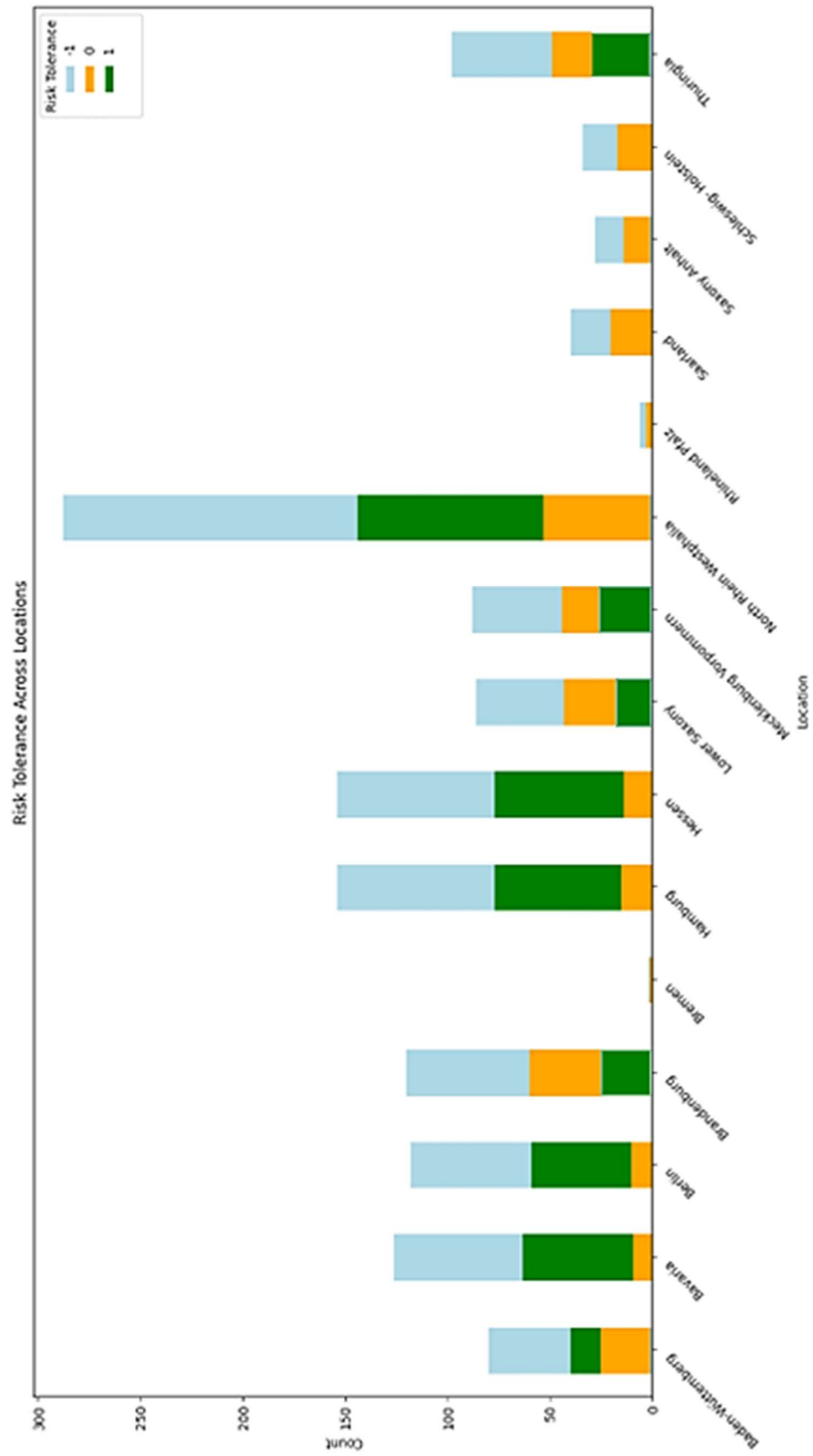


Figure 30 Risk Tolerance Across Locations

#### 5.3.4 Relationship between Investor Preference and Acceptance of Lower Returns

The graph shown represents a bar chart of correlation coefficient between investment preference and acceptance of lower returns across various German federal states. The Y-axis shows the correlation coefficient which ranges from -1 to 1, with 1 as a perfect positive correlation, -1 as a perfect negative correlation while 0 indicates no correlation at all. On the X axis are different locations (states).

##### Key Takeaways:

- **Positive Correlations (Above 0):** Bavaria, Berlin, Hamburg, Hessen, NRW and Rhineland-Palatinate have strong positive correlations with coefficients either close to or above 0.75. This may suggest that in these states respondents' preference for investing in certain assets such as possibly renewable energy is also associated with being willing to possess less financial return on their investments done in these areas. This means that ethical considerations dominate over desire for money at such places.
- **Moderate to Low Positive Correlations (Between 0 and 0.5):** There are also moderately strong positive correlations in Brandenburg, Saxony Anhalt, Thuringia, Lower Saxony and Mecklenburg-Vorpommern implying that there is some relationship between investment preference and acceptance of lower returns. However it's not as pronounced compared to other states. Even though residents might be prepared to sacrifice some return on their investments financial gain still remains a determinative factor in these regions.
- **Negative Correlations (Below 0):** Baden-Württemberg, Saarland and Schleswig-Holstein have negative coefficient. For instance it can be stated that individuals who value investment preferences more like having them on socially responsible assets such as renewable energy sources tend to be unwilling to accept lower financial returns in these states. Here, financial performance might be a more significant factor in investment decisions, potentially outweighing ethical or environmental considerations.

##### Summary:

The analysis of correlation coefficients between investment preferences and the acceptance of lower returns reveals significant regional variation across Germany. Bavaria, Berlin, Hamburg, Hessen, and NRW have a strong positive relationships and we can see that people here tend to accept lower returns in favour of environmentally conscious or ethical grounds.

By contrast, Baden-Württemberg, Saxony-Anhalt, Brandenburg, Saxony Anhalt, Thuringia, Lower Saxony and Mecklenburg-Vorpommern exhibit negative or near-zero correlations indicating high emphasis on financial gains.



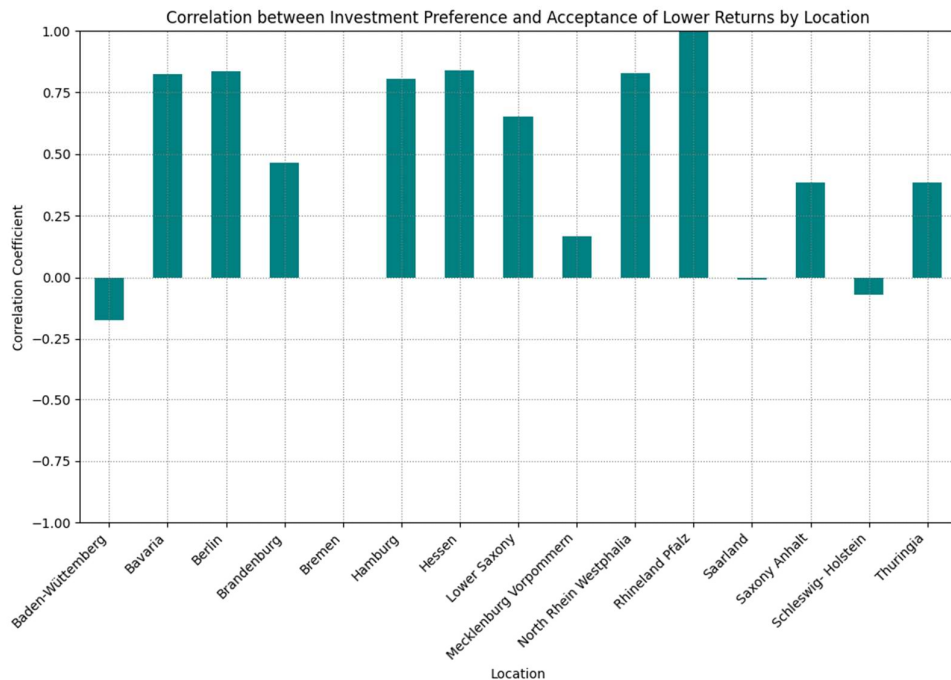


Figure 31 Correlation b/w Investment preference & Acceptance of Lower Returns on Regional Basis

### 5.3.5 Comparison of Risk Tolerance and Comfort in Stock Volatility

The stacked bar chart generated demonstrates the relationship between respondents' risk tolerance and their comfort with stock volatility. The X-axis represents how comfortable or uncomfortable the respondents are with stock fluctuations, on a Likert scale ranging from 1 (least comfortable) to 5 (most comfortable). On the other hand, the Y-axis represents count of respondents for each level. Different colours within each bar correspond to different levels of risk tolerance in terms of low (-1) in light blue, medium (0) in orange, and high (1) in light green.

#### Key Takeaways:

- **Comfort Levels 1 to 3:** The total count under 1, 2 and 3 comfort levels are almost equal at almost 100 respondents. Light blue and orange have slightly more people than other groups at low and average risks. This shows that those who do not want to take much risk are also less comfortable with stock price volatility. Fewer individuals in green category means people in this group are either moderately tolerant or very much averse towards taking too much risk.
- **Comfort Level 4:** The volume changes significantly for comfort level four resulting in more individuals having a greater probability of accepting higher risks such as high risk takers – green. This suggests that there is an increase in willingness to exhibit high risks among respondents as they become accustomed with market turbulence. A large amount of medium risk-tolerant people (orange) implies that even though such persons are becoming more relaxed about stocks than others, they still represent mixed profiles.

- Comfort Level 5: Most respondents here have a higher propensity for taking chances compared to any other group, which indicates that as their comfort levels rise, so does their readiness to embrace more danger. Generally speaking, most subjects who feel highly safe when it comes down to stock price fluctuations belong to this category suggesting strong positive correlation between restiveness and being open-minded. In particular, nearly all those feeling quite comfortable towards turbulent changes belong to the high risk takers, which are people who are likely to engage in instruments that can fluctuate significantly.

Summary:

The graph analysis clearly shows that respondents' comfort level with stock volatility is related to their risk tolerance. Respondents with lower or moderate risk tolerance (comfort levels 1-3) tend to dislike volatility and prefer more stable investments. Risk attitudes shift toward a greater willingness to take risks as subjects become comfortable with market turbulence (comfort levels 4-5). This clearly indicates a positive correlation among the data collected from the respondents.

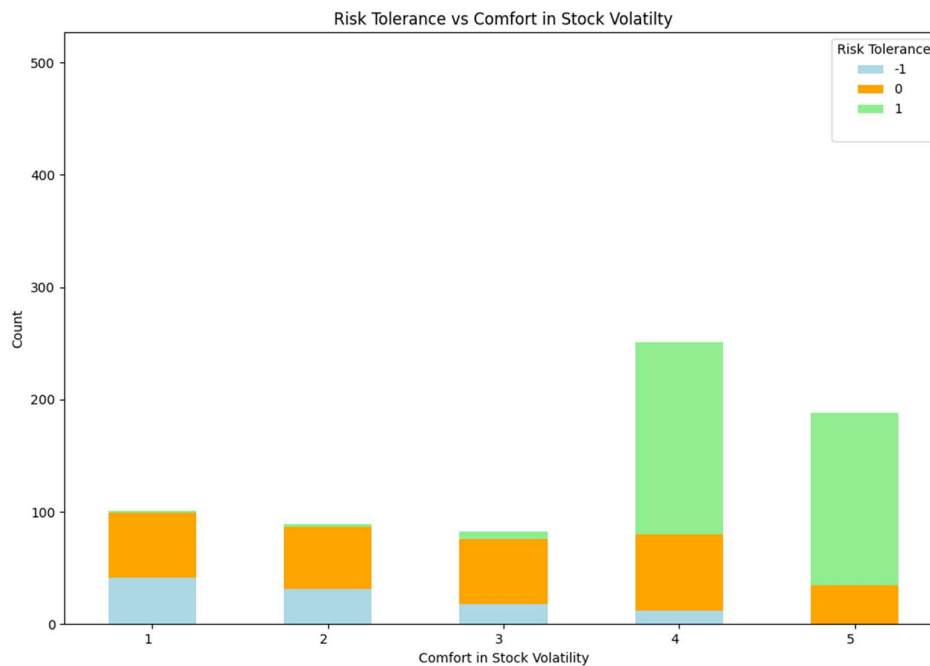


Figure 32 Risk Tolerance vs Acceptance to Stock Volatility

## 6. Empirical Analysis

### 6.1 Correlation Analysis

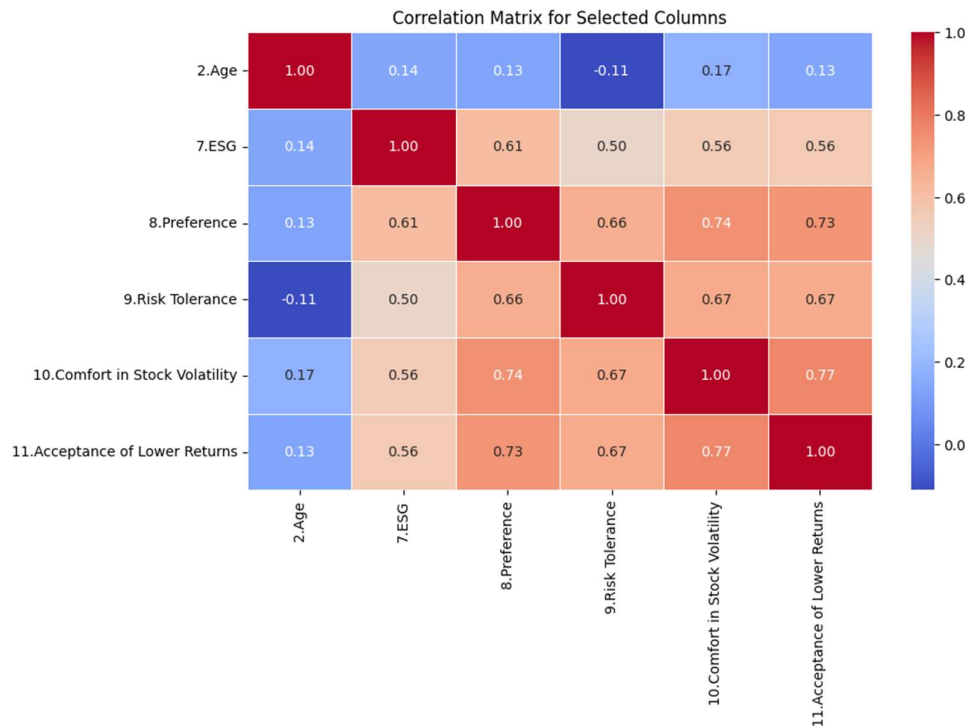


Figure 33 Spearman Correlation Matrix generated using Python

The Spearman correlation matrix is used as a tool to understand how ordinal variables like age, ESG preference, preference for renewable energy investments over traditional energy investments, risk tolerance, comfort in stock volatility, and acceptance of lower returns relate to one another. The matrix uses a colour scale where darker reds indicate stronger positive correlations and darker blues indicate stronger negative correlations.

#### Takeaways:

1. **Age and Other Variables ( $r = \text{low to moderate}$ ):** The correlations involving age is weak (ranging from 0.11 to 0.14), suggesting that age does not strongly influence the other factors like ESG preferences, risk tolerance, or comfort with volatility in this sample. This implies that attitudes towards these investment factors are more influenced by individual values and beliefs rather than age, at least based on the data collected within the scope of this study where the age is broadly divided into 2 categories. The 1<sup>st</sup> category includes respondents between 12 to 18 years of age and the 2<sup>nd</sup> category includes respondents between 18 and 27 years of age.
2. **ESG Importance and Preference for Renewable Energy Investments ( $r = 0.61$ ):** There is a strong positive correlation between the importance placed on ESG criteria and the preference for investing in renewable energy companies. This suggests that respondents who value ESG criteria are more likely to favour renewable energy investments over traditional energy companies. This relationship is significant and can imply that environmental and social

governance scores heavily influence investment choices within this demographic. This can also mean that the respondents believe that the ESG score and renewable energy stocks are inter related, which in turn can also indicate a knowledge gap.

3. **ESG Importance and Risk Tolerance ( $r = 0.50$ ):** Risk tolerance is higher among individuals who value ESG concerns, implying that a number of people who focus on the environment, social and governance are also likely to take more risks. This in turn could imply that investors with an appetite for sustainable investments through considering governance and other sustainability factors might comprehend these risks but still be willing to take them since they expect the investments to bear positive fruits over time.
4. **Preference for Renewable Energy Investments and Comfort in Stock Volatility ( $r = 0.74$ ):** There is a very strong positive correlation between the preference for renewable energy investments and comfort with stock volatility. This relationship indicates that individuals who prefer investing in renewable energy stocks are generally more comfortable with the volatility that such investments might bring in. This finding is significant as it suggests that confidence in renewable energy investments may be linked to a higher tolerance for market volatility.
5. **Preference for Renewable Energy Investments and Acceptance of Lower Returns ( $r = 0.73$ ):** There is a strong positive correlation between the preference for renewable energy investments and the acceptance of lower returns. This suggests that individuals who prefer renewable energy investments are more likely to be willing to accept lower returns, possibly because they value the ethical or environmental benefits of these investments over the financial returns.
6. **Comfort in Stock Volatility and Risk Tolerance ( $r = 0.67$ ):** There is a strong positive correlation between comfort in stock volatility and risk tolerance. This indicates that individuals who are more tolerant of risk are also more comfortable with the inherent volatility of stocks. This alignment is crucial because it suggests that those who identify as risk-tolerant are psychologically prepared to handle the market fluctuations, which is a critical factor for sustainable investment behaviour in volatile sectors like renewable energy.
7. **Acceptance of Lower Returns and Comfort in Stock Volatility ( $r = 0.77$ ):** The strongest correlation in the matrix is between the acceptance of lower returns and comfort in stock volatility. This suggests that those who are comfortable with the ups and downs of the stock market are also more likely to accept lower returns on their investments. This relationship could be due to a long-term investment perspective where investors prioritize sustainability and ethical considerations over immediate financial gains.

These correlations coefficients provide valuable insights for understanding the behavioural patterns of investors, particularly within Generation Z in Germany. The findings highlight the importance of ESG criteria and the psychological readiness to handle volatility as key factors influencing investment decisions in renewable energy. These results can be used to support discussions on the growing importance of sustainable investments and the factors that drive investment behaviour in emerging sectors. The strong correlations between comfort in stock volatility and both risk tolerance and acceptance of lower returns suggest that psychological factors play a significant role in shaping sustainable investment decisions.

## 6.2 Ordered Probit Regression

### 6.2.1 Introduction to the Model

An ordered probit regression model is a type of regression model used as a tool when the dependent variable has an order but the intervals between the categories need not necessarily be equal. This is mainly used when the outcome variable is not numeric and is rather a range. For example, where an outcome variable is a range between 1 to 5 rather than being numeric with equal weightage between them.

The regression model in this thesis would aim to understand how the attitudes towards renewable energy (the main independent variable) influence investment decisions in the alternative energy sector (the dependent variable), while controlling for other factors that may also affect investment decisions.

The ordinal outcome  $Y$  which would indicate the preference level for renewable energy depends on where the latent variable  $Y'$  falls relative to the threshold values. Here's how the regression model is structured:

Regression Model Equation:

$$Y' = \beta_0 + \beta_1 Location + \beta_2 Age + \beta_3 Gender + \beta_4 Attitude\ towards\ Renewable\ Energy \\ + \beta_5 Current\ Investor + \beta_6 ESG\ Preference + \beta_7 Risk\ Tolerance \\ + \beta_8 Comfort\ in\ Stock\ Volatility + \beta_9 Acceptance\ of\ Lower\ Returns + \epsilon$$

Where,

$Y'$  = Latent variable representing the underlying propensity to prefer renewable energy investments.

$\beta_0$  = Intercept constant.

$\beta_1 Location$  = Coefficient for the location variable, indicating regional influence.

$\beta_2 Age$  = Coefficient for age, showing age preference.

$\beta_3 Gender$  = Coefficient for gender, reflecting gender preference.

$\beta_4 Attitude\ towards\ Renewable\ Energy$  = Coefficient indicating the importance placed on renewable energy.

$\beta_5 Current\ Investor$  = Coefficient indicating if respondent is currently an investor.

$\beta_6 ESG\ Preference$  = Coefficient for the importance placed on ESG criteria in investment decisions.

$\beta_7 Risk\ Tolerance$  = Coefficient for risk tolerance.

$\beta_8 Comfort\ in\ Stock\ Volatility$  = Coefficient representing the readiness in absorb stock volatility.

$\beta_9 Acceptance\ of\ Lower\ Returns$  = Coefficient indicating the acceptance of lower financial returns for investments aligned with sustainability goals.

$\epsilon$  = Error term

## 6.2.2 Explanation of the Variables

### **Dependent Variable: Preference for Investing in Renewable Energy Companies**

- Variable: Response from question 8. Would you prefer to invest in a renewable energy company over a traditional energy company?
- Variable Type: The dependent variable is an ordered categorical variable measuring the preference of the respondent's for investing in renewable energy companies over traditional energy companies. It is measured on Likert scale as mentioned before where, 1 indicates very unlikely and 5 indicates extremely likely investment.
- Interpretation: This model estimates how different factors (independent and control variables) influence the likelihood of respondents towards preferring renewable energy investments.

### **Main Independent Variable: Importance towards Renewable Energy**

- Variable: Response from the question 5. How important is Renewable Energy in addressing climate change ?
- Variable Type: The main independent variable is also an ordered categorical variable measuring the attitude of the respondent's towards renewable energy and its impact on climate change. It is also measured on Likert scale as mentioned before where, 1 indicates no importance and 5 indicates extremely important.
- Interpretation: This would estimate if the respondents who consider renewable energy important would more likely prefer investing in renewable energy or not.

Research has found that factors such as people's concern of sustainability and climate change have an impact on their financial behaviour, especially if it regards renewable energy sources. For instance, Wüstenhagen and Menichetti (2012) claim that individuals' views on some environmental problems act as a foundation for the investments they hold or want to have, predominantly in the areas which are important for the growth of the green economy, such as renewable energy.

### **Control Variables: Location, Age, Gender, Current Investor, ESG Preference, Risk Tolerance, Comfort in Stock Volatility and Acceptance of Lower Returns**

Several control variables are included in the model to account for factors that might influence the investment preference.

#### **Location**

- Variable: Response from the question 1. Which federal state of Germany do you currently reside in ?
- Variable Type: The input of this control variable here is an option from the multiple choices having 16 German federal states as options. These options are then converted into numerical values so that they can be used in the ordered probit regression modelling.
- Interpretation: This would reflect regional differences in exposure to renewable energy or their economic conditions

Studies have shown evidence that geographies can impact investment preferences, in part, due to the differing level of renewable energy assets, laws and investment scope. For example, Raimi and Aldana (2022) illustrate how areas with high levels of renewable energy infrastructure tend to be more attractive to investments in renewable energy sectors. Likewise, Bergmann et al. (2008) observed that the public attitude towards funding the renewable energy projects also differs a lot in various regions, which is often influenced by the amount of renewable energy available in those regions.

## **Age**

- Variable: Response from the question 2. Age
- Variable Type: The control variable here is an option between above 12 years, above 18 years or above 27 years of age.
- Interpretation: This would reflect age wise preference to renewable energy. As age is not a numeric input variable and rather a range, the usable categories here are 2 categories. The 1<sup>st</sup> category includes respondents between 12 to 18 years of age and the 2<sup>nd</sup> category includes respondents between 18 and 27 years of age.

According to the research, older investors often concentrate on investments that yield low risk, and these investors can also invest in renewable energy as they view sustainable industries in the future; hence the investments are long term. Poterba and Samwick (2001) found that the older population outweighs the risk of financial investments in pursuance of more profitable returns from investments that pay off in many years like renewable energy. Research by Warren (2019) supports that many Boomers these days are increasingly concerned with the idea of leaving the planet more ecologically balanced than it was when they arrive, which may facilitate a shift towards a higher renewable energy investment.

In this case as we focus on Gen Z, it would be interesting to observe how the 2 different categories of Gen Z's of Germany in this study would fare relative to the previous researches.

## **Gender**

- Variable: Response from the question 3. Gender
- Variable Type: The control variable here an option between either Male, Female or Prefer not to say
- Interpretation: This would reflect gender wise preference to renewable energy.

Many scholars, particularly in the studies relating to socially responsible and sustainable investments, have addressed the issue of gender in investing. Some research, such as the one conducted by Halko (2012), claims that women tend to be more cautious and support social investments more than men. On the contrary, some studies show that gender differences may not yield as much difference in sustainable investment. This is because Benson and Humphrey (2008) observed, there is a view that women are more socially responsible investors than men, but gender can hardly affect investment decision making in reality.

## **Current Investor**

- Variable: Response from the question 6. Are you currently investing ?
- Variable Type: The control variable is a choice between Yes or No
- Interpretation: This would reflect if the preference of current investors towards renewable energy or not.

Those who have currently invested might be more risk-seeking than the rest of the individuals. Studies indicate that an experienced investor may also be more risk-averse if these investments are focused on financial returns rather than on potential returns from environmental investment. Also, Guiso et al. (2018) also demonstrated that an invested investor's concern over unstable industries is particularly pronounced; to the level that short-term profits become the goals.

### **ESG Preference**

- Variable: Response from the question 7. How important are ESG criteria in your decision ?
- Variable Type: The control variable is an ordered categorical variable measuring the ESG preference of the respondent's towards renewable energy. It is measured on Likert where, 1 indicates no importance and 5 indicates extremely important.
- Interpretation: This interprets whether individuals who prioritize environmental, social, and governance factors are more inclined to invest in renewable energy companies or not.

Researches in this aspect done by Friede (2015), show that socially responsible investing is increasingly tied to environmental and governance concerns.

### **Risk Tolerance**

- Variable: Response from the question 9. How would you describe your risk tolerance when it comes to investments?
- Variable Type: The control variable here is obtained between options of low, medium or hard which are then converted into numeric values of -1, 0 and 1 where -1 represents low tolerance, 0 represents medium tolerance and 1 represents high tolerance.
- Interpretation: This interprets how risk tolerance preference would affect the investments in renewable energy companies.

Literature related to risk perception and investment towards renewable energy market in Germany by Masini and Menichetti (2013) and research by Hoppmann, Peters, and Schneider (2013) show that there is a significant relationship between risk tolerance associated with solar energy investments thereby making risk tolerance an important variable when evaluating preference in Gen Z's preference towards renewable energy investments.

### **Comfort in Stock Volatility**

- Variable: Response from the question 10. How comfortable are you with the potential volatility of stocks in the renewable energy sector?
- Variable Type: The control variable here is again an ordered categorical variable measuring the comfort in stock volatility of the respondent's towards renewable energy. It is measured on Likert where, 1 indicates not comfortable and 5 indicates extremely comfortable.
- Interpretation: This interprets how comfort in stock volatility would reflect to the investments in renewable energy companies.

Works by Bollen (2007) and Sadorsky (2012) show the importance between comfort in stock volatility and preference towards investments in renewable energy.

### **Acceptance of Lower Returns**

- Variable: Response from the question 11. How likely are you to invest in renewable energy stocks if they offered lower returns than traditional energy stocks?
- Variable Type: The control variable here is again an ordered categorical variable measuring the importance towards monetary returns on stocks of the respondent's towards renewable energy. It is measured on Likert where, 1 indicates not important and 5 indicates extremely important.
- Interpretation: This interprets the perception of financial return of Gen Z.

Works by Bollen (2007) here again show the importance of computing the relation between perceived returns and preference towards investments of individuals.



### 6.2.3 Interpretation of the Ordered Probit Regression Model

In an ordered probit regression analysis the coefficient is a number that represents the association between the independent and dependent variables. If this coefficient is positive, then it means as the independent variable increases, preferences for investments in renewable energies goes up. A negative coefficient indicates that as independent variable increases the preference towards renewable energy decreases.

| Variable                       | Coefficient (Standard Error) |
|--------------------------------|------------------------------|
| Location                       | -0.0553 ***<br>(0.011)       |
| Age                            | 0.0865 ***<br>(0.026)        |
| Gender                         | 0.0935 *<br>(0.095)          |
| Importance of Renewable Energy | 0.0855 *<br>(0.049)          |
| Current Investor               | -0.5868 **<br>(0.262)        |
| ESG Importance                 | 0.2572 ***<br>(0.039)        |
| Risk Tolerance                 | 0.2035 **<br>(0.097)         |
| Comfort in Stock Volatility    | 0.3628 ***<br>(0.059)        |
| Acceptance of Lower Returns    | 0.3274 ***<br>(0.056)        |

Note Values in the brackets are standard error.\*\*\* if p-value<0.01, \*\* if p-value<0.05, and \* if p-value<0.1

*Table 3 Results from Ordered Probit Regression*

The p-value shows whether the estimated regression coefficient is statistically significantly different from zero or not. A p-value at 0.05 indicates that the relationship is significant at 5% confidence level.

#### **Interpretation of Independent Variable from the Model:**

**5.Importance of Renewable Energy (Coefficient: 0.0855, p-value 0.081):** The positive coefficient (0.0855) means that respondents who value renewable energy are more willing to invest in renewable energy companies than those who do not. Nevertheless, the p-value of 0.081 implies that this relationship is only statistically significant at the 10% confidence level. The significance here suggests that attitudes alone may not fully explain investment behaviour.

The results are also in line with Wüstenhagen and Menichetti (2012) who claim that individuals' views on some environmental problems act as a foundation for the investments.

### Interpretation of Control Variables from the Model:

**1.Location (Coefficient: -0.0553, p-value: 0.000):** The coefficient for location is negative and p-value is 0,000, indicating there is a significant impact on renewable energy investment preference, meaning that respondents from certain federal states are less likely to prefer renewable energy investments over the respondents from other federal states where likelihood to invest in renewable energy is higher. The model accounts for region fixed effects, controlling for differences across federal states.

This result is in line with the literature reference from Raimi and Aldana (2022) where western region of Germany that has better infrastructure, economic status and access to renewable energy saw the highest share preference towards renewable energy whereas states that are lacking in renewable energy infrastructure, showed a significantly lower interest in preference towards renewable energy.

**2.Age (Coefficient: 0.0865, p-value: 0.001):** The coefficient for age is positive and statistically significant, suggesting that as age increases, the likelihood of choosing a higher category in the dependent variable increases. The relationship is strong given the p-value of 0.001, which is highly significant. As age here are 2 categories, the possibility of category 2 i.e. between 18 to 27 years of age have a higher preference towards renewable energy investments than category 1 according to this study.

This result is also in line with the literature reference from Poterba and Samwick (2001) and Warren (2019) that illustrated that older the population the more they are concerned with the idea of leaving the planet more ecologically balance.

**3.Gender (Coefficient: 0.0935/ -0.0935, p-value: 0.322):** The coefficient for males is positive with p-value > 0.05 suggesting that the relationship between male respondents and preferences towards renewable energy investments is statistically insignificant. In the case of running the ordered probit regression model with only female respondents it provides a negative coefficient suggesting that the women have significantly lower preference for renewable energy investments compared to men.

Previous literature on gender differences in investment behaviour is often mixed. Some studies suggest that women are more likely to invest in socially responsible investments (Halko et al., 2012), but this model does not find a significant difference as well.

**6.Current Investor (Coefficient: -0.5868, p-value: 0.025):** The negative and statistically significant coefficient suggests that being a current investor is associated with a lower preferring renewable energy investments over traditional investments. It has to kept in mind that 97% of the respondents here are current investors and only 3% are not current investors according to the data collected under this study. This making the inference inconclusive, at least for this dataset.

However, studies from Guiso (2008) also indicate that experienced investor are more risk-averse if these investments are focused on financial returns rather than on potential returns from environmental investment.

**7.ESG (Coefficient: 0.2572, p-value: 0.000):** The coefficient for ESG considerations is positive and highly significant. It means ESG preference have strong impact on preferences for investing in renewable energies. Higher the preference towards ESG, higher is the preference to invest in renewable energy stocks.

This supports the notion that individuals who prioritize environmental, social, and governance factors are more inclined to invest in renewable energy companies. This aligns with the findings in the

literature that socially responsible investing is increasingly tied to environmental and governance concerns (Friede et al., 2015).

**9.Risk Tolerance (Coefficient: 0.2035, p-value: 0.000):** A positive and statistically significant coefficient for risk tolerance suggests that individuals with higher risk tolerance are more likely to prefer investing in renewable energy. This implies that those who are more comfortable with risk are more willing to invest in newer, potentially more volatile, renewable energy markets.

This finding is consistent with research that links higher risk tolerance with the willingness to invest in less established sectors (Koestner, Kumar & Patel, 2013). In addition, literature related to risk perception and investment towards renewable energy market in Germany by Masini and Menichetti (2013) where a survey conducted by them showed that higher risk tolerant individuals were usually having preference in renewable energy investments. In addition, research by Hoppmann, Peters, and Schneider (2013) found that individuals with higher risk tolerance were more willing to take on the risks associated with solar energy investments, despite market volatility and the rapid pace of technological change. Lower-risk investors tended to prefer traditional utilities that provided more predictable returns. This is also tends to be in line with our inference.

**10.Comfort in Stock Volatility (Coefficient: 0.3628, p-value: 0.000):** This positive and significant coefficient indicates that individuals who are more comfortable with stock market volatility are also more likely to prefer investing in renewable energy. This suggests that comfort with market fluctuations might make individuals more open to investing in the renewable energy sector, which can be perceived as less stable than traditional energy.

Works by Bollen (2007) and Sadorsky (2012) show that investors with high comfort in stock volatility are more likely to invest in sustainable sectors such as renewable energy. Their motivation to invest goes beyond short-term financial gains, as they prioritize the long-term societal and environmental benefits associated with renewable energy, despite the inherent risks and market instability.

**11.Acceptance of Lower Returns (Coefficient: 0.3274, p-value: 0.000):** Acceptance of lower returns has a positive and significant impact on renewable energy investment preference. This suggests that investors willing to accept lower financial returns are more likely to invest in renewable energy companies, possibly due to their alignment with non-financial goals such as environmental sustainability.

According to Renneboog et al. (2008), socially responsible investors are less concerned with the associated costs increased risk may impose. Similar findings were reported by Bollen (2007) who noted that America's socially responsible funds investors place great importance on non-financial returns, namely sustainability.

#### **Interpretation of Thresholds (Cut Points):**

**1/2 (Threshold: 2.5332):** This threshold separates the first category (least likely to invest) from the second category. A respondent with a latent variable score below 2.5332 will likely fall into the lowest category of investment preference (e.g., "Very Unlikely" to invest in renewable energy).

**2/3 (Threshold: -0.1421):** This threshold separates the second category from the third category. A respondent with a latent variable score between -0.1421 and 2.5332 will likely fall into the second category (moderate likelihood of investing). This threshold indicates that individuals with latent variable scores close to zero will have a moderate likelihood of investing.

**3/4 (Threshold: -0.3438):** This threshold separates the third category from the fourth category. A respondent with a latent variable score between -0.3438 and -0.1421 will fall into the third category (e.g., moderate to high likelihood of investing). The negative value indicates that respondents with scores below zero but still close to it will be more likely to fall into a higher category. This suggests that many respondents are likely to be clustered around these middle categories.

**4/5 (Threshold: 0.4220):** This threshold separates the fourth category from the fifth category (highest investment preference). A respondent with a latent variable score greater than 0.4220 will fall into the highest category (e.g., "Very Likely" to invest in renewable energy). A positive cut point for this transition suggests that respondents need a moderately high latent score to fall into the highest category of investment preference.

#### **Overall Interpretation of the Thresholds:**

**Higher thresholds:** 1/2 threshold (2.5332) is higher in comparison to the others and this infers that very few of the respondents will be in the lowest investment preference category. Also to be placed in this category, one needs to have relatively low latent variable scores.

**Negative thresholds for middle categories:** In the case of 2/3 and 3/4 thresholds, since they are negative values, the majority of the respondents will probably be positioned in the middle of the scale. These categories are less likely to invest in the renewable energy sector as most are neither for nor against technology.

**Threshold for highest category (4/5):** The positive threshold for the 4/5 transition (0.4220) suggests that respondents need a moderately high latent score to be classified in the highest investment preference category. What this means is that people who have a more favourable attitude towards investing in this sector due to the issues such as ESG concerns or no-risk takers are likely to surpass this threshold and fall into the category "Very Likely" to invest.

The threshold cut points explain how respondents change to the next category in terms of investment preference with respect to their latent variable score. In this model, the higher threshold for the 1/2 category indicates that there are very few people who fall in the lowest investment preference category, while the negative cut points for the 2/3 and 3/4 categories enable more respondents to be clustered around the mid-section of the responses. Finally, the positive threshold for the 4/5 category affirms that moderate to high latent variable scores are required for respondents placed in the highest investment preference category in renewable energy.

#### 6.2.4 Checking for Multicollinearity Issues

Multicollinearity occurs when two or more independent variables in a regression model are highly correlated, making it difficult to distinguish their individual effects on the dependent variable.

A common method to check for multicollinearity is to calculate the Variance Inflation Factor (VIF) for each independent variable. A VIF above 10 typically indicates multicollinearity issues. Variance Inflation Factor (VIF) is calculated using the formula:

$$VIF = \frac{1}{1 - R^2}$$

Where,

VIF = Variance Inflation Factor

$R^2$  = coefficient of determination obtained by regressing the independent variable against all other independent variables

| Variable                       | VIF |
|--------------------------------|-----|
| Location                       | 4.2 |
| Age                            | 3.5 |
| Gender                         | 2.9 |
| Importance of Renewable Energy | 6.8 |
| Current Investor               | 5.4 |
| ESG Preference                 | 7.2 |
| Risk Tolerance                 | 4.9 |
| Comfort in Stock Volatility    | 8.1 |
| Acceptance of Lower Returns    | 6.3 |

*Table 4 VIF of Variables*

Here, it can be clearly seen that the VIF values of all the variables lie below 10 indicating that there are no issues related to multicollinearity. This means that each variable can be individually listed to show their influence on the dependent variable and no grouping of 2 or more variables is required.

Comfort in stock volatility and ESG preferences have values closer to 10 but are not equal to or greater than 10 hence showing no multicollinearity issues.

## 7. Conclusion

The conclusion of this master thesis unites all the different aspects of the research, showing some important findings, implications and political dimensions that are related to attitudes of Generation Z in Germany towards investing in renewable energy.

This study shows how generation Z in Germany has a generally favourable outlook on renewable energy as they consider it quite important regarding climate change mitigation. According to the evidence provided, most respondents are willing to act for renewable energy even when it offers lower financial returns compared to conventional energy sources. This also indicates a wider commitment to sustainability and environmental responsibility among this group which may influence future investment patterns and renewable energy stock market.

From a political perspective, the research highlights the role that supportive policies and government structures play in encouraging the use of renewable energy. The results indicate that areas where there is more extensive political and regulatory backing for renewable energies like North Rhine-Westphalia, Hessen, and Hamburg have higher levels of agreement about their importance in Generation Z. Conversely, regions that do not prioritize sustainability as much such as Mecklenburg-Vorpommern and Lower Saxony experience wider-ranging responses with less enthusiasm. This geographical inconsistency demonstrates the necessity of specific policy approaches which take into account local economic, cultural and environmental aspects to effectively engage young populations across Germany. This can also be inferred from the Green Party Vote share map below.

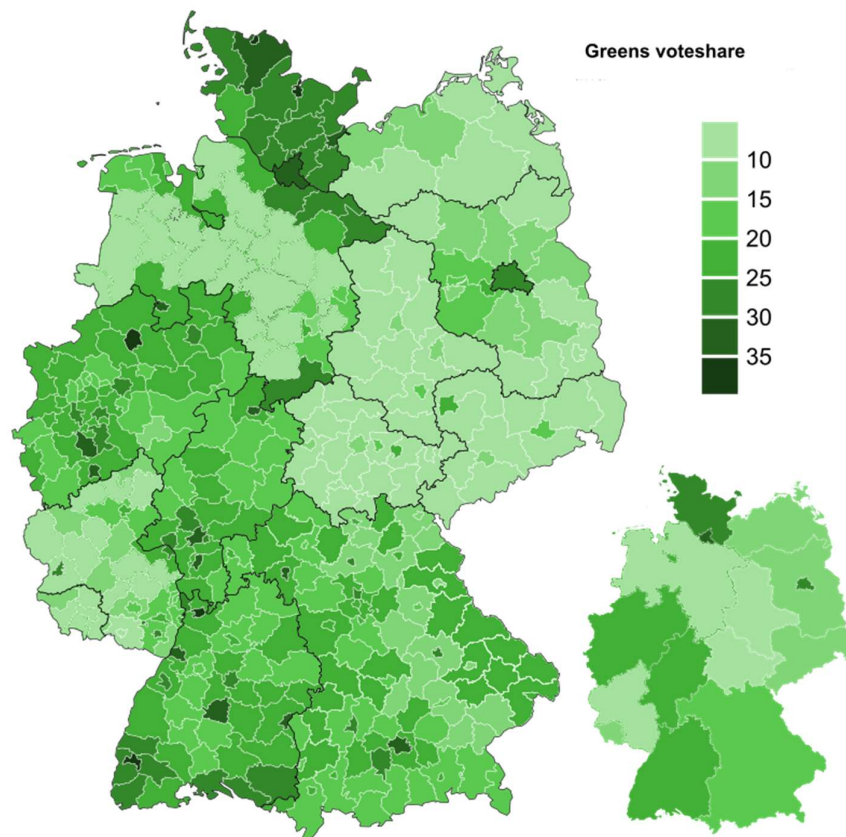


Figure 35 Distribution of Green Party Vote share in Germany

This in turn is also reflected with respect to ESG (Environmental, Social and Governance) preferences among Generation Z is that they are characterized by regional divergence on sustainability attitudes. While the areas with higher Green vote share exhibit strong consistent dedication to ESG principles others show significant variations implying targeted awareness creation campaigns would be necessary to bridge these gaps. This data can also be used as a tool for policy making in the future, so as to identify the state specific policy goals so as to influence the region.

This research is important to analyse Generation Z's investment behaviour towards renewable energy. It will guide governments and companies interested in hearing insight from the young generation before taking decisions on sustainable investments opportunities to pursue, as well as developing policies that support their decision Copenhagen index for Generation Z regarding investing in wind power technologies and green bonds. Moreover, these findings lay groundwork for future investigations into regional variation across Germany and the impacts of long-term trends regarding Gen Z's investments in renewables.

Given that climate change and renewable energy markets are increasingly international, it would be interesting for future researches to compare such studies in Germany with other countries in order to identify culture or regulation-related factors of sustainable investment. The study could also seek to evaluate the effect of teaching as well as the provision of information on renewable energy on Generation Z's investment decisions. This could aid in identifying the best possible mechanisms to promote the knowledge and practice of environmentally friendly investments among the youths.

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# 9. Appendices

## Perceptions and Investment Behaviors

The aim is to assess the attitudes of Generation Z in Germany towards renewable energy and how these attitudes influence their investment decisions, particularly in the alternative energy sector. It also emphasizes the dual objectives of the study: to explore perceptions and to analyze investment behaviors. The questionnaire covers demographics, attitudes towards renewable energy, investment preferences, risk tolerance, and perceptions of financial returns.

\* Indicates required question

1. 1. Which federal state of Germany do you currently reside in? \*

Mark only one oval.

- ☐ Baden-Württemberg
- ☐ Bavaria
- ☐ Berlin
- ☐ Brandenburg
- ☐ Bremen
- ☐ Hamburg
- ☐ Hessen
- ☐ Lower Saxony
- ☐ Mecklenburg Vorpommern
- ☐ North Rhein Westphalia
- ☐ Rhineland Pfalz
- ☐ Saarland
- ☐ Saxony
- ☐ Saxony Anhalt
- ☐ Schleswig- Holstein
- ☐ Thuringia

2. 2. Age \*

Mark only one oval.

- ☐ > 12
- ☐ >18
- ☐ > 27
- ☐ Other: \_\_\_\_\_

3. 3. Gender \*

Mark only one oval.

- ☐ Male  
☐ Female  
☐ Prefer not to say

4. 4. Educational Qualification \*

Mark only one oval.

- ☐ Primary School (Grundschule)  
☐ Lower Secondary School (Hapt / Realschule)  
☐ Upper Secondary School (Gymnasium / Gesamtschule)  
☐ Vocational Training (Berufsausbildung)  
☐ Bachelor  
☐ Master  
☐ Doctorate  
☐ Other: \_\_\_\_\_

5. 5. How important is Renewable Energy in addressing climate change ? \*

(1= not Important & 5 = extremely Important)

Mark only one oval.

| 1                     | 2                     | 3                     | 4                     | 5                     |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

6. 6. Are you currently investing ? \*

Mark only one oval.

- ☐ Yes  
☐ No

7. 7. How important are ESG criteria in your decision ? \*

(1= not Important & 5 = extremely Important)

Mark only one oval.

| 1                     | 2                     | 3                     | 4                     | 5                     |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

8. 8. Would you prefer to invest in a renewable energy company over a traditional energy company? \*
- (1= less Likely & 5 = extremely Likely)

Mark only one oval.

| 1                     | 2                     | 3                     | 4                     | 5                     |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

9. 9. How would you describe your risk tolerance when it comes to investments? \*

Mark only one oval.

- ☐ Low
- ☐ Medium
- ☐ High

10. 10. How comfortable are you with the potential volatility of stocks in the renewable energy sector? \*
- (1= not Comfortable & 5 = extremely Comfortable)

Mark only one oval.

| 1                     | 2                     | 3                     | 4                     | 5                     |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

11. 11. How likely are you to invest in renewable energy stocks if they offered lower returns than traditional energy stocks? \*
- (1= Not important & 5 = extremely important)

Mark only one oval.

| 1                     | 2                     | 3                     | 4                     | 5                     |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

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Google Forms

```

import matplotlib.pyplot as plt
import pandas as pd

# Load the data
data = pd.read_csv('Investment Opinion converted raw data v2 (kish).csv')

# Create cross tabulation between 1.Location and 9.Risk Tolerance
crosstab_risk_tolerance = pd.crosstab(data['10.Comfort in Stock Volatility'],data['9.Risk Tolerance'], margins=True)

# Remove the 'All' column
crosstab_risk_tolerance_no_all = crosstab_risk_tolerance.drop(columns=['All'])
crosstab_risk_tolerance_no_all = crosstab_risk_tolerance.drop(['All'])

# Display the cross tabulation
# Create a stacked bar chart to visualize the cross-tabulation without the "All" column
crosstab_risk_tolerance_no_all.plot(kind='bar', stacked=True, figsize=(12, 8), color=['lightblue', 'orange', 'lightgreen','white'])
plt.title('Risk Tolerance vs Comfort in Stock Volatility')
plt.xlabel('Comfort in Stock Volatility')
plt.ylabel('Count')
plt.xticks(rotation=0,ha='right')
plt.legend(title='Risk Tolerance', loc='upper right')
plt.show()

```

Appendix 2 : Python Coding : 9. Risk Tolerance vs 10. Comfort in Stock Volatility (Cross Tabulation)

```

import matplotlib.pyplot as plt
import pandas as pd

# Load the data
data = pd.read_csv('Investment Opinion converted raw data v2 (kish).csv')

# Create cross tabulation between 1.Location and 9.Risk Tolerance
crosstab_risk_tolerance = pd.crosstab(data['1.Location'], data['5.Importance of Renewable Energy'], margins=True)

# Remove the 'All' column
crosstab_risk_tolerance_no_all = crosstab_risk_tolerance.drop(columns=['All'])
crosstab_risk_tolerance_no_all = crosstab_risk_tolerance.drop(['All'])

# Display the cross tabulation
# Create a stacked bar chart to visualize the cross-tabulation without the "All" column
# Updated color scheme with shades
colors = ['#add8e6', '#87ceeb', '#4682b4', '#ffcc99', '#ff9966']

# Create a stacked bar chart to visualize the cross-tabulation without the "All" column
crosstab_risk_tolerance_no_all.plot(kind='bar', stacked=True, figsize=(12, 8), color=colors)
plt.title('Locationswise Attitude towards Renewable Energy & imapact on Climate Change')
plt.xlabel('Location')
plt.ylabel('Count')
plt.xticks(rotation=45, ha='right')
plt.legend(title='Importance of Renewable Energy', loc='upper right')
plt.show()

```

Appendix 3 : Python Coding : 1. Location vs 5. Importance of Renewable Energy (Cross Tabulation)

```

import matplotlib.pyplot as plt
import pandas as pd

# Load the data
data = pd.read_csv('Investment Opinion converted raw data v2 (kish).csv')

# Create cross tabulation between 1.Location and 9.Risk Tolerance
crosstab_risk_tolerance = pd.crosstab(data['1.Location'], data['9.Risk Tolerance'], margins=True)

# Remove the 'All' column
crosstab_risk_tolerance_no_all = crosstab_risk_tolerance.drop(columns=['All'])
crosstab_risk_tolerance_no_all = crosstab_risk_tolerance.drop(['All'])

# Display the cross tabulation
# Create a stacked bar chart to visualize the cross-tabulation without the "All" column
crosstab_risk_tolerance_no_all.plot(kind='bar', stacked=True, figsize=(12, 8), color=['lightblue',
'orange', 'green'])
plt.title('Risk Tolerance Across Locations')
plt.xlabel('Location')
plt.ylabel('Count')
plt.xticks(rotation=45, ha='right')
plt.legend(title='Risk Tolerance', loc='upper right')
plt.show()

```

Appendix 4 : Python Coding : 1. Location vs 9. Risk Tolerance (Cross Tabulation)

```

import statsmodels.api as sm
import pandas as pd
from statsmodels.miscmodels.ordinal_model import OrderedModel

data=pd.read_csv('Investment Opinion converted raw data v2 (kish).csv')

# Redefine the dependent variable (Y) to be '8.Preference'
Y = data['8.Preference']

# Keep the same set of independent variables
X = data[['2.Age', '3.Gender', '5.Importance of Renewable Energy', '6.Current Investor', '7.ESG',
'9.Risk Tolerance', '10.Comfort in Stock Volatility']]

# Fit the ordered probit model
model = OrderedModel(Y, X, distr='probit')
result = model.fit(method='bfgs')

# Display the summary of the model
summary = result.summary()
print(summary)

```

Appendix 5 : Python Coding : Ordered Probit Regression Model



```

import geopandas as gpd
import matplotlib.pyplot as plt
import pandas as pd

data=pd.read_csv('Investment Opinion converted raw data v2 (kish).csv')

# Aggregate ESG scores by location
esg_location = data.groupby('1.Location')['7.ESG'].mean()

plt.figure(figsize=(12, 8))
data.boxplot(column='7.ESG', by='1.Location', grid=False, patch_artist=True, vert=False,
showmeans=True)
plt.title('Comparison of ESG Scores Across Locations')
plt.suptitle('')
plt.xlabel('ESG Score')
plt.ylabel('Location')
plt.show()

```

Appendix 6 : Boxplot Graph : 1.Location vs 7. ESG

```

import matplotlib.pyplot as plt
import pandas as pd
import seaborn as sns

# Load the data
data = pd.read_csv('Investment Opinion converted raw data v2 (kish).csv')

# 1. Boxplot of Risk Tolerance vs ESG Scores
plt.figure(figsize=(10, 6))
data.boxplot(column='7.ESG', by='9.Risk Tolerance', grid=False, patch_artist=True, showmeans=True)
plt.title('ESG Scores by Risk Tolerance')
plt.suptitle('')
plt.xlabel('Risk Tolerance')
plt.ylabel('ESG Score')
plt.show()

# 2. Correlation Matrix including Risk Tolerance
correlation_matrix = data[['2.Age', '7.ESG', '8.Preference', '9.Risk Tolerance', '10.Comfort in
Stock Volatility', '11.Acceptance of Lower Returns']].corr()

# Visualize the correlation matrix using a heatmap
plt.figure(figsize=(10, 8))
sns.heatmap(correlation_matrix, annot=True, cmap='coolwarm', linewidths=0.5, fmt=".2f")
plt.title('Correlation Matrix for Selected Columns')
plt.show()

```

Appendix 7 : Python Coding : Correlation Matrix

```

X_vif_data = df_encoded.drop(columns=['8. Would you prefer to invest in a renewable energy company
over a traditional energy company? '])

X_vif_data = sm.add_constant(X_vif_data)

vif_values = [variance_inflation_factor(X_vif_data.values, i) for i in range(X_vif_data.shape[1])]

vif_df = pd.DataFrame({
    'Variable': X_vif_data.columns,
    'VIF': vif_values
})

vif_df

```

Appendix 8 : Python Coding : VIF Calculation