Thesis for the Degree of Doctor of Philosophy

Research on Influencing Factors of Chinese Public Renewable Energy Acceptance Intention: Based on Theory of Planned Behavior Approach

by

Xin-Cheng Meng

Graduate School of Management of Technology

Pukyong National University

February, 2022

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(중국 공공재생에너지 수용의도 영향 요인 연구: 계획행동접근론을 기반으로)

Advisor: Prof. Min-Kyu Lee

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Xin-Cheng Meng

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Approved by:

_____
(Chairman)   Dong Phil, Chun

_____
(Member)   Sungmoon, Jung

_____
(Member)   Minghao, Huang

_____
(Member)   Sun-Jin, Kim

_____
(Member)   Min-Kyu, Lee

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Xin-Cheng Meng

부경대학교

기술경영전문대학원

요약

재생 에너지는 미래의 저탄소 에너지 공급의 중요한 부분이고, 지구 기후 온난화를 완화하기 위한 해결책 중 하나이다. 재생 에너지의 확산은 사회 지향적인 과정으로 볼 수 있다. 이 과정에서 개인 의도는 중요한 역할을 수행하는데, 재생 에너지의 대중 수용에 직접적인 영향을 미치고 재생 에너지 개발의 핵심 요소로 작용한다. 중국은 세계에서 이산화탄소 배출량이 가장 많은 나라로 전세계 이산화탄소 배출량의 27.2%를 차지한다. 이에 따라, 중국의 탄소 배출 통제는 전세계 탄소 배출 추세에 중요한 영향을 미칠 것으로 판단된다. 중국은 가계로 대표되는 에너지 소비가 막대한 양의 이산화탄소 배출량을 발생시켜 다른 부문에 비해 훨씬 많다고 볼 수 있다. 중국 에너지 구조에서 재생 에너지의 비중이 증가하고 있지만, 중국 대중이 재생 에너지 기술을 이해하고 있는지는 불확실하고, 재생 에너지의 수용에 대한 조사와 연구가 부족한 상황이다. 따라서, 본 연구는 재생 에너지를 수용하려는 중국 대중의 의도에 영향을 미치는 요소들을 탐구하는 것을 목표로 한다.

첫째, 본 논문은 서지 측정법을 사용하여 Scopus 데이터베이스에서 계획 행동

이론, 녹색 소비 행동 및 재생 에너지와 같은 키워드를 검색하고, Citespace 소프트웨어를 사용하여 1991 년부터 2021 년까지 1,397 개의 관련 문헌에 대한 서지 측정학적 분석을 수행한다. 또한 연구의 인기도, 해당 분야의 영향력 있는 기여자, 연구 핫스팟 및 연구 경계선, 지식 클러스터링 등의 측면에서 재생 에너지의 공공 수용 의도에 영향을 미치는 연구 테마의 특성과 추세를 조사한다. 이전 연구의 요약을 바탕으로 본 논문은 계획 행동 이론(TPB)에 기초한 확장 모델을 제안하며, 원래의 TPB 모델에 4 가지 새로운 영향 요인(환경적 우려, 재생 에너지 지식, 인식된 위험, 정부 신뢰)을 추가한다. 문헌 검토에 기초하여, 본 연구는 중국 대중적 맥락에 적합한 설문지로 고전 기사의 성숙도 측정 항목을 사용한다. 설문지는 온라인으로 배포되었으며, 중국 각 지역의 총 513 개의 공개 표본 데이터가 수집되었다.

본 연구는 확인 이론 시험 방법을 채택하고 구조 방정식 모델링(SEM)을 사용하여 경험적 증거를 기반으로 구성된 가상 구조 모델에 대한 경험적 분석을 수행한다. 결과는 본 연구에서 최종적으로 형성된 이론적 프레임워크 모델의 R^2(0.403)가 본 연구에서 구성된 설명 변수가 공공 재생 에너지 허용 의도의 결과 변수에 대해 충분한 설명력을 가지고 있음을 보여준다.

특히, 본 논문은 정부 신뢰의 조정 역할뿐만 아니라 환경 관심사, 재생 에너지 지식, 인식된 위험 및 재생 에너지 수용 의도 사이의 직간접적 관계를 평가하고 비교하는 데 초점을 맞추고 있다. 분석결과에 따르면, 지각 행동 통제, 주관적 규범 및 태도가 재생 에너지의 수용 의도에 유의하고 긍정적으로 영향을 미치며 지각 행동 제어가 주요 영향 요인임을 나타낸다. 또한 환경 문제, 재생 에너지 지식, 인식된 위험 및 재생 에너지 허용 의도 사이에는 상당한 직간접적인 영향이 있다고 분석된다. TPB 의 세 가지 요인은 간접 효과에서 중간 변수의 역할을 한다고 간주할 수 있다. 본 연구의 분석결과는 정부의 신뢰가 태도, 인식된 행동 통제 및 재생 에너지 수용 의도에 대한 대중의 인식 위험의 부정적인 영향을 상당히 완화시킬 수 있다는 것을 제시했다. 경험적 결과를 바탕으로 정책적 시사점을 제공한다.

주제어: 재생 에너지; 계획행동론; 문헌계량분석; 환경 문제; 재생 에너지 허용 의도; 중국 대중.

Ⅰ. Introduction

1.1　Research background

1.1.1 Realistic background

Energy is the basis and driving force for the progress of human civilization, and slowing down the rising trend of global temperature is a common challenge for all mankind. More and more countries strengthen their national self-help contribution (NDC) by setting carbon neutralization targets. The Paris Agreement, proposed at the 2015 Paris Climate change Conference, aims to "limit the rise in global average temperatures to less than 2 °C above pre-industrial levels, and strive to limit temperature rise to 1.5 °C above pre-industrial levels(Intergovernmental Panel on Climate Change [IPCC], 2018)." As a major source of global carbon emissions, the energy sector is the key to addressing global climate challenges. According to the BP World Energy Statistics Review report, the power supply industry, especially fossil fuel power plants, accounts for more than 1/3 of global carbon dioxide emissions, accounting for 64.2% of the world's electricity and more than 70% in China. IEA also pointed out in its report that the path of controlling global temperature at 1.5 °C and 2 °C shows that carbon dioxide emission control in power production plays an extremely important role in achieving the 2030 and 2050 climate targets (International Energy Association [IEA], 2020). Therefore, reducing the dependence of the power production sector on fossil fuels, expanding the proportion of renewable energy in primary energy consumption,

and comprehensively considering the adjustment of energy structure brought about by the low-carbon operation of the power sector, it has become the key to achieving the global net zero emission target by the middle of this century (Alvik et al., 2020). Achieving net zero emissions of carbon dioxide means profound and even unimaginable energy changes. If the world wants to achieve the goal that the temperature rise in the Paris Agreement will not exceed 1.5 ℃ in the pre-industrial period by the end of this century, it means that the world must be carbon-neutral around 2050, when the world's coal use will be almost zero. the use of oil, natural gas and other fossil energy will also be greatly reduced, and at least 70% of the power supply will come from renewable energy technologies represented by photovoltaic and wind energy. Therefore, the goal of tackling global climate change has become an important driving force in the development and utilization of renewable energy, and has become the common consensus and common goal of all countries in the world.

China is currently the largest country in carbon dioxide emissions in the world, accounting for 27.2% of global emissions. Its per capita emissions are close to the average level of European countries and are still much lower than those of the United States (Z. Liu, 2016). However, in terms of volume and growth trend, China's carbon emission control will have a key impact on the global carbon emission trend. Under the 1.5 ℃ warming control target, if China does not take more active measures, other countries will need to reduce carbon by more than 95% or even achieve negative emissions by 2050, which will be an almost impossible task for the world (Boston Consulting Group[BSG], 2020). Therefore, as early as January 1, 2006, the Chinese

government issued the "Renewable Energy Generation" to establish a framework for promoting the development of renewable energy in China. By the end of 2020, the total installed scale of renewable energy power generation in China had reached 930 million kilowatts, accounting for 42.4 percent of the total installed capacity, an increase of 14.6 percent over 2012. Among them: hydropower 370 million kilowatts, wind power 280 million kilowatts, photovoltaic power generation 250 million kilowatts, biomass power generation 29.52 million kilowatts, the scale of development and utilization ranks first in the world, providing a strong support for the green and low-carbon transformation of global energy (National Energy Administration[NEA], 2021). In particular, on September 22, 2020, Chinese leaders promised at the 75th session of the United Nations General Assembly that China would increase its national independent contribution and adopt more effective policies and measures to achieve a peak in carbon dioxide emissions by 2030 and to achieve carbon neutrality by 2060.

Therefore, achieving climate change mitigation requires the promotion of renewable energy consumption. As countries pay more and more attention to reducing carbon emissions, renewable energy has been widely accepted and promoted at different policy levels. The success of the promotion and development of renewable energy is ultimately reflected in the public adoption and acceptance as consumers, a process that depends to a large extent on end-users, including their awareness, acceptance and willingness to adopt and pay for renewable energy.

As an innovative energy technology, the process of promotion and diffusion is largely affected by a variety of factors, which may come from social, regulatory and

economic dimensions(Leucht et al., n.d.). However, in addition to considering technical efficiency and economic issues, at the social level, the broad public acceptance of renewable energy technologies is essential for achieving carbon reduction targets. Therefore, it is equally important to understand the social factors related to public acceptance of renewable energy.

Based on the above realistic background, when making decisions on the development and utilization of renewable energy in China, in addition to taking into account public health, safety and environmental impacts, understanding public acceptance or opposition to renewable energy technologies is also a key factor that regulators must consider when adjusting their energy structure. In the literature research so far, there is no survey literature on the intention of the Chinese public to accept renewable energy technology.

1.1.2 Theoretical background

Public acceptance is very important for the successful implementation of technology in society. High public acceptance can simplify the implementation of technology in society, but when it is low, it will hinder or even stop their implementation. Achieving renewable energy promotion goals while taking into account public preferences is a major challenge for policy makers (Van Rijnsoever et al., 2015). The existing literature on the social acceptance of renewable energy is mostly limited to a specific renewable energy technology, such as wind energy (Ladenburg & Möller, 2011; Wolsink, 2007), photovoltaic power generation (Yuan et al., 2011), biomass energy (Susaeta et al., 2010). However, the future energy system will be a hybrid energy system

with a variety of renewable energy technologies, and the research perspective will be focused on a particular technology. it will not be able to really understand the public acceptance of renewable energy as an innovative technology and its influencing factors, because it will lead to biases due to myopic decision-making (Payne et al., 1999). Therefore, in order to reliably measure the public acceptance of renewable energy technologies, it is necessary to explore the personal behavior intention behind the acceptance of renewable energy technologies. A better understanding of the determinants of public acceptance and preferences can help policy makers make more informed decisions about renewable energy policies.

Some scholars have pointed out that in a democratic society, investment in planning and decision-making processes includes expert opinions as well as the feelings and views of the public (Assefa & Frostell, 2007), but the rational behavior of individuals is often considered to conflict with the public interest. and it may hinder the implementation of the policy. Therefore, it is necessary to study the behavior intention made by the public out of rational judgment to understand the influencing factors behind these behavior intentions. Theory of Planned Behavior (TPB) (Ajzen, 1991) is an extended model of Theory of Reasoned Action (TRA) based on (Fishbein & Ajzen, 1977) . Both theories stipulate that behavioral intention precedes explicit behavior. TRA interprets customer behavior intention from the perspective of social psychology. Under this theory, intention is considered to be the only predictor of human behavior (Fishbein & Ajzen, 1977). However, what TRA solves is pure will control, and does not solve the problem of owning necessary opportunities and resources (Madden et al., 1992),

especially the behavioral constraints perceived by individual consumption behavior, which cannot be well predicted only by behavioral intention. In TPB theory, the addition of perceived control factors greatly improves the predictability of TRA theory to consumer behavior intention.

In TPB theory, behavioral intention is defined as an individual's preparation for performing a certain behavior, which is assumed to be the direct antecedent of actual behavior and is controlled by attitude, subjective norms and perceived behavior control (Ajzen, 1991). The model optimizes the potential relationship between intention and its determinants by measuring each construct at an equivalent level of specificity (Paul et al., 2016). A number of studies have suggested that public acceptance of renewable energy technologies is attributed to an expression of environmentally friendly behavior (Batley et al., 2001; Ek, 2005; Roe et al., 2001; L. Zhang & Wu, 2012). For renewable energy, an innovative energy technology, hydropower, wind, solar photovoltaic, biomass and other renewable energy sources are widely used to provide more environmentally friendly electricity. Renewable energy generation technologies do not cause local air pollution or greenhouse gas emissions, while reducing the country's over-reliance on fossil fuels, so it is also considered green energy (L. Zhang & Wu, 2012). Early recipients of renewable energy technologies tend to pay more attention to environmental issues, accept renewable energy technologies, are considered to be out of a sense of responsibility for environmental protection, and consider themselves environmentalists. Therefore, the environmental problem is one of the important sustainability variables in the green marketing literature (Wiernik et al., 2013).

Moreover, the beliefs, principles and behaviors that individuals adhere to on environment-related issues form their psychological attitudes (Schultz et al., 2004). At present, TPB theory has been widely used to understand consumers' green purchase behavior (M.-F. Chen & Tung, 2014; Kanchanapibul et al., 2014; Maichum et al., 2016; Whitmarsh & O'Neill, 2010). At present, the models developed based on TPB theory are implemented for specific countries, and most of the studies are carried out in the context of developed countries. Empirically, consumers in developed countries are more concerned about the environment than consumers in developing countries(Paul et al., 2016).

Renewable energy technology as an innovative activity of energy technology, the promotion and implementation of renewable energy technology in a specific social, cultural, economic, legal and political context, there may be significant differences among countries. Previous research on social acceptance of renewable energy has focused on developed countries, and the differences in social attributes and characteristics of individual members of the public have made it difficult to directly disseminate research findings from developed countries to developing countries. The influence factors of the public in different countries are different under the research and design of the TPB model. Therefore, based on China's national conditions, it is also necessary to use the theoretical model of TPB to verify the behavior intention and influencing factors of Chinese public acceptance of renewable energy technology.

1.2 Research significance

1.2.1 Realistic significance

The Chinese government's massive renewable energy development and energy efficiency improvements are combined with end-use electrification, which is essential for successful energy transformation and reduction of energy-related carbon dioxide emissions. Generally speaking, since changes in one sector (energy sector) affect another sector (transport, construction, etc.), such a significant transformation in multiple sectors requires greater interdependence between energy and other infrastructure sectors. In particular, the energy consumption of the household sector produces huge carbon dioxide emissions. According to statistics, household energy consumption accounts for 72% of global greenhouse gas emissions(Hertwich & Peters, 2009). In China, the household sector consumes much more electricity than other sectors (Murata et al., 2008). As (Dubois, 2015) said, we need to understand the willingness of households to change. And the extent to which climate policy formulation will mobilize positive behavioral change. It can be said that without the continued support and participation of the public, it would be impossible for China to achieve its goal of carbon neutralization by 2060. Therefore, when the government carries out a large-scale renewable energy development and utilization plan, there is an urgent need to link the policies on the demand side and the supply side so as to gain public support for renewable energy technology. The *emissions Gap report 2019* by UN Environment Programme (UNEP) expresses the urgency of increasing public acceptance of renewable energy technologies and the need to bridge the gap between the "level of emission reductions committed" and the "level of emission reductions that must be achieved to prevent climate change from reaching dangerous levels". There is no more

time, the government cannot afford to wait, every one of us, every family cannot afford to wait, our economy and way of life must achieve decarbonization transformation (The United Nations Environment Programme [UNEP], 2019).

Renewable energy is an important part of low-carbon energy supply in the future, which can effectively optimize the energy structure and balance the contradiction between supply and demand. At the same time, renewable energy is one of the solutions to mitigate climate change, and the growth of renewable energy has significantly reduced carbon dioxide emissions (Meng et al., 2021). Therefore, based on the realistic background of achieving climate change mitigation, there is a need to promote renewable energy consumption. Renewable energy is also one of the main tools to achieve carbon neutrality expressed in China's long-term energy strategy (National Energy Administration [NEA], 2021). Although renewable energy technologies (such as hydropower, photovoltaic and wind power) account for an increasing proportion of China's energy structure, it is uncertain whether the Chinese public is aware of renewable energy technologies. There is also a lack of research on the acceptance of renewable energy technologies. Understanding the factors that affect the Chinese public's acceptance of renewable energy technologies is of vital practical significance to the Chinese government's intention to achieve the goal of carbon neutrality by 2060.

1.2.2 Theoretical significance

Although, the model based on TPB theory has been verified in different research fields. However, in the study of public acceptance intention of renewable energy technology, other variables must be added to better predict the public acceptance

intention of renewable energy technology (Paul et al., 2016). In order to promote the development of renewable energy, public awareness and acceptance of renewable energy technology is very important (Batley et al., 2001; L. Zhang & Wu, 2012). Especially for renewable energy technology, an innovative energy technology, the general public will make use of their limited knowledge background to judge it. In this case, it is difficult for the public to balance risks and benefits and make reasonable judgments. Therefore, the public attitude towards renewable energy technology, subjective norms, perceived behavior control three factors will be affected by the intuitive feelings from personal life experience and then affect their behavior intention. For example, the general attitude of the public towards environmental issues (Paul et al., 2016; L. Zhang & Wu, 2012), their own understanding of renewable energy technologies (Arkesteijn & Oerlemans, 2005; Pellizzone et al., 2015; N. Yu et al., 2012), and perceived risks (E. Park & Ohm, 2014), these factors will have an impact on public acceptance of renewable energy.

In addition, the social acceptance of renewable energy technology is not only a question of individual perceived risks and perceived benefits, but also a social process mainly. Obviously, it is difficult for most of the public to fully understand the advantages of renewable energy technology and the extent of its impact on improving climate change. In many cases, the public's acceptance of an innovative technology needs to rely on the views of professionals in the government and non-governmental organizations, and use this to balance personal views (Greenberg, 2014). When regulators make decisions under uncertain conditions, they will invoke this unique form

of social trust (Bratspies, 2009). The existing literature points out that trust and acceptability are indirectly related through perceived risk and perceived benefit (Bronfman et al., 2008; Terwel et al., 2009).

In summary, on the basis of the current research on the influence of the three control factors (internal factors) of the TPB theoretical model on behavioral intention control, four factors including environmental concern, renewable energy knowledge, perceived risk, and government trust are added as the public's The contextual factors (external factors) of the intention to accept renewable energy technologies have important theoretical significance for a more profound and accurate understanding of the influencing mechanism of the Chinese public's acceptance of renewable energy technologies.

1.3 Research objectives

Through literature retrieval and sorting, this paper collects and sorts out the theoretical results related to this research, based on the extended theoretical model of planned behavior, on attitudes, subjective norms, perceived behavior control, environmental concerns, renewable energy knowledge, perceived risks, government trust, and Theoretical analysis of the mutual influence of public renewable energy acceptance intentions, empirical research with the Chinese public as a research sample, and the use of structural equation models to verify the relationship between various variables, it reveals the mechanism of using external situational factors as expansion factors of the TPB theoretical model to the public's intention to accept renewable energy. This research strives to achieve the following goals:

(1) Explore the mechanism of the three control factors (attitudes, subjective norms, and perceived behavior control) in the TPB model on the intention to accept renewable energy, and verify the role of the three factors in promoting the public's intention to accept renewable energy.

(2) Explore the mechanism of external contextual factors (environmental concern, renewable energy knowledge, perceived risk) on the intention to accept renewable energy, and verify that the three factors of environmental concern, renewable energy knowledge, and perceived risk have a direct effect on the public's intention to accept renewable energy.

(3) Explore the mechanism of the impact of external contextual factors (environmental concerns, renewable energy knowledge, perceived risk) on the three factors of the TPB model, and verify that the TPB model has environmental concerns, renewable energy knowledge, perceived risk, and the public Renewable energy accepts the mediating effect between the intent and influence.

(4) Explore the mechanism of government trust regulating the relationship between perceived risk and attitude, perceived behavior control, and public renewable energy acceptance intention, and verify the regulatory effect of government trust intermediary between perceived risk and perceived behavior control, attitude and renewable energy acceptance intention.

(5) Summarize the research conclusions, based on the TPB theoretical model, add external contextual factors as expansion factors of the TPB model, explore its influence on the public's intention to accept renewable energy, and provide effective management

for government regulatory agencies when promoting renewable energy technologies to the Measures and recommendations. Ultimately, fundamentally increase the public's willingness to accept renewable energy technologies.

1.4 Research contributions

This study is based on the Chinese Situational, taking the Chinese public as the research sample, goal frame guiding environmental behavior and TPB theory as the theoretical basis to establish a theoretical model. The purpose of this paper is to explore the mechanism of the extended TPB model on the intention of public acceptance of renewable energy technology in China, which provides a new theoretical support and research context for TPB theory. Compared with previous studies, the innovation of this study is reflected in the following aspects:

(1) Based on the concept of social acceptance of renewable energy and the goal framework theory that guides environmental behavior, the theory of planned behavior is introduced into the study of Chinese public's intention to accept renewable energy technology. it enriches the theoretical support and research situation of the TPB model on the influence mechanism of behavior intention, and provides a new theoretical framework and support for the follow-up research.

(2) Based on the framework of TPB model, this paper effectively extends the model, introduces external situational factors, and uses the mediated regulatory effect model to construct the research framework of the extended TPB model on the action mechanism of renewable energy technology acceptance intention. For the first time, this study uses the three controlling factors of the TPB model as mediating variables
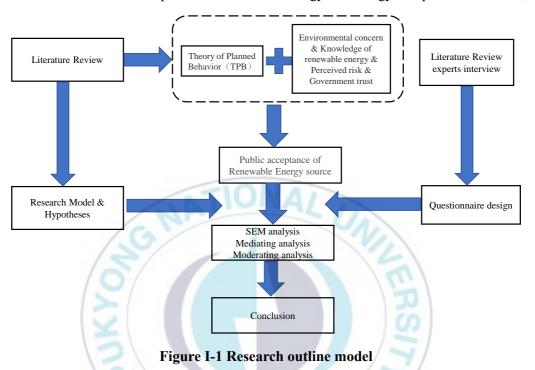
between the public's external situational factors and the intention to accept renewable energy technologies, and introduces government trust as a moderating variable, which improves the effectiveness of the original TPB model in explaining individual behavioral intentions. Finally, a new theoretical model of public environmental concern, renewable energy knowledge, perceived risk, government trust, attitude, subjective norms, perceived behavior control, and intention to accept renewable energy technologies has been formed.

(3) Taking China's national conditions as the research background, the cross-cultural research variable government trust is introduced for the first time as an intermediary moderator of perceived risk and perceived behavior control, attitude, and renewable energy technology acceptance intention. Constructed an expanded planning behavior theory model adapted to China's national conditions, and applied it to the Chinese public's research on the acceptance of renewable energy technologies, providing a new research context for the research and investigation of the acceptance of renewable energy technologies.

1.5 Research outline and scope

1.5.1 Research outline model

This research interdisciplinary the ideas of social psychology and management, using a combination of theoretical review and empirical research, qualitative analysis and quantitative analysis, and puts forward the research theme of this research through the analysis of the research background and research significance. Use scientific bibliometric research methods to search for relevant subject terms, sort out the research

frontiers and latest developments of renewable energy technology acceptance intentions,

Figure I-1 Research outline model

and form the theoretical basis of this research by summarizing and sorting out previous research results. Based on TPB theory and low-carbon transition theory, construct the theoretical model of this research and put forward research hypotheses. Using questionnaire survey and statistical analysis methods, through literature analysis, on the basis of defining each variable, the measurement scale is determined, and the structural reliability and validity of the questionnaire are analyzed through a small sample pilot study, and finally a formal questionnaire for large sample analysis is formed. Finally, a large sample of empirical testing and analysis is used to draw research conclusions. The Research outline is shown in Figure I-1.

1.5.2 Research scope

In the context of China's efforts to achieve the goal of "carbon neutrality" by 2060, this study uses the Chinese public as a research sample and uses the theory of planned behavior as the theoretical basis to understand the Chinese public's awareness and acceptance of renewable energy, investigate and analyze the impact The influencing factors and the mechanism of public acceptance of renewable energy technology. From the two aspects of external situational factors and TPB model, explore the effect path of influencing factors on the public's intention to accept renewable energy technologies. Based on the public's perception of government trust, it explores the restriction conditions of the public perception of risk on the mechanism of the acceptance of renewable energy technologies. This study draws research conclusions by constructing theoretical models, empirical analysis and testing, and provides effective management measures and suggestions for the Chinese electric power regulatory authorities to promote renewable energy technologies to the public. The full text is divided into 6 chapters, and the structure is as follows:

Chapter 1: Introduction. This part first introduces the background and significance of the topic, research objectives, and research methods of this article, clarifies the outline model and research scope of the thesis, and finally elaborates the innovation of the thesis.

Chapter 2: Literature Review. Using bibliometric analysis methods, quantitatively analyze the target documents in the Scopus database, analyze the micro (authors), meso (journals) and macro (national) levels, and objectively measure the research impact of this research theme Power, and by the visual map intuitively presented.

Comprehensively comb the development status and research trends of the problems studied in this article, and explore the research ideas of this article on this basis. This chapter provides the basis for the subsequent chapters and establishes the research direction of this article.

Chapter 3: Theoretical basis and research hypothesis. Sorting out the concepts of social acceptance involved in this research, the target framework theory that guides environmental behavior, the theory of planned behavior and its expansion factors, and the theoretical foundation as the support, construct the theoretical model of this article. Then put forward research hypotheses.

Chapter 4: Research Design and Small Sample Test. This part first introduces the constructs involved in this research, then designs the questionnaire, and introduces the design of the questionnaire used in this research. Collect small sample data of the questionnaire through pre-survey, analyze the reliability and validity of the small sample test data, and revise the questionnaire according to the results to finally form a formal questionnaire.

Chapter 5: Empirical Analysis and Hypothesis Testing. This chapter collects, organizes and analyzes a large sample of data based on the formal questionnaire, and uses factor analysis, structural equation model and hierarchical regression analysis on the basis of empirical investigations to perform model fitting and assumptions on the variables and the overall model structure of this article. Test and verify the theoretical structure model and research hypothesis put forward in this research, and draw the conclusion of this research.

Chapter 6: Conclusion. This chapter summarizes the verification results of each hypothesis, and proposes the contribution of this research based on the research conclusions of this research, points out the research limitations that this research has not broken through, and finally gives future research recommendations.

II. Literature Review

2.1 Methods and data collection

The research theme of this thesis is the influencing factors of public acceptance of renewable energy technology. Therefore, before conducting formal research, it is very important to comprehensively and quantitatively evaluate or grasp the development trend of the research topic, which will lay a solid theoretical foundation for the subsequent research of this article. In addition, it is a challenge to use traditional literature review methods to analyze research fields that have a long research span and a huge amount of literature, and to effectively organize, fully summarize and quantitatively analyze their development trends and characteristics. In particular, the influencing factors of the public's acceptance of renewable energy technology involve interdisciplinary research fields, covering social psychology, environmental science, energy, economics, sociology and other disciplines. In order to give a comprehensive overview of the research topic, this section adopts the bibliometric analysis method to conduct a literature review.

2.1.1 Bibliometric analysis

Bibliometrics are widely used in the quantitative analysis of scientific publications. It is an effective literature analysis method based on the identification of publications in a specific subject area (Dominko & Verbič, 2019).

The method of bibliometric analysis has been applied more and more. Bibliometric analyses have the following advantages:

(1) Quantitative analysis of target documents, objective, measurement of research influence, and visual presentation with the help of visual graphs;

(2) they can realize the comparative analysis of large data sets;

(3) they are scalable and can be analyzed at different levels of micro (author), meso (journal, institution) and macro (national) of specific data sets (Ellegaard & Wallin, 2015; Primc et al., 2021).

In this chapter, this article hopes to reveal the characteristics and trends of the research topic that affects the public's acceptance of renewable energy technologies from the following aspects：

(1) Is research on the influence of TPB theoretical model on behavioral intention still growing? (Based on the number of published articles);

(2) Who are the influential contributors to the field? (With regard to countries, journals, and authors);

(3) What are the hot spots and research frontiers of the acceptance of renewable energy technologies research?

(4) What is the knowledge clustering of the acceptance intention of renewable energy technology research based on keyword co-occurrence?

(5) What are the implications for the research theme of this thesis?

This study also used CiteSpace5.7. R5 software, developed by Chaomei Chen, for scientific metrological analysis and the visual processing of literature data. CiteSpace can effectively map knowledge by analyzing the structure and time of various social networks of scientific publications, including national collaboration network, author co-

citation network, and keyword co-occurrence network. The relevant literature provides more information on how to use the CiteSpace software to conduct scientometrics in the research field (C. Chen, 2020).

2.1.2 Data sources

We collected data from Elsevier's Scopus database. Before effective data retrieval, we determine the research boundaries to obtain citation data more effectively. The target of the current study is to explore the mechanism and implementation path of the influencing factors of public acceptance of renewable energy technology based on the TPB theoretical model. Finally, the retrieval policy was set to:

TITLE-ABS-KEY (("the theory of planned behavior" OR "TPB") AND ("green Purchase

Behavior" OR "green products" OR "green buying" OR "sustainability" OR "renewable

energy" OR "purchase intention" OR "acceptance" OR "willing to pay") OR

("knowledge" OR "trust" OR "perceived risk" OR "environmental Concern"))

On September 7, 2021, 2825 initial literature records were extracted from the online library of Pukyong National University, South Korea. The retrieval data were further screened and the literature type was limited to "Article-ar," the publication source type was limited to "SRCTYPE-j," and literature that was not relevant to the research topic was manually deleted after reading the title and abstract. The complete records and metadata referenced were downloaded and imported into CiteSpace for data cleansing and analysis. After reprocessing by CiteSpace software, 1,397 valid literature records were finally obtained. The overall research framework is shown in Figure II-1.
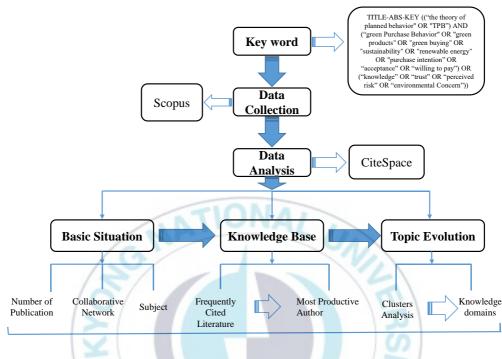
Figure II-1 Research framework

2.2 Results and discussions

2.2.1 Literature quantity analysis

In the past 27 years, the number of publications in this field has shown an overall upward trend. (Ajzen, 1991)first proposed an extended TPB theoretical model based on the TRA theoretical model, and incorporated the perceptual behavior control factors controlled by nonvolition into the model. Since then, the TPB theoretical model has been widely used to predict the relationship between consumer behavioral intentions and their influencing factors, because the TPB model "allows us to examine the influence of personal determinants, social environment and the influence of non-volitional determinants on intention" (H. Han et al., 2011). Judging from the trend of

publications, since 2010, the use of TPB theory to predict consumer purchase behavior of green products and environmentally friendly products has shown a rapid increase in related documents. From the perspective of consumers, the rise of environmentalism has had a great impact on consumers' concept of sustainable consumption. Consumers buy more environmentally friendly and green products to reflect their concerns about environmental issues and the concept of sustainable development that will benefit future generations (Kalafatis et al., 1999; Laroche et al., 2001). From the perspective of product marketing, marketers also need to understand what factors can prompt consumers to make green product consumption decisions in addition to the core premise of meeting personal needs when consumers are faced with different product choices (Bruce et al., 1996; M.-F. Chen & Tung, 2014; Oreg & Katz-Gerro, 2006). Therefore,

Figure II-2 Number of publications from 1991 to 2021 by year

in recent years, the number of publications in this field has shown a sharp increase. In 2020 alone, there are 253 publications. As of August 2021, the number of publications has reached 201, and the number of publications in the whole year is likely to reach the highest level in history. This trend reflects the growing interest in the subject on a global scale. The number of publications on the subject, from 1991 to 2021, can be seen in Figure II-2.

In addition, this article is also concerned that the upward trend of publications in this field is positively related to the increasing international emphasis on changing public consumption behaviors and patterns in mitigating the impact of environmental

changes. By reviewing relevant IPCC[1] reports from 1995 to the present, we found clues to the increase in the number of publications. In 1995, the SAR *Climate Change 1995: Economic and Social Dimensions of Climate Change* completed by the IPCC in 1995 specifically recommended the implementation of information and advisory measures on sustainable consumption patterns at the social level to promote the mitigation trend of climate and environmental changes (Bruce et al., 1996).

In 2001, the third assessment report of the IPCC pointed out that the combination of low-emission and sustainable life and consumption patterns of the public combined with technological innovation can enhance social and economic potential and slow down the deterioration of the climate and environment. Although these innovations will encounter resistance, they can be solved by increasing public participation in decision-making, which will add new ways for people to achieve sustainable development and social equity (Metz et al., 2001).

In 2018, the IPCC released the latest Global Warming of 1.5ºC special report, highlighting that the impact of global warming caused by human greenhouse gas emission activities on the natural and human systems is accelerating, and the energy system's low-carbon production methods are transforming, especially the large-scale utilization of renewable energy technologies is of great significance to slow down the global temperature rise (Intergovernmental Panel on Climate Change [IPCC], 2018). Therefore, since 2018, more and more scholars have begun to pay attention to the

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[1] *The Intergovernmental Panel on Climate Change (IPCC) is the United Nations body for assessing the science related to climate change.*

research on the public's behavioral influence factors and the mechanism of action in the process of accepting renewable energy technologies, providing a solid research foundation for the subsequent large-scale use of renewable energy.

2.2.2 Country, author analysis and cited-journal

In order to clarify the current status of the research on the influencing factors of the public acceptance of renewable energy technology, this section is based on the visualization and co-citation relationship graph of CiteSpace to identify the development process and structure of this scientific knowledge field. Determine the influential and cutting-edge achievements in this field (Country, journal, author), but also trying to discover the research context between scientific knowledge existing in different disciplines.

2.2.2.1 Country productivity

Table II-1 lists the publications of the top 15 producing countries and the H-index[2], and lists the H-index of Marketing and Social Psychology respectively according to the main distribution fields of TPB research literature. The graph network is used to describe the academic productivity and in-fluence of a certain country/region. In the network graph, Citation tree-rings is used to describe the citation history of the node, different colors of Citation tree-rings represent the corresponding citation time, and the thickness of rings is positively associated with the number of citations of the node. The

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[2] *The index, developed by the SCImago research group, uses Google's algorithm PageRank to index Elsevier's Scopus database to evaluate scientific publications, H-index can not only measure the influence of individuals, but also evaluate the influence of organizations and nations.*

thickness of the Citation has a positive relation with the number of citations in the node. Betweenness Centrality is an important indicator that detects boundary-spanning potentials and novel brokerage connections in scholarly publications in CiteSpace (C. Chen, 2020). Nodes with higher Betweenness Centrality are shown as purple rings. The thickness of purple rings describes the value of Betweenness Centrality, which is used to describe the importance or influence of this node on other nodes in the network.

Table II-1 Top 15 productive countries during 1991–2021

Country/Regions	N	Betweenness Centrality	First year	H-index	
				Marketing	Social Psychology
UNITED STATES	285	0.68	1991	411	463
CHINA	141	0.07	2009	99	76
MALAYSIA	94	0	2009	65	44
UNITED KINGDOM	84	0.07	1999	196	227
TAIWAN	82	0.07	2004	100	74
AUSTRALIA	73	0.01	2006	160	162
INDIA	60	0.04	2005	78	56
GERMANY	49	0.01	1996	142	195
SOUTH KOREA	47	0	2003	116	75
SPAIN	34	0.06	2006	110	102
PAKISTAN	31	0	2015	32	23
ITALY	30	0.01	2000	88	109
CANADA	28	0.02	1995	170	215
NETHERLANDS	25	0	1995	158	190
IRAN	24	0	2006	36	32

Note: N is Number of total publications per country. H-index data source is https://www.scimagojr.com/. Accessed 10 September 2021.

From 1991 to 2021, a total of 1397 articles have been contributed from 79 countries

in the field of behavioral intention research based on TPB theory, of which the 15 most active countries are the United States, China, Malaysia, the United Kingdom, Taiwan, Australia, India, Germany, South Korea, Spain, Pakistan, Italy, Canada, the Netherlands, and Iran. In terms of the start time of the study, the United States was the earliest (1991). After that, Canada, the Netherlands, Britain, Germany and other major European and American countries also began to study this field, which may be related to the establishment of TRA and TPB theoretical models based on the cultural background of European and American developed countries. The models developed under these theories are specific to specific countries and cannot be easily applied outside their national background (C. Lee & Green, 1991). At the same time, consumers' attitude towards green consumption depends on many factors, including culture and environmental concerns expressed by consumers (Zhou et al., 2009). From the perspective of betweenness centrality, the United States (0.68) is much higher than other countries, has absolute influence in this research field, and has established close international cooperation with other countries centered on the United States.

In terms of the total number of publications, the United States and China are the two most productive countries. As a major developed country, the United States has the highest per capita carbon emissions, and its public generally has a high awareness of environmental protection, and its electricity market system allows the public to choose renewable energy technologies on their own. therefore, it is in a leading position in the field of green product marketing and renewable energy technology acceptance intention research. However, China's research in this field started relatively late. In this search of

publication data, China's initial research year is 2009. (Zhou et al., 2009) the TPB theoretical model is used to predict the behavior intention of the Chinese public to use mobile phones when driving handheld or handsfree.

In addition, few Chinese scholars use TPB theory to predict the behavior intention of Chinese consumers or the public for environmental protection. On the one hand, it is related to cultural background. Compared with European and American developed countries, consumers pay more attention to the decisive role of personal behavior habits in behavior intention (individualism), The Chinese public pays more attention to the behavior control impact of others and social pressure (collectivism). On the other hand, in the past two decades, due to the increasingly serious environmental deterioration caused by the rapid economic development, the public's awareness of environmental protection and the concept of green consumption are still in the embryonic stage. However, as the Chinese government advocates low-carbon transformation development and large-scale development and utilization of renewable energy technologies, the research on public green consumption behavior, and the research of acceptance of renewable energy technologies is increasing year by year (Fu et al., 2019; Ru et al., 2019; S. Wang et al., 2019; Xu et al., 2020). Developed countries have always been active advocates of low-carbon and environmentally friendly lifestyles. Among the top 15 productivity countries, Developed countries account for nearly 50%. Moreover, the research on reducing carbon emissions in European countries generally started early, and their strong scientific research strength is reflected not only in productivity, but also in academic influence. It can be seen from Figure II-3 those European countries are in

a more central position in the network map and have carried out extensive academic cooperation with other countries.

We also noticed that, with developing countries' increasing concern about climate change adaptation and environmental protection, there are positive changes in the number of publications. For example, there are six developing countries in the top 15
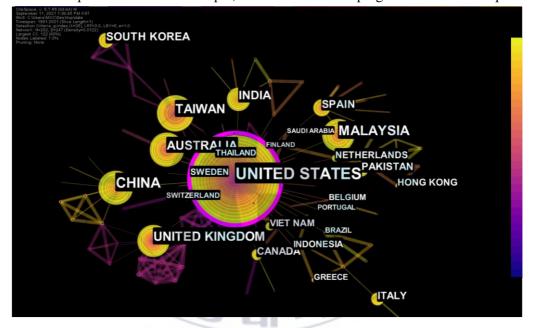
Figure II-3 National cooperation network map (1991–2021)

productive countries list. As can be seen in Figure II-3, except for China, developing countries such as Malaysia, Taiwan, India, Pakistan, and Iran are also gradually starting to contribute to their research strength in this field through international cooperation. To some degree, the distribution of publications in this field mirrors the general situation of different countries in academia (H. Yu et al., 2016).

2.2.2.2 Distribution of journals

The statistical results of journal sources show that 1397 publications based on TPB theory published in 635 journals. From the number and types of journals distributed in scientific publications, the prediction of behavior intention by TPB theory has been scientifically demonstrated in many fields, and has stronger general theoretical characteristics. Under this research topic, the journal with the largest number of publications is *Sustainability* (Switzerland), with 117 publications. Among them, there are 55 journals with more than 5 publications, and the total number of publications is 606, accounting for 43.37% of the total journal publications, which indicates that the publications in the field of behavioral intention research based on TPB theory are mainly concentrated in these journals.

In terms of total citation frequency, the *Journal of cleaner production* is the highest, 2059 times, followed by the *Journal of environmental psychology* and *British Food Journal*, 1534 times and 1318 times respectively. All these journals are the research core that has an important impact on the research of behavioral intention based on TPB theory. Table II-2 lists the top 16 peer-reviewed journals in terms of number of publications.

Table II-2 Top 16 most productive journals (1991–2021)

Journal	NP	TC	TC/NP	H-index	Country	Publication
Sustainability (Switzerland)	117	1085	9.27	85	Switzerland	MDPI AG
Journal of Cleaner Production	56	2059	36.77	200	United Kingdom	Elsevier Ltd.
British Food Journal	23	1318	57.30	80	United Kingdom	Emerald Group Publishing Ltd.
Transportation Research Part F	20	478	23.90	94	United Kingdom	Elsevier Ltd.

Journal						
British Journal of Health Psychology	18	335	18.61	88	United States	Wiley-Blackwell
Journal of Retailing and Consumer Services	13	1036	79.69	89	United Kingdom	Elsevier Ltd.
Frontiers in Psychology	13	61	4.69	110	Switzerland	Frontiers Media S.A.
Resources, Conservation and Recycling	11	924	84.00	130	Netherlands	Elsevier
Journal of Environmental Management	11	439	39.91	179	United States	Academic Press Inc.
Journal of Health Psychology	11	220	20.00	88	United Kingdom	SAGE Publications Ltd
Environmental Science and Pollution Research	11	120	10.91	113	Germany	Springer Science + Business Media
Journal of Consumer Marketing	10	854	85.40	98	United Kingdom	Emerald Group Publishing Ltd.
Transportation Research Part A	10	226	22.60	133	United Kingdom	Elsevier Ltd.
Journal of Islamic Marketing	10	109	10.90	39	United Kingdom	Emerald Group Publishing Ltd.
Journal of Environmental Psychology	9	1534	170.44	137	United States	Academic Press Inc.
Ecological Economics	9	1241	137.89	202	Netherlands	Elsevier

Note: NP is Number of publications per journal. TC is Total Citations Per Publication. 5The

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Table II-3 lists the top ten cited literatures related to the research topic of this paper. These papers were published between 1991 and 2010. The most frequently cited paper was published by (Venkatesh et al., 2003). This paper provides the latest comments on eight modeling technologies that predict users' technology acceptance behavior, including TPB model, and constructs a unified technology acceptance and use theory (UTAUT) model to predict users' Acceptance Intention of information technology.

(Mathieson, 1991)compared two models for predicting personal intention to use information technology: Technology Acceptance Model (TAM) and planned behavior theory (TPB). The results show that both of them can well predict the behavior intention of using information technology. Compared with the ease-of-use advantage of TAM, TPB provides more specific information and can better guide the development. On the basis of this research, (Taylor & Todd, 1995b)further expanded the comparison scope of prediction model, increased the evaluation of TPB decomposition model, obtained research results similar to (Mathieson, 1991), and emphasized that the decomposed TPB model can more comprehensively understand behavior intention by refining the limiting factors of behavior intention .

(Pavlou & Fygenson, 2006) The TPB theoretical model is extended to explain and predict the process of users' adoption of e-commerce. The research results emphasize the significant importance of trust and technology adoption variables (perceived usefulness and ease of use) as expansion factors for predicting e-commerce adoption intention. It is also proved that the expansion of influencing factors within the

framework of TPB can improve the accuracy of the original TPB model for e-commerce adoption intention prediction. (Rai et al., 2002) in the quasi-voluntary information system (IS) environment, structural equation modeling technology is used to verify the effectiveness of the information system success model. The results show that the IS Success Model well supports the effectiveness of these theories under the broader theoretical background including Technology Acceptance Model and Planned Behavior Theory. (Chau & Hu, 2001) extended the applicable environment of Technology Acceptance Model (TAM), planned behavior theory (TPB) and decomposed TPB model to the professional environment of health care. and points out that the decomposed TPB model does not significantly increase the effectiveness of explaining or predicting behavior intention, and more extensive exploration of factors other than TPB is needed to better increase the explanatory power of the TPB model.

Table II-3 Top 10 most highly cited papers

Title	Author (Year)	Journal	Cited count
User acceptance of information technology: Toward a unified view	Venkatesh, V., et al. （2003）	MIS quarterly	34911
Understanding information technology usage: A test of competing models	Taylor, S., & Todd, P. A. (1995)	Information systems research	11235
Predicting user intentions: Comparing the technology acceptance model with the theory of planned behavior	Mathieson, K. (1991)	Information systems research	6157
Understanding and predicting electronic commerce adoption: An	Pavlou, P. A., & Fygenson, M. (2006)	MIS quarterly	3214

extension of the theory of planned behavior			
Assessing the validity of IS success models: An empirical test and theoretical analysis	Rai, A., et al. （2002）	Information systems research	2308
Factors influencing the adoption of internet banking: An integration of TAM and TPB with perceived risk and perceived benefit	Lee, M. C. (2009)	Electronic commerce research and applications	2085
Information technology acceptance by individual professionals: A model comparison approach	Chau, P. Y., & Hu, P. J. H. (2001)	Decision sciences	2002
Risk and rationality in adolescent decision making: Implications for theory, practice, and public policy	Reyna, V. F., & Farley, F. (2006)	Psychological science in the public interest	1606
Explaining and predicting users' continuance intention toward e-learning: An extension of the expectation-confirmation model	Lee, M. C. (2010)	Computers & Education	1175
Understanding information technology acceptance by individual professionals: Toward an integrative view	Mun, Y. Y., et al. (2006)	Information & Management	1399

Note: The cited count data source Google Scholar. Accessed 13 September 2021.

For an innovative technology, the main theoretical paradigms for understanding users' acceptance of the technology include planned behavior theory (TPB), technology acceptance model (TAM) (Davis, 1989), Diffusion of Innovations Theory (DIT) (Rogers, 2010), etc. Similar other technological innovations, renewable energy also has a technological component. According to (Rogers, 2010)，It defines diffusion as the process of diffusion of innovation through specific channels among members of a social

system over time. Among the five factors of innovation diffusion (relative advantage, compatibility, complexity, Trialability and observability), relative advantage has been found to have a significant positive effect on the willingness to adopt new technologies(Holak & Lehmann, 1990). Like the innovation diffusion theory, the Technology Acceptance Model (TAM) is used to study another basic theory of users' adoption of technology products and services(Davis et al., 1989). But TAM focuses on explaining the intention to use a particular technology or service, and perceived ease of use (PEU) and perceived usefulness (PU) are the two main predictors(Legris et al., 2003).And (Schwartz, 1977)Norm Activation Model (NAM) is also often used to analyze consumers' intention of pro-environmental behavior. According to(De Groot & Steg, 2010) a survey of the acceptance of nuclear technology found that when people feel morally obliged to do so, they are more likely to resist nuclear power than support it. Because consider what is emphasized in the normative activation model is the moral obligation reflected by individual norms or the feeling of not taking specific action(Schwartz, 1977). As a result, NAM, which is based on an ethical framework, is more likely to predict the behavior of opposing new technology than supporting it.

The TPB theoretical model based on social psychology is considered to have good expansibility and can provide more detectable influencing factors, so it is widely used in the prediction of Technology Acceptance Intention (Mun et al., 2006). Compared with other scholars' research methods of individually verifying these competitive technology acceptance models, more scholars try to integrate several different technology acceptance models, so as to predict the Technology Acceptance Intention better.

(M.-C. Lee, 2009) turned the research perspective to the behavior prediction of users using online banking. Through the integrated model of TAM and TPB with perceived risk and perceived return, he explained that positive factors (perceived return) and negative factors (perceived risk) have a direct and indirect impact on users' behavior intention of using online banking through the mediation of TPB model. The results show that attitude in TPB is the most important intermediary factor of perceived risk and perceived return, and has a significant negative and positive impact on behavioral intention through attitude. In another article, (M.-C. Lee, 2010)The expectation-confirmation model (ECM), technology acceptance model (TAM) and planned behavior theory (TPB) are combined. The results show that the unified model has good explanatory power, and lays a foundation for further integration of other technology acceptance theory models. (Mun et al., 2006) integrates three closely related technology acceptance models of TAM, TPB, IDT into a more comprehensive prediction model. In fact, the research results also confirm the same research conclusion, that is, the integration of different technology acceptance models has better fit than the original individual model, and the understanding of limiting factors is more complete. Table II-4compares several major technology acceptance models.

Table II-4 Comparison of technology acceptance models

Model	Definitions	Core predicted factors
Diffusion of Innovations Theory（DIT）	the process by which an innovation is communicated through certain channels over time among members of a social system.	Relative advantage, Compatibility, Complexity, Trialability, Observability
Technology Acceptance Model （TAM）	The model hypothesized that system usage is directly determined by behavioral usage intentions, which in turn are influenced by users' attitudes toward using the system and the perceived usefulness of the system.	Perceived ease of use (PEU), Perceived usefulness (PU)
Norm Activation Model （NAM）	These personal norms are activated when people are aware of the adverse consequences of not behaving in socially desirable ways and when they feel they can do something to mitigate these problems.	Personal norm, Social norm
Theory of Planned Behavior （TPB）	Behavioral intention is defined as an individual's readiness to perform a behavior, it is assumed to be the direct predicate of the actual behavior, and is controlled by three factors: attitudes, subjective norms, and perceived behavioral control	Subjective norm (SN), Attitude, Perceived behavioral control (PBC)

(Reyna & Farley, 2006) The theme of the study is the optimal decision-making problem of adolescents about the determinants of risk behavior. It is emphasized that risk perception plays an important role in the rational behavior decision-making framework. Intervention control of risk perception can reduce the probability of dangerous behavior.

To sum up, the top ten cited literatures under this topic mainly focus on the research

field of TPB theoretical model in predicting the Acceptance Intention of information technology, with an earlier time distribution (1991-2010). According to (Lei et al., 2019), chronological trend of literature citations is observed, and the research time of literature with high citations is usually earlier. The large-scale literature of using TPB theory to predict consumers' purchase intention of green products began in 2010. (H. Han & Kim, 2010) incorporated consumers' subjective attitudes towards environmental problems, perceived customer effectiveness and environmental awareness into the extended TPB theoretical model to predict consumers' willingness to pay for green hotel prices. The results show that compared with the original TPB model, the extended TPB model with consumers' environmental attitude has a higher degree of fit, and well predicts the behavior intention of consumers' green consumption. Since then, the research results of a large number of scholars on green products and consumers' green purchase behavior show that TPB support includes additional structure, because it improves the prediction ability of TPB framework in predicting consumers' green purchase intention and behavior, and environmental attitude is an important pre factor of green consumption behavior (M.-F. Chen & Tung, 2014; Paul et al., 2016; Yadav & Pathak, 2016, 2017).

2.2.2.3 Author productivity

In this study, the researcher pays more attention to the top 10 authors with the highest productivity. Table II-5 includes the top 10 authors with the largest number of papers published in this research field and their academic profiles. We used the h-index, scientists' productivity (number of publications) and impact (number of citations) to assess the importance of scientists' contributions (Hirsch, 2005). The

author field recording the frequency of occurrence shows that the authors with the

most articles are Katherine M. white and Wang Shanyong (8 articles).

Table II-5 The 10 most productive author during 1991–2021

| Author | Institution | Scopus Profile | | | | MCT[8] |
		Country	TC[4]	Doc[5]	Cit[6]	H-index[7]	
White, Katherine M.	Queensland University of Technology	Australia	8	207	7,829	42	TPB; Perceived Behavioral Control
Wang, Shanyong	University of Science and Technology of China	China	8	79	2,062	25	Pro-Environmental Behavior; Green Product; Environmental Attitudes
Adnan, Nadia	Habib University	Pakistan	6	26	623	14	Battery Electric Vehicles; Alternative Fuel Vehicles; Electric Car
Hung, Shin Yuan	National Chung Cheng University	Taiwa	6	81	2,790	21	TAM; UTAUT
Han, Heesup	Sejong University	South Korea	6	327	12,313	57	Pro-Environmental Behavior; Green Product; Environmental Attitudes

Ramayah, T.	Universiti Sains Malaysia	Malaysia	6	433	7,891	45	TAM;UTAUT;Environmentally Preferable Purchasing;
Ajzen, Icek	University of Massachusetts Amherst	United States	5	88	65,930	54	TPB; Perceived Behavioral Control
Damalas, Christos Asterios	Democritus University of Thrace	Greece	5	147	4,131	33	Pesticides; Farmers; Protective Equipment
Norman, Paul	The University of Sheffield	United Kingdom	5	161	5,634	42	TPB; Perceived Behavioral Control
Dwivedi, Y. K.	Swansea University	United Kingdom	5	472	15,060	70	TAM; UTAUT

Note: TC: total count per author is based on the retrieved data. Doc: Documents by author.Cit: Total number of citations. H-index data source is https://www.scimagojr.com/. Accessed 15 September 2021. MCT is the most contributed topics 2016–2020 per author.

According to the results, White is a professor at Queensland University of Technology (Australia), and she has published the most papers in this research field. White's main research field is to predict behavior intention based on TPB model and its extended model (Hamilton & White, 2008). In the data retrieved this time, most of White's works are with Hamilton Kyra from Griffith University (Australia), who are the main collaborators, and they have jointly published 6 articles. Wang Shan yong Associate Professor from University of Science and Technology of China has also published 8 related articles, his main research direction is energy and low-carbon consumption behavior. (S. Wang et al., 2016) constructed an extended TPB prediction

model, adding two influencing factors of consumers' environmental concern and moral norms. The results show that the predictive explanatory power of the extended TPB model on consumers' behavioral intention to use hybrid electric vehicles (HEVs) is significantly improved. Environmental attention indirectly affects adoption intention, and has a positive correlation with attitude, subjective norms, perceived behavior control and personal moral norms. In another article, (Xu et al., 2020), similar results are obtained in the analysis of consumers' purchase intention of green furniture, and it is emphasized that perceived behavior control has the greatest impact on purchase intention.

Adnan Nadia from Universiti Teknologi Petronas (Malaysia) also focus on the prediction of consumer adoption behavior of HEVs (Adnan et al., 2018). Professor Han heesup from Sejong University (South Korea) have long been committed to using TPB model to predict consumer behavior intention in green consumption and tourism destination selection (H. Han & Kim, 2010; Y. Kim & Han, 2010). Professor Hung Shin Yuan from National Chung Cheng University (Taiwan) and Dwivedi, Y. K from Swansea University (United Kingdom). Them of the research areas are based on TPB and UTAUT models to predict the acceptance intention of information technology (Alryalat et al., 2012; Hung & Chang, 2005).

Professor Ajzen icek, works at the University of Massachusetts Amherst (United States). (Ajzen, 1991) first proposed the basic framework of TPB model. TPB "allows us to examine the impact of personal determinants and social environment, as well as non-volitional determinants on intention" (H. Han & Kim, 2010). Moreover, behavior

intention is formed by predictors composed of individual attitude towards behavior intention, subjective norms and perceived behavior control (H. Han & Kim, 2010; S. Wang et al., 2016). At present, TPB model and extended model based on TPB have been widely used in information technology acceptance prediction (Chau & Hu, 2001; Hung & Chang, 2005; Pavlou & Fygenson, 2006; Rai et al., 2002). Especially, because of its high ability to predict environmental intention and behavior, planned behavior theory has been widely used in various fields of customer environmental behavior (Adnan et al., 2018; Bamberg, 2003; S. Wang et al., 2016; Xu et al., 2020). As a result, Ajzen himself has gained great influence in the field of social psychology.

Norman Paul is from the University of Sheffield (United Kingdom). His research perspective is mainly the prediction of behavioral intention in the field of health (Booth et al., 2014). Ramayah, T. is a professor of Universiti Sains Malaysia, which mainly focuses on the prediction of behavioral intention to adopt financial technology (Ramayah et al., 2014). Damalas, Christos asterios, from Democritus University of Thrace (Greece), focuses on the prediction of behavior intention in the field of agricultural production(Bagheri et al., 2019).

2.2.3 Knowledge domain

(Olawumi & Chan, 2018) proposed that clustering analysis is an exploratory data mining technology, which is used to identify and analyze the classification of significant terms and backgrounds in specific research fields, and use a series of algorithms to transform the collected data into several structured clusters, thus discovering the topic distribution and organizational structure in the knowledge field. Keywords are the core

of literature, and keywords with high frequency in the subject field are often regarded

Figure II-4 Clusters with timeline view of key Words

as research hotspots (Rongying & Limin, 2010). Therefore, in this section, CiteSpace is used to extract the Article keywords under this topic from 2010 to 2021, and LLR algorithm is used to identify 10 main research clusters and corresponding keywords. The silhouette(S) values of these 10 research clusters are greater than 0.85. According to (Fengyang, 2018), when S> 0.7, the clustering is significant. The timeline view is used to summarize the evolution process of keywords under each cluster, and arranged vertically in descending order of size, and the curve represents the associated links between clusters more intuitively, which represents the process of topic evolution (Meng et al., 2021). As shown in Figure II-4 .

Based on the clustering results, this paper combines the above 10 research clusters

with their clustering keywords, and summarizes two knowledge domains of behavioral intention research based on TPB theory. As shown in Table II-6.

Table II-6 The knowledge domain of the research

Knowledge domain	Topic	Clusters	Keyword
Climate Change & Sustainability Development	Renewable energy source / Green consumption behavior	0#, 3#, 5#, 9#	consumption behavior,climate change,environmental protection,green product,renewable energy,solar power,sustainability,sustainability development,recycling,pro-environmental behavior,alternative energy ,energy efficiency,electric vehicle,carbon emission,green consumer,green consumption,air quality improvement,low carbon consumer behavior
Consumption Behavior	Theory of planned behavior / Situational Factors	1#, 3#, 7#, 10#, 11#, 13#	theory of planned behavior,subjective norm,perceived behavioral control,environmental concern,psychological theory,public attitude,perception,human behavior,willingness to pay,purchase intention,knowledge, influencing factor,environmental behavior,risk perception,technology adoption,public acceptance,public perception,education

2.2.3.1 Climate change & sustainability development

Human activities threaten the sustainability of the environment and socio-

economic systems, on the one hand, the continuous global warming caused by the increase in greenhouse gas emissions, which poses a threat to the living environment of future generations; on the other hand, with the development of economy, the demand for global energy consumption and energy supply security is getting higher and higher (Batley et al., 2001; Fuss et al., 2009). According to (Güney, 2019), sustainable development can be defined as maintaining the number of resources used by society to meet today's needs at a level that will not deprive future generations of their needs. In the context of this definition, sustainable development has three dimensions, namely, economy, society and environment (Assefa & Frostell, 2007). Therefore, in order to meet the goal of sustainable human development, it is necessary to meet the growing demand for energy and minimize pollution in the process of energy production and use (Ozturk & Acaravci, 2011).

In this context, renewable energy (RES) is favored as an innovative technological means to reduce the use of fossil fuels (Li et al., 2009). In recent years, public awareness of the use of fossil fuels as energy supply to bring irreversibility to the climate environment is gradually increasing (Malik et al., 2020; Roe et al., 2001; L. Zhang & Wu, 2012). According to the existing literature, there are still many uncertainties in the top-down large-scale promotion plan of renewable energy technology (Batley et al., 2001; Fu et al., 2019; M. S. Han et al., 2020; Li et al., 2009). Although renewable energy is greener than traditional energy, the cost of traditional fuel is lower, which is due to the public neglect of the higher social externality cost of traditional fuel. On the other hand, the social cost of renewable energy is low, but due to the need for the public to

bear additional costs and lack of understanding of renewable energy technology, the public, especially in developing countries, has maintained a cautious attitude towards renewable energy technology, which hinders its popularization and application to a certain extent (J. Kim et al., 2013; Pleeging et al., 2021; Scarpa & Willis, 2010).

Renewable energy source

Energy is an important issue related to sustainable development goals. The increasing demand for energy leads to significant environmental pressure at the global, national, regional and local levels (Del Rio & Burguillo, 2009). In the energy system, meeting human needs through socially accepted technological system innovation and appropriate policy and political means should be a good combination of solving energy consumption and sustainable development (Assefa & Frostell, 2007). Energy use dominated by fossil fuels is the main cause of climate change, accounting for about 60% of global greenhouse gas emissions (International Energy Association [IEA], 2020). Renewable energy is those resources that can produce energy repeatedly, such as solar energy, wind energy, biomass energy, geothermal energy and so on，also known as alternative energy (Rathore & Panwar, 2007).

Since renewable energy technology has little destructive impact on the environment, it is also endowed with the attribute of green energy (Pleeging et al., 2021). Renewable energy can meet the domestic energy demand, and almost does not emit air pollutants or greenhouse gases into the atmosphere (Panwar et al., 2011). However, in the current technology stage, the market price of renewable energy is still higher than that of traditional energy. Consumers who have a positive attitude towards renewable

energy technology are often environmentalists who pay high attention to the environment (Ek, 2005). An important advantage of RES is the internalization of external costs (Georgakellos, 2010). Although renewable energy has obvious environmental advantages, the public and society need to bear additional costs in the process of energy structure transformation, which has created a disgusting atmosphere among the public (Stigka et al., 2014).

(Dimitropoulos & Kontoleon, 2009) A case study of wind farm location on Greek islands points out that public acceptance is not only a key factor for the success of renewable energy projects, but also a driver for the development of renewable energy technologies. (C.-Y. Lee et al., 2017) A survey on public willingness to pay for renewable energy in South Korea was conducted using CV approach, emphasizing that public acceptance of renewable energy projects is more important than other projects. (Batley et al., 2001) A survey of British people's willingness to pay for renewable energy shows that willingness to pay varies with social status and income. Although most consumers support renewable energy, it is difficult to expand renewable energy generation capacity in the UK by consumers alone in the absence of other government support mechanisms. In addition, the existing literature mostly adopts CV valuation method to investigate the public's acceptance of renewable energy, so as to evaluate the public's willingness to pay for the social value of renewable energy (Jin et al., 2019; Nomura & Akai, 2004; L. Zhang & Wu, 2012).

However, the survey on the influencing factors of the public's intention to accept renewable energy technologies is relatively lacking, and there is still a certain gap from

the willingness to pay to the actual adoption of renewable energy technologies. Especially for a developing country like China, considering the different cultural background from developed countries, it is necessary to investigate the behavioral intention of Chinese public to accept renewable energy technologies.

Green consumption behavior

Green consumption is a way to improve environmental sustainability (S.-C. Chen & Hung, 2016). The term "green products" is defined as "products that do not pollute the earth or destroy natural resources, and can be recycled or protected" ("green products") (Shamdasani et al., 1993), and is also considered as a low-carbon lifestyle (Whitmarsh & O'Neill, 2010). Low carbon transition (LCT) advocates the integration of low-carbon lifestyle into a more systematic and long-term conceptual category (Meng et al., 2021), including not only the significant changes in the substitution of fossil fuels by renewable energy in the energy system, but also the public's "purchase decisions" (shopping, composting and reuse), "habits" (domestic water and energy protection) and "recycling" (Barr et al., 2005).

It is generally believed that these green consumption behaviors are related to different lifestyles (i.e., social demographic characteristics and environmental values). (Akehurst et al., 2012)believes that psychological variables are more relevant than socio-demographic variables in explaining green consumption behavior. (Z. Wang et al., 2018) A survey of the public's willingness for classified collection of domestic waste in China points out that the public's willingness for classified collection of domestic waste is significantly influenced by the behavior of others, facility conditions and moral

obligations. (Pakpour et al., 2014) applied the extended theory of planned behavior to investigate household waste recycling behavior in Iran and found that attitude, perceived behavior control, intention, moral obligation, self-identity, action plan and past recycling behavior were important predictors. When green consumers are aware of the deterioration of the environment, out of a more responsible attitude towards environmental protection, their environmental concerns will be included in their purchase decisions, leading them to buy products with the least impact on the environment (Wei et al., 2018). Moreover, this environmental value is widely influenced by social values, which is reflected in that consumers pay more attention to their social identity as environmentalists (Oliver & Lee, 2010; Wei et al., 2018). In the investigation of green consumption behavior in the hotel industry with more concentrated resource consumption, it has further confirmed consumers' environmental values and played an important role in choosing green hotels and being willing to pay more (H. Han & Kim, 2010; Verma & Chandra, 2018).

The broader literature on environmental behavior also points out that the factors that affect consumers' different environmental behaviors are diverse. While environmental values or environmental concerns may play a role, other motivations and different situational factors usually play a greater role (Jackson, 2005; Schultz et al., 1995).

2.2.3.2 Consumption behavior

Theory of planned behavior

The theory of planned behavior (TPB) is based on social psychology. This model

has been adopted by many researchers and has been verified as a useful model for exploring personal behavior intention and actual behavior (Bagheri et al., 2019; Chau & Hu, 2001; Hamilton & White, 2008; Rai et al., 2002; Ramayah et al., 2014). In recent years, many studies have applied TPB model to analyze consumers' green purchase behavior (Albayrak et al., 2013). TPB believes that behavior (B) is directly determined by behavior intention (BI); Behavior intention is formed by a person's attitude (ATT), which reflects the favor or disgust of performing behavior; Subjective norm (SN), reflect the perception that an important person wants the individual to perform or not to perform an act; Perceived behavior control (PBC) reflects the perception of internal and external constraints of behavior (Ajzen, 1991).

In other words, consumer behavior attitude, subjective norms and perceived behavior control jointly lead to the formation of behavior intention, the TPB model[3] as
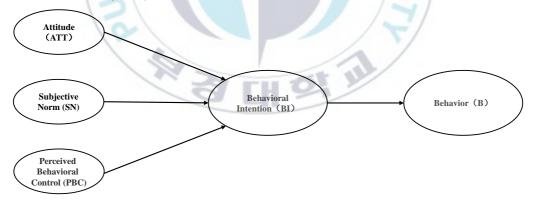
Figure II-5 TPB model

shown in Figure II-5.

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[3] *TPB model source:* (Ajzen, 1985).

Attitude

In the TPB model, attitude refers to the overall evaluation of a specific behavior (H. Han & Kim, 2010). Ajzen think that Attitude towards behavior is defined as "the degree to which a person has a positive or negative evaluation of the relevant behavior" (Ajzen, 1991). It can be seen from this definition that attitude includes the judgment of whether the considered behavior is good or bad, and whether the actor wants to do the behavior (Leonard et al., 2004).

According to the research of (Ru et al., 2019). attitude is the main predictor of behavioral intention. Attitude is the psychological emotion transmitted through the evaluation of consumers. If it is positive, the behavioral intention is often more positive (M.-F. Chen & Tung, 2014). More specifically, in the context of green products, a positive relationship between attitude and behavioral intention has been established in many scenarios. In the context of green hotels, many studies have determined that green consumption intention is positively affected by attitude (M.-F. Chen & Tung, 2014; H. Han & Kim, 2010). In organic food selection behavior, scholars have found a positive correlation between attitude and intention (Arvola et al., 2008). (Tarkiainen & Sundqvist, 2005) In the study of Finnish consumers' choice behavior of organic food, it is found that consumers' willingness to buy organic food can be predicted by their attitude, and the explanatory variance is very high (R^2 = 0. 558). The survey on renewable energy utilization also shows the positive impact of attitude on behavioral intention (Irfan et al., 2020). The above research confirms that the basic principle of attitude-intention is dominant in the green consumption behavior.

Subjective norm

Subjective norms are the second major determinant of behavioral intention. The term "subjective norm" is defined as "perceived social pressure to perform or not perform the behavior" (Ajzen, 1991). Subjective norms capture how individuals feel about the social pressure they feel about specific behaviors (Paul et al., 2016). These social pressures may come from the influence of others who are close / important to the individual, such as "family, close friends, colleagues or business partners" (H. S. Park, 2000). Therefore, to a certain extent, consumers who have positive subjective norms on specific behavior are more likely to have a positive impact on the relevant behavior intention (M.-F. Chen & Tung, 2014).

Perceived behavior control

As the third factor affecting behavior intention, perceived behavior control considers the personal ownership of necessary opportunities and resources (Madden et al., 1992), especially the behavior constraints perceived by personal consumption behavior, which cannot be well predicted only by behavior intention. Therefore, the addition of perceived control factors in TPB theory greatly improves the predictability of TRA theory to consumer behavior intention. Perceptual behavior control refers to "the degree of difficulty of perceiving executive behavior" (Ajzen, 1991), which exerts influence control on PBC by past experience and expected obstacles. Generally speaking, self-efficacy emphasizes personal internal control factors (Bandura, 1992), while PBC emphasizes the influence of external situational factors and general factors on it (Armitage & Conner, 2001). Many studies have shown that there is a positive

correlation between PBC and intention in a variety of research contexts (M.-F. Chen & Tung, 2014; H. Han et al., 2010; Tarkiainen & Sundqvist, 2005).

Renewable energy acceptance intention

Renewable energy technology acceptance intention is the direct result of this study. According to (C.-Y. Lee et al., 2017), The study regards social acceptance of renewable energy as the intention to use technology. And through willingness to pay (WTP) or in the case of renewable energy technologies, the conditional valuation method is used to measure public acceptance by investigating public preference for payment of renewable energy technologies as alternative sources of energy. Surveys on the valuation of public willingness to pay for renewable energy using conditional valuation methods have been conducted in a number of countries, the results show that willingness to pay is closely related to socio-economic characteristics, education, environmental concerns and renewable energy knowledge (Stigka et al., 2014). In addition, a variety of policy, economic, technical and social factors may play a vital role in the development of RES. Therefore, the success of the promotion of renewable energy technology largely depends on the end users, that is, the public's understanding, acceptance and willingness to adopt, use and pay for renewable energy. It can be seen that public acceptance is a key factor in the development of renewable energy (Dimitropoulos & Kontoleon, 2009).

In the existing literature, most of the studies on attitudes and willingness to accept / use / or willing to pay for renewable energy are mostly concentrated in developed countries, investigations on the acceptance intentions of the Chinese public on renewable energy technologies are also limited to the analysis of specific renewable

energy technologies (such as solar and wind energy) (Jin et al., 2019; C.-Y. Lee et al., 2017; Li et al., 2009; Nomura & Akai, 2004; Pleeging et al., 2021; Roe et al., 2001; Scarpa & Willis, 2010; Z. Wang et al., 2018). (Davis et al., 1989) pointed out that in TPB model, behavioral intention and actual behavior have the same determinants, although behavioral intention is usually more predictable than actual behavior. Ajzen pointed out that behavior intention is the direct determinant of actual behavior. When the measurement of intention reaches a certain degree, it will provide the most accurate behavior prediction (Ajzen, 1991). It also means that acceptance intention may have a stronger correlation with influencing factors than actual acceptance behavior.

In addition, considering that the promotion of renewable energy technology in China is still in its infancy, a large number of consumers are deciding whether to accept this energy technology. Therefore, this study believes that it is more appropriate to measure acceptance intention than actual acceptance behavior.

Situational Factors

The TPB theoretical model based on social psychology is considered to have good expansibility and can provide more probable factors, so it is widely used in the prediction of technology acceptance intention (Mun et al., 2006). According to (Ajzen, 1991) the discussion of planned behavior theory, it is considered that it includes internal factors (environmental concerns, perceived risks, attitudes, etc.) and external factors (accessibility of renewable energy, etc.). It is very important to fully understand the impact of these factors on the behavioral intention of the final use of renewable energy, which is very important for the promotion of renewable energy. (Sangroya & Nayak,

2017) pointed out that consumers' decision to adopt green energy is not only influenced by financial costs, but also driven by personal emotional and social factors. according to (Hast et al., 2015)，the results of a survey on the acceptance of renewable energy conducted in Shanghai, China, showed that respondents expressed concern about environmental degradation, and many of them recognized the environmental role of green energy, which is conducive to the sustainability of social development. These social emotions are positively reflected in the public's positive attitude and interest in green energy. (Lin & Syrgabayeva, 2016), which also emphasizes the public's concern for the environment, positively affects the intention of using renewable energy through pro-environmental behavior. In fact, knowledge is also an important psychological factor, which has a significant impact on public acceptance of renewable energy as an innovative technology(Stoutenborough & Vedlitz, 2016). To sum, as consumers of electric energy, there is a certain relationship between the internal factors such as environmental concern, knowledge and attitude of renewable energy and the behavior intention of using renewable energy.

From the perspective of social external factors, as consumers of electricity commodities, the public's perceived risk of renewable energy mainly comes from the intermittent characteristics of renewable energy and the resulting instability of energy supply，and worry about related to the possible additional costs in the future(Yang et al., 2015). And if the public thinks that the personal financial cost of supporting renewable energy promotion policies is too high, then even people who attach importance to social norms and environmental outcomes may not support energy

policies that are consistent with their own values(Phillips et al., 2019). It also means that the perceived risk of renewable energy, as an obstacle to its promotion, will prevent the majority of well-intentioned public from abandoning their environmental values and will not pursue plans to promote renewable energy as an alternative source of energy.

Therefore，in the research context of renewable energy Acceptance Intention, it is important to understand the attitudes of power consumers, because their attitudes are the basis of their final behavior (Ek, 2005). Three specific parameters seem to emphasize public behavior: (a) information owned by the public, (b) public views and positions, and (c) fear, that is, danger or anxiety exacerbated by ignorance (Assefa & Frostell, 2007; Nomura & Akai, 2004; Zoellner et al., 2008), these influencing factors must be further investigated. Based on a review of the existing literature, it is found that other variables must be added to better understand the public's intention to accept renewable energy technologies. Therefore, this paper extends the original TPB model by adding four external situational factors: environmental concern, knowledge of renewable energy, perceived risk and government trust.

Environmental concern

Environmental concern refers to values, attitudes, emotions, cognition, knowledge and behavior related to the environment (Bamberg, 2003). Although early literature studies believed that in the study of the direct relationship between environmental concern and behavior, it was considered that the direct explanatory power of environmental concern on behavior was not sufficient (Eckes & Six, 1994). However, in recent years, the correlation between environmental concern and willingness to pay

or behavioral intention has been confirmed many times in green consumption behavior and green energy consumption represented by renewable energy.

(Paul et al., 2016) Investigated the green product purchase intention of Indian consumers and verified it with structural equation model (SEM). The extended planned behavior theory (TPB) as a research framework to explain purchase intention is more effective than TPB and TRA, and TPB mediates the relationship between environmental concern and green product purchase intention. (Hansla et al., 2008) also emphasized the significant correlation between EC and green behavior. More and more people worry about environmental problems and adopt Pro environmental behavior because they believe and worry about the adverse consequences of environmental problems on themselves (egoistic beliefs and concerns), others (social altruistic beliefs and concerns) or the biosphere (biosphere beliefs and concerns). (Hartmann & Apaolaza-Ibáñez, 2012)In the survey of consumers' attitude towards choosing green energy brands and purchase intention, the direct and indirect influence of EC on purchase intention is determined.

It can be seen that the relationship between environmental concern and the intention of green consumption behavior is becoming more and more certain. The reason may be that the increasing public attention to the environment highlights the importance of the relationship with green consumption behavior.

Knowledge of renewable energy

Knowledge of Renewable energy is one of the important variables of renewable energy technology acceptance intention. Knowledge is defined as knowing something

through learning, exercise and education; It is experience and wisdom (Lambrinou et al., 2009). In this study, renewable energy knowledge refers to the public understanding of renewable energy and renewable energy technologies. Some studies have revealed the relationship between renewable energy knowledge and behavioral intention, and generally there is a positive correlation between them. A survey of Finnish students' understanding of biomass energy shows that due to the lack of understanding of biomass energy, the acceptance of this renewable energy technology is lower than that of wind energy and solar energy (Halder et al., 2010). (W. Liu et al., 2013)A survey on the acceptance of renewable energy deployment by rural residents in Shandong, China also found similar results. In view of the positive impact of renewable energy on the environment, rural residents generally support the development of renewable energy. However, the low level of awareness of renewable energy technology hinders the intention to accept the deployment of renewable energy to a certain extent. Another survey on consumers' willingness to pay for renewable energy in Slovenia emphasizes that renewable energy knowledge is always associated with high willingness to pay for green energy (GE) (Siegrist, 2021).

Perceived risk

Perceived risk refers to an individual's perception of the uncertainty and possible negative consequences of a specific event or behavior, and the size of an individual's perceived risk depends on the probability of risk occurrence and its potential loss (Jacobs & Worthley, 1999). In this study, perceived risk is defined as the individual's concern about the stability of renewable energy power supply and the social risks it

brings to the society in the face of renewable energy as a source of power supply. and the degree of concern about the rising cost of personal electricity consumption due to the investment costs brought about by investment in renewable energy projects. Perceived risk is an important psychological variable in behavior research which has a significant impact on individual attitude and behavior. (E. Park & Ohm, 2014) In the survey of Korean people's willingness to accept renewable energy technologies, it shows that perceived risk is the key determinant of people's attitude, and indirectly negatively affects people's intention to accept renewable energy technologies through attitude.(Pellizzone et al., 2015)The intention of public participation in geothermal energy in southern Italy was also investigated, and the same impact relationship was found, and the perceived risk had a negative impact on the acceptance of public participation in geothermal energy development.

Government trust

Trust is considered to be an important variable to mitigate perceived risk, which can better understand the perception of certain hazards and the acceptance of various technologies (Siegrist, 2021). Trust plays an increasingly important role in modern society, which is more based on the differentiation and specialization of roles (Bronfman et al., 2012). The social acceptance of renewable energy technology is not only a matter of personal feelings, perceived risks and perceived benefits, but also a social process. This is particularly important in the public sector, as society relies on regulators to reduce and manage the risks posed by scientific and technological development. This unique form of social trust is invoked when regulators make decisions under uncertain

conditions (Bratspies, 2009), especially the nuclear energy development and promotion process (E. Park & Ohm, 2014; S. Wang et al., 2019). The general public may lack professional knowledge or rely only partially on their knowledge to determine the acceptability of certain technologies or hazards that require more attention. In the context of various risks, if knowledge is missing, trust will be used to evaluate the benefits and risks associated with the hazards, and may ultimately affect the acceptance of the technology (Siegrist & Cvetkovich, 2000).

In other words, risk perception is affected by trust in the institutions that regulate or propose to implement these technologies. Compared with the lack of trust, in the case of sufficient trust, the public may view the technology more positively and be more receptive to it (Frewer et al., 2003). In this study, we define trust as government trust, which is the degree of public trust in the national renewable energy development strategy formulated by the government and regulatory agencies.

Ⅲ. **Theoretical Background and Hypotheses**

3.1 Theoretical background

The acceptance of renewable energy technologies is a complex and multifaceted process, which is affected by many factors. The purpose of this study is to study the factors that affect the public's willingness to accept renewable energy technology. Renewable energy meets the growing energy needs of the population in a sustainable manner (Irfan et al., 2019), and the development of renewable energy can be expanded by understanding consumer behavior towards renewable energy.

According to (Stern, 2000), environmental behavior can be defined as all types of behaviors that change the availability of materials or energy in the environment or change the structure and dynamics of ecosystem or biosphere, regardless of whether people are aware of or consider environmental impacts before making these decisions . Stern's research also recognizes that environmental behavior may come from a variety of motives, and its research scope should be understood in the overall dimension of the environment, including nature, technology, society and virtualization. Therefore, for the green energy technology acceptance behavior of renewable energy technology, it is very important to include more public choice motivation, and understand the ways of motivation interaction and how they affect individuals' orientation towards environmental behavior.

3.1.1 The concept of social acceptance of renewable energy

Environmental and social issues related to energy use have become important

drivers for the development of renewable energy technologies, and public acceptance of renewable energy technologies is essential for their successful introduction into society. Based on the current situation of media publicity and environmental degradation, broad opinion polls show high public support for renewable energy technologies, but the social acceptance of renewable energy technologies still needs to be further studied and verified. Due to the concern of the public's own living environment, the public's support for renewable energy cannot fully become the behavioral driving force of public support for renewable energy (W. Liu et al., 2013). It is necessary to understand what specific factors promote (or hinder) the public's shift from supportive attitude to actual behavior.

In this study, we distinguish between two dimensions of social acceptance (acceptability), social acceptance and public acceptance. Among them, social acceptance is the most widespread and common acceptability (Wüstenhagen et al., 2007). It reflects the basic attitude of the public towards regional, national or international events or policy-making (Huijts et al., 2012)，which may reflect only the simplest public attitude towards environmental concern, or out of the emotional influence of altruism. It is not affected by its own availability and costs, risks and benefits.

Public acceptance reflects the public's recognition of the availability of technological innovation, that is, the behavioral response to the purchase and use of such products (Huijts et al., 2012). When the public examines renewable energy technologies as consumers, they are more under the emotional control of egoism and pay special

attention to perceived risk, availability and cost (Irfan et al., 2021). In a complete renewable energy technology chain, end consumers (the public), as key stakeholders, cannot be taken for granted to understand their acceptance intentions of renewable energy technologies. In addition to seeing the public showing a high degree of social acceptance, the factors that promote (or hinder) the public's acceptance of renewable energy technologies as consumers should also be reviewed.

3.1.2 Goal frame guiding environmental behavior

For a long time, social psychology has assumed that individuals have different views of looking at any particular situation, and these views are important for determining how a person behaves in this situation (Lindenberg & Steg, 2007). (Gollwitzer & Bargh, 1996) regards goals as the main determinant of how a person views a particular situation. A framework built on specific goals can be said to be the way people process information and take action against it. When people change their goals, they will also look at the situation in different ways. When it is activated or "focused", the goal is a combination of motivation and activated knowledge structure (Gollwitzer & Bargh, 1996). (Lindenberg & Steg, 2007) connects the goal framework theory with the theory and research of environmental behavior. He believes that different theories of environmental behavior tend to focus on different motivations or goals, and the goal framework theory contributes to a better understanding of environmental behavior. Under the guidance of goal framework theory, acceptance is inspired by different goals or final states that people strive to achieve.

Goal framework theory emphasizes the impact of goals on cognitive process, that

is, goals dominate what people pay attention to, which knowledge and attitudes are most easily obtained in cognition, how people evaluate all aspects of a specific situation, and what alternatives are being considered. (Lindenberg, 2001) defined three goals closely related to environmental behavior, namely, hedonic goal of "feeling better now", "gain goal of" protecting and improving their own resources "and normative goal of" appropriate action ". Hedonic goal has the widest range, and the standard to achieve the goal is the improvement of people's way of feeling. The standard for the achievement of gain goal is the improvement (or prevention of reduction) of a person's resources or resource efficiency. Once the environmental behavior motivation is interfered by sub goals (such as the transformation cost of renewable energy technology and the perceived risk of renewable energy technology), it is easy to activate these sub goals and hinder them from implementing specific environmental behavior. However, the normative goal frame is closely related to various sub goals related to appropriateness (such as acting in a socially normative way and contributing to environmental protection). Under the influence of normative goal, individuals are particularly sensitive to what they or others think they should do.

On the basis of these three basic goal frames, (Lindenberg, 2005) also extended the fourth goal smart norms. Smart norms should be regarded as an abstract specification, because people need smart efforts to transform the abstract specification into a specific decision on what is appropriate or inappropriate in a given situation. For example, in order to adopt renewable energy as alternative energy for the purpose of environmental protection, people need to have a certain understanding of renewable energy knowledge

and understand the irreversibility of fossil energy to environmental damage, in order to further strengthen the acceptance of renewable energy technology for the purpose of environmental protection.

The three goal frames of goal frame theory are very consistent with the popular theories and models in environmental psychology, but the latter usually focus on only one motivation (Lindenberg & Steg, 2007). For example, the Norm Activation Model (NAM) is used to examine the role of prosocial motivation in consumer decision-making responsible for the environment(H. Han, 2014), and the altruism of this prosocial motivation can be explained by NAM(Schwartz, 1977), which is consistent with normative goal. Theory of Planned Behavior (TPB) has been widely used to predict people's pro-environmental behavior (M.-F. Chen & Tung, 2014; Paul et al., 2016). TPB theory assumes that individuals are motivated by self-interest: they will choose the most profitable alternative rather than the lowest-cost one, that is, consumers are willing to act environmentally friendly for their own benefit. This is also consistent with the value orientation of gain goal. The theory related to emotions pays attention to the role of individual feeling, which is consistent with the goal of hedonic.

In the context of environmental behavior, environmental behavior is indeed caused by a variety of motivations. A large number of studies have also shown that the single application of NAM or TPB is not enough to explain green behavior intention(Y. Liu et al., 2017; X. Zhang et al., 2018). TPB is considered that individual behavior intention is positively influenced by self-interest and social recognition, while NAM revolves around individual environmental motivation and pro-social altruism.

Therefore, based on the goal framework theory, this paper cooperatively integrates the key elements and objectives between TPB and NAM, and puts forward a comprehensive framework for the acceptance of renewable energy technology. The three factors in the TPB model are used as the intermediary variables of environmental concern, renewable energy knowledge and perceived risk, and government trust is used as the moderating variable of perceived risk and attitude, perceived behavior control and renewable energy technology acceptance intention. The acceptance intention of China's public renewable energy technology is studied. The theoretical model research
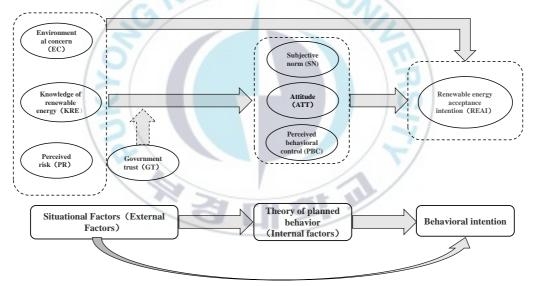
Figure III-1 Theoretical model research framework

framework of this study is shown in Figure III-1.

3.2 Research hypothesis

3.2.1 Impact of TPB factors on renewable energy acceptance intention

TPB has been adopted by many researchers and is regarded as a useful model for

exploring individual behavior intention and actual behavior (Chau & Hu, 2001; Hamilton & White, 2008). TPB assumes three predictors of intention, namely, Attitude (ATT) to behavior, Subjective Norms (SN) and Perceived Behavior Control (PBC) to predict the relationship between each determinant and behavior intention. We will introduce the impact of the three intention factors of TPB on the public's intention to accept renewable energy one by one.

3.2.1.1 Influence of SN on renewable energy Acceptance Intention

The term "subjective norm" is defined as "perceived social pressure to perform or not to perform the act" (Ajzen, 1991). SN capture how individuals feel about the social pressure they feel about a particular behavior (Paul et al., 2016). These social pressures may come from the influence of others who are close / important to individuals, such as "family, close friends, colleagues or business partners" (H. S. Park, 2000). Therefore, to a certain extent, consumers who have positive subjective norms on specific behavior are more likely to have a positive impact on the relevant behavior intention (M.-F. Chen & Tung, 2014). In the context of marketing and consumer behavior, many studies regard subjective norms as an important determinant of intention. In the formation of customers' intention to visit the green hotel, it is also confirmed that subjective norms have a positive impact on behavior intention (H. Han et al., 2010). Another study on consumers' willingness to pay for renewable energy confirms that there is a positive relationship between SN and willingness to pay for renewable energy (Irfan et al., 2020). Therefore, we make the following assumptions:

H1: There is a positive correlation between the subjective norms of the public and the acceptance intention of renewable energy technologies.

3.2.1.2 Influence of ATT on renewable energy Acceptance Intention

Attitude refers to "the degree of a person's positive or negative evaluation of relevant behaviors" (Ajzen, 1991). According to the research of (Ru et al., 2019), attitude is the main predictor of behavioral intention. Attitude is the psychological emotion transmitted through the evaluation of consumers. If it is positive, the behavioral intention is often more positive (M.-F. Chen & Tung, 2014). More specifically, in the context of green products, the positive relationship between attitude and behavioral intention has been established in many scenarios. (Van Birgelen et al., 2009) observed that if consumers have a positive attitude towards environmental protection, they prefer environmentally friendly beverage packaging. Consumer attitudes through positive feelings about specific products or brands and constructive image shaping will eventually prompt consumers to form ecological purchasing intentions (Thøgersen et al., 2015). In fact, in the context of green hotel research, many studies have determined that behavioral intention is positively influenced by attitude (M.-F. Chen & Tung, 2014; H. Han et al., 2010; Y. Kim & Han, 2010; Verma & Chandra, 2018). Based on the above literature, we propose the following hypotheses:

H2: There is a positive correlation between public attitude towards renewable energy and acceptance intention of renewable energy technology.

3.2.1.3 Influence of PBC on Renewable Energy Acceptance Intention

PBC is defined as "the degree of difficulty of perceiving executive behavior"

(Ajzen, 1991). As the third factor affecting behavior intention, PBC considers the individual's possession of necessary opportunities and resources (Madden et al., 1992), especially the perceived behavior constraints of personal consumption behavior, which cannot be well predicted only by behavior intention. PBC emphasizes the perception of the ability to control factors that may promote/restrict the processing of specific behavioral intentions. In the context of various green behavior research, it is confirmed that there is a positive correlation between PBC and behavior intention, such as the recycling of garbage behavior (Taylor & Todd, 1995a), green hotel choice behavior (H. Han et al., 2010) and organic food choice (Tarkiainen & Sundqvist, 2005). Therefore, based on the above literature, the following assumptions are put forward:

H3: There is a positive correlation between public perceived behavior control and renewable energy technology acceptance intention.

3.2.2 Impact of situational factors on renewable energy acceptance intention

Although the original TPB model has wide applicability to behavior prediction. However, some studies have also proved that by adding additional influencing factors to the TPB model, the explanatory power of the model for the prediction of specific behavior intention can be improved (H. Han & Kim, 2010; Kaiser & Scheuthle, 2003). Therefore, this study adds four situational factors: environmental concerns (EC), Renewable energy acceptance intention (REAI), perceived risk (PR) and government trust (GT) as the antecedents of the impact of TPB on behavioral intention.

3.2.2.1 Impact of EC on renewable energy Acceptance Intention

EC is defined as "the degree of people's understanding of environmental problems, and the degree to which they support efforts to solve these problems and/or express their willingness to make personal contributions to their solutions" (R. E. Dunlap & Jones, 2002). In recent years, in the green consumption behavior and the green energy consumption represented by renewable energy, the correlation between EC and willingness to pay or behavior intention has been confirmed many times. In a survey of Indian consumers' green product purchasing intentions, it not only confirmed that environmental concerns have a positive impact on green product purchasing intentions, but also had an indirect impact on purchase intentions through the mediation effect of TPB (Paul et al., 2016). (Bang et al., 2000) used the TRA theory to study the public's intentions of green energy consumption and also proved the mediating role of attitudes between environmental concerns and behavioral intentions. Another analysis on the purchase intention of green energy brands has obtained similar results. Environmental concern has a positive impact on the purchase intention through direct and indirect effects (Hartmann & Apaolaza-Ibáñez, 2012).

The growing public attention to the environment highlights the importance of studying this relationship. (Bamberg, 2003) in a survey of green power concern of college students, it is pointed out that the previous direct relationship between environmental attention and specific environmental-related behaviors was not significant because it was based on a false assumption that environmental attention should be It is a direct determinant of specific behaviors, and proves that environmental concerns indirectly affect behavior intentions through the three core variables of TPB.

The research of (M.-F. Chen & Tung, 2014) also found that the three core variables of TPB mediate the relationship between environmental attention and behavioral intentions. Environmental awareness, as a prior variable, has a positive impact on the three core variables of TPB. Therefore, based on the above research results, we propose the following hypotheses:

H4: There is a positive correlation between environmental concern and the acceptance intention of renewable energy technologies.

H4a: There is a positive correlation between environmental concern and public subjective norms.

H4b: There is a positive correlation between environmental concerns and public attitudes towards renewable energy.

H4c: There is a positive correlation between the public's environmental concerns and their perceived behavioral control of renewable energy.

3.2.2.2 Impact of REAI on Renewable Energy acceptance intention

Knowledge is an important structure in behavior research, and it plays a vital role in consumers' product purchase decisions (Kaplan, 1991). Knowledge is to understand something through learning, exercise and education, it is experience and wisdom (Liarakou et al., 2009). The acquisition of specific knowledge can also change the basis of people's opinions (Huijts et al., 2012). The research of (Molin, 2005) shows that people who have more knowledge about hydrogen as a fuel will think that the safety risk is less, and will also show a positive attitude towards the attitude of using hydrogen as fuel and the behavioral intention of using hydrogen fuel technology. Many studies

have shown that knowledge has a direct and indirect impact on behavioral acceptance intention. (S. Wang et al., 2018) pointed out in the investigation on the adoption intention of electric vehicles (EV) that the public's lack of corresponding knowledge is the main reason for the psychological barrier (PBC) to accepting electric vehicles, and its survey results support that the public's understanding of electric vehicles is significantly positively correlated with their attitude and willingness to adopt electric vehicles. (Pagiaslis & Krontalis, 2014) considered that consumers with a higher level of knowledge of renewable energy products are more likely to accept renewable energy products. (Stigka et al., 2014) also noted that public awareness and knowledge of wind power and related infrastructure may affect their acceptance of renewable energy development. It can be seen from the above literature that knowledge may affect public acceptance intention, may also affect information absorption, and cause obstacles to attitude and perceived behavior control, thus indirectly affecting behavior intention. Therefore, we propose the following assumptions:

H5: There is a positive correlation between renewable energy knowledge and the acceptance intention of renewable energy technologies.

H5a: There is a positive correlation between renewable energy knowledge and public attitude towards renewable energy technology.

H5b: There is a positive correlation between renewable energy knowledge and the public's perceived behavioral control of renewable energy.

3.2.2.3 Impact of PR on Renewable Energy acceptance intention

Perceived risk refers to the individual's perception of the uncertainty and possible

negative consequences of specific events or behavior. the individual's perception of the perceived risk depends on the probability of the occurrence of the risk and its possible loss (Jacobs & Worthley, 1999). Perceived risk is an important psychological variable in behavior research, which has an important impact on individual attitude and response. A large number of studies have found that perceived risk has a negative impact on attitude, perceived behavior control and behavior intention. (E. Park & Ohm, 2014) investigated the Korean public's views on renewable energy technology after the Fukushima accident, and the study found that perceived risk has a negative impact on the public's willingness to use renewable energy. (Yaqoot et al., 2016) also found the negative impact of perceived risk on public acceptance of renewable energy in its literature review on obstacles to the spread of renewable energy systems. In addition, it also emphasizes the intermittent characteristics of renewable energy (especially solar and wind energy), which has a negative impact on the public's perceived behavior control. More surveys on public acceptance of nuclear energy also emphasize that perceived risk is the biggest obstacle to acceptance of nuclear energy (Roh & Kim, 2017; Takebayashi et al., 2017). In this study, perceived risk is defined as an individual's concern about the stability of renewable energy power supply and the social risks brought to the society in the face of renewable energy as the source of power supply, as well as the worry about the increase in personal electricity costs caused by investment costs brought about by investment in renewable energy projects. Attitude, as one of the three core elements of TPB, has the most influence on behavioral intention, and perceived risk indirectly affects the public's acceptance intention of renewable energy

technology through the influence of attitude. Therefore, based on the above discussion, this paper puts forward the following assumptions:

H6: There is a negative correlation between public's perceived risk and the acceptance intention of renewable energy technologies.

H6a: There is a negative correlation between public's perceived risk of renewable energy and its attitude towards renewable energy.

H6b: There is a negative correlation between public's perceived risk and perceived behavioral control of renewable energy.

3.2.2.4 Impact of GT on Renewable Energy acceptance intention
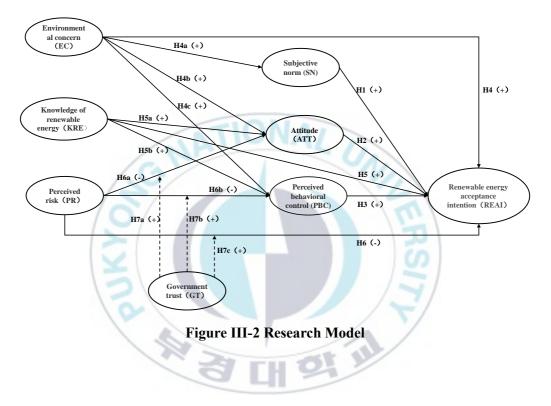
Trust is considered to be an important variable to mitigate perceived risk, which can better understand the perception of certain hazards and the acceptance of various technologies (Siegrist, 2021). When people know little about a technology, acceptance may mainly depend on the trust of the participants responsible for the technology. As a heuristic or alternative method, the general public may lack professional knowledge or only partially rely on their knowledge to determine the acceptability of some technologies or hazards requiring more attention. In the context of various risks, if knowledge is lacking, trust will be used to evaluate the benefits and risks related to hazards, and may ultimately affect the acceptance of technology (Siegrist & Cvetkovich, 2000). In recent years, trust has increasingly become a social problem. The reason may be that the public's concern about technology risks seems to have increased. The existing literature has found that the trust in technology regulatory authorities (replacing the government to perform relevant functions) will affect the public's views on the risks and

benefits of relevant technologies under multiple research backgrounds (Bronfman et al., 2012; Siegrist & Cvetkovich, 2000), such as in the carbon capture and storage acceptance survey (Huijts et al., 2007). The indirect role of social trust in the formation of universal acceptance is more prominent. Many studies have pointed out that trust indirectly affects the acceptance of technology through the regulation of perceived risk (Huijts et al., 2007). (Siegrist, 1999) proposed the trust causal chain account model, which points out that the acceptance of new technologies is affected by the relevant risk perception, and in turn, risk perceptions are affected by trust in institutions that supervise or propose to implement these technologies (Viklund, 2003). Therefore, based on the understanding of the above literature, the following assumptions are put forward:

H7a：Government trust positive moderates the relationship between the public's perceived risk of renewable energy technology and the perceived behavior control.

H7b：Government trust positive moderates the relationship between the public's perceived risks and attitudes towards renewable energy technologies.

H7c：Government trust positive moderates the relationship between the public's perceived risks and the acceptance intention of renewable energy technologies.

This research is based on the extended TPB model to study the Chinese public's intention to accept renewable energy technologies. Based on the above research hypothesis, the following research model is proposed, as shown in Figure III-2.

Figure III-2 Research Model

Ⅳ. Research Design and Pilot Study Analysis

Based on a detailed reading of relevant literature at home and abroad, this paper uses a combination of qualitative and quantitative research to verify the relationship between environmental concern, knowledge of renewable energy, perceived risk, government trust, attitude, subjective norm, Perceived behavioral control and renewable energy acceptance intention. This chapter mainly introduces the following three points: first, the research design, which gives an overall introduction to the research methods and objects, and describes the questionnaire design process; Second, adopt or adapt the mature measurement items of classical literature and translate it into the content of the items suitable for Chinese public understanding. Third, the measurement items of the questionnaire are having pilot study with a small sample to test its applicability in China, and its reliability and validity are preliminarily evaluated, and the items is modified according to its reliability and validity, and finally a formal questionnaire is formed.

4.1 Research design and measurement development

4.1.1 Research objects and research methods

In this study, the confirmatory theoretical test method is used to verify the hypothetical structure model based on empirical evidence (Henseler et al., 2016). Since all variables are latent variables, questionnaire survey method is used to collect data. According to (Chang & Krosnick, 2009), Internet-based data collection can be regarded as a feasible way to conduct representative sample surveys. And online questionnaire survey method has the advantages of saving survey time and cost, reducing

questionnaire data entry errors (Wright & Schwager, 2008), and easy to be obtained by individuals (S. Wang et al., 2019). The research object involved in this study is the Chinese public. In order to improve the universality of the sample, a nationwide sample collection was conducted. Firstly, an electronic questionnaire is established on the questionnaire star (www.wjx. CN) platform and an answer link is formed. In order to ensure the authenticity of the questionnaire information, the researchers made a commitment of "information confidentiality" and "data is only used for academic research" in the questionnaire guide.

This study uses structural equation modeling (SEM) methods to analyze survey data and test hypotheses. SEM, also known as latent variable path analysis, is a common method used in many behavioral and social sciences to represent the correlation (can be said to be "causality") in multivariable data (McDonald & Ho, 2002). The application of structural equation model (SEM) can not only estimate the unknown coefficient of causality between potential variables, but also specify how the observed variables represent the hypothetical structure (Jöreskog & Sörbom, 1989). In this study, spss26 and amos26 software packages are used to test whether the collected data are consistent with the proposed theoretical model. The research process is divided into three parts: 1) combined with the specific situation of this study, reasonably design the measurement items of variables and form the initial questionnaire; A formal questionnaire was formed through expert interview, pilot study analysis. 2) The empirical study of large sample data follows two research models of SEM (Hair, 2009). First, confirmatory factor analysis (CFA) was performed to test the quality and adequacy of the measurement

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model to ensure the reliability, convergent validity and discriminant validity of the studied structure. 3) Finally, the structural model is used to test the model fitting and hypothesis test(Anderson & Gerbing, 1988).

4.1.2 Questionnaire design

There are four main parts in the questionnaire. The first part is used to explain the research purpose of the survey, introduce the instructions for filling in the questionnaire, and thank the respondents for their participation. The second part is used to briefly introduce the concept of renewable energy and the development plan of renewable energy. The third part is used to collect the basic demographic information of respondents (such as gender, age, marital status, education level and monthly income). The last part is used to collect the construct data. The measurement items of the variables in this study adopted the maturity items used in the early research to ensure the validity of the content, and made appropriate corrections to adapt to the research background of the Chinese public's intention to accept renewable energy technologies. Perform three steps to refine the project to improve the accuracy of the measurement. First, select measurement items suitable for this research from authoritative journals, translate them into Chinese sentences, and strictly follow the back-translation process during the research process to avoid semantic differences and ensure the content validity of the scale (Brislin, 1970). Secondly, three professors and four graduate students who are familiar with renewable energy related information are selected to form a focus group to check the Chinese sentences of the measurement items to ensure that they are easy to read and understand. The process includes the following steps: first, two doctoral

students majoring in management translate the English items into Chinese; Secondly, another two doctoral students retranslated the translated Chinese items into English; Finally, three professors in this field are invited to check the three versions of the measurement items (i.e., original English measurement items, translated Chinese measurement items and back translated English measurement items). Finally, through the pilot study analysis, the measurement items are evaluated and improved to ensure the content validity (see Appendix I for the questionnaire).

4.1.3 Measurement development

According to the research hypothesis of this article, there are eight variables involved in the theoretical model, that is, Environmental concern (EC), Perceived risk(PR), Government trust(GT), Subjective norm (SN), Attitude(ATT), Perceived behavioral control (PBC) , Renewable energy acceptance intention(REAI). The definition of each construct in this paper as shown in Table IV-1.

Table IV-1 The definitions and description of constructs

Construct	Definitions
EC	The public's understanding of environmental problems and the extent to which they support efforts to solve these problems and / or express their willingness to make personal contributions to their solutions.
KRE	Public awareness and understanding of renewable energy technologies and advantages.
PR	The public's concern about the stability of renewable energy power supply and the social risks brought to the society, as well as the degree of concern about the rise of their own power consumption cost due to the investment cost of renewable energy projects.
GT	The Chinese public's trust in the national renewable energy development strategy formulated by the government or power regulatory agencies is specifically manifested in the public's recognition of the government's and power regulatory agencies' ability to develop and utilize renewable energy; Recognition of the government's determination to adjust the energy structure to promote environmental improvement; And believe the government can guarantee the security of energy supply and set reasonable energy prices.
SN	When the Chinese public accepts or does not accept renewable energy technologies, they face pressure and influence from society and other important people (family, close friends, colleagues or business partners).
ATT	The attitude of the Chinese public towards the adoption of renewable energy technologies; And the attitude towards the positive role of renewable energy in environmental improvement and carbon emission reduction.
PBC	The public has achieved personal control over the capabilities, resources, opportunities and other factors required to use renewable energy as an alternative energy source.
REAI	The intention of accepting renewable energy source as an alternative energy source.

According to the operational definition of each variable, referring to the existing maturity measurement items, and according to the opinions of the focus group

composed of three professors and four graduate students, this study designs the initial measurement items. In the setting of question answers, the respondents were asked to use the 5-point Likert scale to express their agreement / disagreement with the description of the measurement items, ranging from 1 to 5, in which the knowledge of renewable energy can be expressed in *very unfamiliar* (1) - *very familiar* (5), and the perceived risk can be expressed in *very impossible* (1) - *very possible* (5); The remaining environmental concerns, government trust, subjective norms, attitudes, perceived behavior control and renewable energy acceptance intention are expressed in *strongly disagree* (1) - *strongly agree* (5).

Since the latent variables in the structural equation cannot be obtained directly by measurement, the observed variables representing each potential variable must be set. According to the suggestion of (Shook et al., 2004), the observed variable of a latent variable is composed of at least 3 items. This study follows this principle to set the observation variables for each potential variable. The specific citation sources and measurement items of each scale are as follows.

(1) *Environmental concern* (EC)

The EC measurement includes six items, involving the public's concern about the living environment and Ecological catastrophe and limits, which are respectively taken from (R. Dunlap et al., 2000), (Paul et al., 2016), (Bang et al., 2000) used maturity measurement items. The 5-point Likert scale was used to express the respondents' agreement / disagreement with the description of the measurement items, ranging from *strongly disagree* (1) - *strongly agree* (5). EC5 is set as a reverse scored item, and the

score reverse processing is required in the data processing process, that is, *very unconcerned* (5) - *very concerned* (1). The specific measurement items are shown in Table IV-2.

Table IV-2 Measurement items of EC

Constructs	Item	Measurement item	Sources
Environmental concern（EC）	EC1	The earth is like a spaceship with only limited room and resources.	Dunlap, et al. (2000) Paul, et al. (2016) Bang, et al. (2000)
	EC2	Humans are severely abusing the environment.	
	EC3	If things continue on their present course, we will soon experience a major ecological catastrophe.	
	EC4	Major social changes are necessary to protect the natural environment.	
	EC5	The electric company should use less expensive energy even if the traditional energy may increase environmental pollution.	
	EC6	How concerned are you about water and air pollution in your city?	

Note: EC5 is a reverse scored item.

(2) *Knowledge of renewable energy* (KRE)

The KRE measurement includes five items, which are taken from (Bang et al., 2000) used maturity measurement items. The 5-point Likert scale was used to express the respondents' agreement / disagreement with the description of the measurement items, ranging from *very unfamiliar* (1) to *very familiar* (5). The specific measurement items are shown in Table IV-3.

Table IV-3 Measurement items of KRE

Constructs	Item	Measurement item	Sources
Knowledge of renewable energy （KRE）	KRE1	How knowledgeable are you about renewable energy?	Bang, et al. (2000)
	KRE2	How knowledgeable are you about wind-generated electricity?	
	KRE3	How knowledgeable are you about solar-generated electricity?	
	KRE4	How knowledgeable are you about biomass-generated electricity?	
	KRE5	How knowledgeable are you about the environmental impact of renewable and thermal power generation？	

(3) *Perceived risk* (PR)

The PR measurement items is adapted from (Hojnik et al., 2021) and (Bronfman et al., 2012), the perceived risk maturity measurement used in the study consists of four items. The 5-point Likert scale was used to express the interviewees' agreement / disagreement with the description of the measurement item, ranging from *very impossible* (1) to *very possible* (5). The specific measurement items are shown in Table IV-4.

Table IV-4 Measurement items of PR

Constructs	Item	Measurement item	Sources
Perceived risk（PR）	PR1	I am worried that the 100% renewable energy supply will be unstable, because wind and sun are not available at all times.	Hojnik, et al. (2021). Bronfman, et al. (2012).
	PR2	I am worried that renewable energy source can bring some unexpected additional costs in the future.	
	PR3	In general, how risky do you consider electricity generation from the use of renewable energy to be for society as a whole in China?	
	PR4	In general, how risky do you consider electricity generation from the use of thermal power to be for the environment in China?	

(4) *Government trust* (GT)

The GT measurement items is adapted from the maturity measurement of government trust used in the study by (Bronfman et al., 2012). The measurement consists of four items. The 5-point Likert scale was used to express the interviewees' agreement / disagreement with the description of the measurement item, ranging from *strongly disagree* (1) to *strongly agree* (5). The specific measurement items are shown in Table IV-5.

Table IV-5 Measurement item of GT

Constructs	Item	Measurement item	Sources
Government trust（GT）	GT1	I feel confident that the government has the competence to make good decisions related to electricity generation from renewable energy source.	Bronfman, et al. (2012).
	GT2	I feel confident that the government has the competence to properly assess risks and benefits related to electricity generation from renewable energy source.	
	GT3	I feel confident that the government has the competence to solve problems related to electricity generation from renewable energy source.	
	GT4	I feel confident that the government is concerned about safeguarding the interests of the citizens and the environment when it comes to assessing risks and benefits and regulating electricity generation from renewable energy source.	

(5) *Attitude* (ATT)

According to (Paul et al., 2016) and (Francis et al., 2004), four items, 5-point Likert type measurement items was used to measure attitudes towards renewable energy. The range is from *strongly disagree* (1) to *strongly agree* (5). The specific measurement items are shown in Table IV-6.

Table IV-6 Measurement item of ATT

Constructs	Item	Measurement item	Sources
Attitude（ATT）	ATT1	I have a favourable attitude toward use renewable energy source as an alternative energy source.	Paul, et al. (2016). Francis, et al. (2004).
	ATT2	Purchasing green is a good idea.	
	ATT3	I like the idea of use renewable energy source as an alternative energy source.	
	ATT4	To slow down the trend of climate warming, use renewable energy source as an alternative energy source is beneficial.	

(6) *Subjective norm* (SN)

The SN measurement items are adapted from (S. Wang et al., 2016) and (Francis et al., 2004) the subjective norm maturity measurement items used in the study. The measurement is composed of four items. The 5-point Likert scale was used to express the interviewees' agreement / disagreement with the description of the measurement item, ranging from *strongly disagree* (1) to *strongly agree* (5). The specific measurement items are shown in Table IV-7.

Table IV-7 Measurement item of SN

Constructs	Item	Measurement item	Sources
Subjective norm (SN)	SN1	Most people who are important to me think I should use renewable energy source as an alternative energy source in the near future.	Wang, S, et al. (2016). Francis, et al. (2004).
	SN2	People whose opinions I value would prefer that I use renewable energy source as an alternative energy source in the near future.	
	SN3	It is expected of me that I use renewable energy source as an alternative energy source to improve environmental pollution.	
	SN4	I feel under social pressure to use renewable energy source as an alternative energy source to improve environmental pollution.	

(7) *Perceived behavioral control* (PBC)

The PBC measurement items is adapted from the maturity measurement items of PBC used in (Paul et al., 2016), the measurement consists of three items. The 5-point Likert scale was used to express the interviewees' agreement / disagreement with the description of the measurement item, ranging from *strongly disagree* (1) to *strongly agree* (5). The specific measurement items are shown in Table IV-8.

Table IV-8 Measurement item of PBC

Constructs	Item	Measurement item	Sources
Perceived behavioral control (PBC)	PBC1	I have resources, time and Acceptance of renewable energy source.	Paul, et al. (2016).
	PBC2	I feel that Acceptance of renewable energy source is not totally within my control.	
	PBC3	If it were entirely up to me, I am confident that I will acceptance of renewable energy source.	

(8) *Renewable energy acceptance intention* (REAI)

The Renewable Energy acceptance intention measurement items is adapted from the maturity measurement items of behavioral intention used in (Paul et al., 2016) and (Hojnik et al., 2021). The scale consists of four items. The 5-point Likert scale was used to express the interviewees' agreement / disagreement with the description of the measurement item, ranging from *strongly disagree* (1) to *strongly agree* (5). The specific measurement items are shown in Table IV-9.

Table IV-9 Measurement item of REAI

Constructs	Item	Measurement item	Sources
Renewable energy acceptance intention （REAI）	REAI1	I will consider using renewable energy source because they are less polluting in coming times.	Paul, et al. (2016). Hojnik, et al. (2021).
	REAI2	I expect to use renewable energy source in the future because of its positive environmental contribution.	
	REAI3	renewable energy source is a good solution for environmental problems.	
	REAI4	I would encourage development of renewable energy source.	

(9) *Demographic characteristics measurement items*

In this study, the demographic characteristics of the respondents were designed as follows, which consists of five items, namely, gender, age, education, marital status and monthly income. The specific measurement items are shown in Table IV-10.

Table IV-10 Demographic characteristics measurement items

Demographic Characteristics	Category
Gender	Male
	Female
Age	18–25 years old
	26–35 years old
	36–49 years old
	50–60 years old
	More than 60 years old
Educational level	Senior high school or below
	Associate bachelor degree
	Bachelor degree
	Master's degree
	PhD
Marriage	Single
	Married
Personal income- monthly (RMB)	Less than ¥2,500
	¥2,501–¥5,000
	¥5,001–¥10,000
	More than ¥10,000

Note: The standards of "Personal income- monthly" are According to the "Income and Consumption Expenditure of Residents in 2020" of the National Bureau of Statistics of China, the median per capita disposable income is taken as the starting amount.

4.2 Pilot study analysis

Before the formal questionnaire survey, the study obtains a certain number of samples through the questionnaire pilot study, and carries out preliminary data processing for each variable. The main purpose is to test the effectiveness of the questionnaire, and delete and correct the measurement items and problems according to the analysis results (Boudreau et al., 2001). The effectiveness evaluation of

measurement items mainly includes the evaluation of "reliability" and "validity" (Bock et al., 2005). Therefore, the reliability and validity evaluation and analysis of small samples in this chapter follow the following verification steps:

(1) Analyze the reliability of the items of the measurement items, delete items with Corrected Item-to-total correlation (CITC)<0.4 in the measurement items, and ensure that the total Cronbach's α coefficient of the measurement items can be improved after the items are eliminated, so as to improve the overall reliability of the measurement items;

(2) After eliminating the unreliable items of the measurement items, Kaiser Meyer Olkin (KMO) measure and Bartlett's test of sphericity were performed on each scale to ensure that the scale is suitable for factor analysis;

(3) The scale was analyzed by exploratory factor analysis to find out the number of factors affecting the construct and the correlation between each factor and the construct.

In the Pilot study of this study, a total of 130 questionnaires were distributed, of which 117 were collected, with a recovery rate of 90%. Through the arrangement of the questionnaire, delete the invalid questionnaire, 112 valid questionnaires, the effective rate of the questionnaire reached 86.2%.

4.2.1 Analysis of reliability and validity of pilot study

(1) *CITC and Cronbach's α measurement*

In this study, the initial questionnaire measurement model is composed of 8 latent variables, and 34 questions constitute the measurement items of these 8 variables.

Reliability analysis is used to evaluate the stability and consistency of measurement items for each potential structure. The criteria for deleting items are CITC and whether the elimination improves the corresponding Cronbach's α value (Parasuraman et al., 1988). Generally speaking, the items with CITC less than 0.40 will be eliminated (Y.-S. Wang et al., 2007). According to the suggestions of (Nunnally, 1994), the reliability coefficient Cronbach's α If the value is greater than 0.7, it meets the reliability requirements. Table IV-11 shows the CITC and Cronbach's α coefficient.

Table IV-11Reliability of constructs items

Constructs	Item	CITC	Cronbach's α If item is deleted	Cronbach's α
EC	EC1	0.688	0.795	0.836
	EC2	0.762	0.776	
	EC3	0.795	0.771	
	EC4	0.747	0.784	
	EC5	**0.028**	**0.917**	
	EC6	0.793	0.772	
KRE	KRE1	0.751	0.812	0.860
	KRE2	0.679	0.831	
	KRE3	0.774	0.806	
	KRE4	**0.418**	**0.897**	
	KRE5	0.803	0.798	
PR	PR1	0.680	0.797	0.842
	PR2	0.656	0.808	
	PR3	0.658	0.807	
	PR4	0.709	0.785	
GT	GT1	0.661	0.790	0.832
	GT2	0.662	0.787	
	GT3	0.689	0.776	
	GT4	0.636	0.799	

	ATT1	0.634	0.812	
	ATT2	0.683	0.791	
ATT	ATT3	0.679	0.792	0.839
	ATT4	0.688	0.788	
	SN1	0.740	0.850	
	SN2	0.761	0.841	
SN	SN3	0.679	0.872	0.882
	SN4	0.797	0.827	
	PBC1	0.799	0.842	
PBC	PBC2	0.771	0.868	0.893
	PBC3	0.806	0.835	
	REAI1	0.696	0.799	
	REAI2	0.670	0.810	
REAI	REAI3	0.678	0.807	0.846
	REAI4	0.686	0.803	

From Table IV-11, it can be seen that the Cronbach's α values of the eight potential variables of the initial measurement items are all above 0.80, which meets the reliability requirements of 0.7. This means that the reliability of the eight potential variables measurement is good. By checking the correlation between the items and the overall to eliminate irrelevant contents. in the EC measurement items, except that the CITC coefficient of EC5(0.028) is less than 0.4, the other five items EC1, EC2, EC3, EC4 and EC6 all meet the standard of CITC threshold above 0.4, and the Cronbach's α If item is deleted coefficient of EC5 is 0.917, which is significantly higher than the current Cronbach's α 0.836 of EC measurement items. Therefore, it is considered to delete the EC5 item in order to improve the Cronbach's α coefficient of the EC measurement items.

In addition, the five items in the KRE measurement items meet the criteria above the CITC threshold of 0.4, but considering if KRE4 is deleted that can improve the total

KRE Cronbach's α to 0.897. thus, we deleting KRE4 items. Then, after deleting the two inappropriate items EC5 and KRE4, we again verified the reliability of the two measurement items of EC and KRE. The results are shown in table IV-12.

Table IV-12 Reliability of after deleting items

Constructs	Item	CITC	Cronbach's α If item is deleted	Cronbach's α
EC	EC1	0.735	0.909	0.917
	EC2	0.809	0.895	
	EC3	0.815	0.893	
	EC4	0.791	0.898	
	EC6	0.794	0.897	
KRE	KRE1	0.778	0.864	0.897
	KRE2	0.731	0.881	
	KRE3	0.783	0.862	
	KRE5	0.792	0.859	

It can be seen from the results in table 4-12 that after deleting EC5 and KRE4, the CITC and Cronbach's α coefficient of the items of EC and KRE have been improved, and all meet CITC and Cronbach's α coefficient's threshold. The overall reliability coefficient of all 32 measurement items was 0.912. Therefore, the reliability results of the 8 potential variables in this study support the use of these 32 observation variables.

(2) *KMO and Bartlett's Test of Sphericity*

In order to determine whether the data are suitable for factor analysis, KMO and Bartlett's Test of Sphericity are needed before factor analysis to measure the sampling adequacy of individual variables to measure structural validity (Rajapathirana & Hui, 2018). Generally speaking, the overall KMO should be 0.6 or more, and the closer it is

to 1, it indicates that the data is more suitable for factor analysis (Azmi & Perumal, 2008; Hutcheson & Sofroniou, 1999). Bartlett's Test of Sphericity is used to verify that each variable is independent (N. Wang et al., 2018). The results are shown in Table IV-13. KMO statistical value 0. 824 > 0. 6; Bartlett's test of sphericity has an approval. Chi-square value of 2357.275, which is significant ($P > 0.000$), indicating that the data has good structural validity and is suitable for subsequent factor analysis.

Table IV-13 Pilot study's KMO and Bartlett's Test of Sphericity

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.824
Bartlett's Test of Sphericity	Approx. Chi-Square	2357.275
	df	496.000
	Sig.	.000

(3) *Exploratory factor analysis*

In this study, principal component analysis and Varimax rotation method were used for factor analysis to verify construct validity. Principal component analysis (PCA) is a multivariate analysis method, which is used to reduce a set of original variables and extract a small number of potential factors (principal components) to analyze the relationship between observed variables (Goloбočanin et al., 2004). Exploratory factor analysis was conducted on all 32 measurement scales using spss26 to obtain the factor load table of the measurement scale (Table IV-14). The matrix shows convergence after 6 iterations, and then the eight factors are named according to the actual situation.

Table IV-14 Rotated component matrix and variance explained

Items	Ingredient								Variance explained (%)
	1	2	3	4	5	6	7	8	
EC1	.734								29.608

Item	Loading	Loading	Loading	Loading	Loading	Loading	Loading	Variance
EC2	.785							
EC3	.801							
EC4	.770							
EC6	.858							
KRE1		.865						
KRE2		.834						
KRE3		.877						11.648
KRE5		.862						
PR1			.823					
PR2			.724					
PR3			.751					7.961
PR4			.733					
GT1				.773				
GT2				.821				
GT3				.820				5.997
GT4				.729				
SN1			.669					
SN2			.803					
SN3			.792					6.828
SN4			.789					
ATT1				.752				
ATT2				.790				
ATT3				.832				5.333
ATT4				.796				
PBC1					.859			
PBC2					.899			3.922
PBC3					.851			
REAI1						.723		
REAI2						.764		3.219
REAI3						.630		
REAI4						.634		
Total variance explained								**74.516**

Through the factor load table, we can see that the five items of EC all fall on factor 1, and the factor load is between 0.734 and 0.858; the four items of REA all fall on factor 2, and the factor load is between 0.834 and 0.877; the four items of PR all fall on factor 3, and the factor load is between 0.724 and 0.823; the four items of GT all fall on factor 5, and the factor load is between 0.729 and 0.821. All the four items of the SN fall on factor 4, and the factor load is between 0.669 and 0.803. The four items of ATT all fall on factor 6, and the factor load is between 0.752 and 0.832. The three items of PBC all fall on factor 7, and the factor load is between 0.851 and 0.899. The four items of REAI all fall on factor 8, and the factor load is between 0.630 and 0.764.

According to (Hair, 2009), it is suggested that factor loads less than 0.4 need to be deleted, because all items of each scale have factor loads of more than 0.6, which meets the standard and all items are retained. According to the suggestion of (Lederer & Sethi, 1991), the cumulative explanatory variance of the extracted common factors should account for more than 60% of the total variance, indicating that the common factors are acceptable. The cumulative explanatory effectiveness of the 8 common factors extracted in this study is 74.516%. Data analysis shows that the scale has acceptable construct validity. After the above procedures, we finally determined the questionnaire of the large sample test in this study.

V. Empirical Analysis and Hypothesis Testing

After literature research, theoretical analysis, questionnaire design and pilot study, this study uses a formal questionnaire to collect a large number of research data. In this chapter, the focus is to use spss26.0 and amos26.0 statistical analysis software to make an empirical analysis of the research data. Descriptive statistical analysis, reliability analysis, validity analysis, path analysis, hierarchical regression analysis and other data analysis methods are mainly used to make empirical analysis and hypothesis test on the obtained data.

5.1 Data collection

The research theme of this paper is the influencing factors of the Chinese public's acceptance intention of renewable energy technologies. In order to make the research more scientific and the conclusions are widely applicable, the collection of research samples pays attention to the diversity of sample demographic characteristics and regional dispersion. The data were collected by the way of distributing questionnaires on the Internet, and the questionnaires were published online through the questionnaire Star Network Survey platform (https://www.wjx.cn/). The respondents answered the questions on the network through the generated questionnaire links. The sample size required for this study is based on the recommendation of (Kline, 2015). There should be at least ten response cases for each item of the observation variable [205]. The formal questionnaire has 8 constructs and 32 measurement items (including 5 items of environmental concern, 4 items of renewable energy knowledge, 4 items of perceived

risk, 4 items of government trust, 4 items of subjective norms ,4 items of attitudes, 3 items of perceived behavior control and 4 items of renewable energy acceptance intention). Therefore, the ideal sample size designed in this study is 480 (=32×15) respondents. A total of 550 questionnaires were sent out in this formal questionnaire, and 513 valid questionnaires were finally recovered, with a recovery rate of 93.2%. Much higher than (Boomsma, 1987), the recommended value of at least 400 sample sizes recommended for structural equation modeling. The geographical distribution of respondents in this questionnaire covers 30 provinces in China and overseas. Limited by the researcher's location and their own resources and capabilities, the data are mainly concentrated in Hebei Province in terms of regional distribution. Hebei Province ranks third in China in the total installed capacity of renewable energy by 2018, second only to Inner Mongolia and Xinjiang, so the survey samples collected in this data are representative in the context of China. In addition, the purpose of this study is the influencing factors of public acceptance intention of renewable energy technology in the context of China, so the regional difference of acceptance intention of renewable energy is not the focus of this study. Therefore, it is decided to use the current data for empirical research and hypothesis testing. The collection and regional distribution of the questionnaire are shown in Table V-1.

Table V-1 Questionnaire collection and regional distributions

Province	Amount	Province	Amount
Hebei	250	Yunnan	8
Shandong	21	Shanghai	8
Guangxi	15	Jiangxi	8
Anhui	15	Gansu	7
Henan	14	Jilin	7
Beijing	14	Inner Mongoria	7
Guangdong	13	Shanxi	5
Shaanxi	13	Chongqing	4
Zhejiang	12	Tianjing	4
Sichuan	12	Ningxia	3
Hunan	11	Taiwan	3
Jiangsu	11	Guizhou	3
Fujian	10	Xinjiang	1
Heilongjiang	10	Qinghai	1
Liaoning	9	Overseas data	5
Hubei	9	**Total**	513

5.2 Descriptive statistical analysis

5.2.1 Demographic characteristics

Descriptive statistical analysis of the effective research data that has been obtained can clearly grasp the basic situation of the research object of this article -the Chinese public. The demographic characteristics of the sample in this study include: gender, age, education level, marital status, and monthly income. Specific sample characteristics are shown in *Table V-2*.

Table V-2 Demographic characteristics of the participants (N=513)

Demographic		Frequencies	Percent (%)
Gender	Male	207	40.35
	Female	306	59.65
Age	18-25	47	9.16
	26-35	165	32.16
	36-49	202	39.38
	50-60	59	11.5
	More than 60	40	7.8
Educational level	high school	62	12.09
	Associate degree	152	29.63
	Bachelor degree	215	41.91
	Master's degree	79	15.4
	PhD	5	0.97
Marital Status	Single	111	21.64
	Married	402	78.36
Monthly living expenses (RMB)	Less than 2500	36	7.02
	2501-5000	225	43.86
	5001-10000	163	31.77
	More than 10000	89	17.35

Note: The standards of "Personal income- monthly" are According to the "Main data of Chinese Household Survey in 2020" of the National Bureau of Statistics of China, the median per capita disposable income is taken as the starting amount.

It can be seen from Table V-2 that in terms of the composition of the overall sample, male respondents and female respondents accounted for 40.35% and 59.65% of the total sample size, respectively, with more females than males. In terms of age structure, the age group with the largest sample size is 36 to 49 years old, accounting for 39.38% of the total sample size, followed by samples from 26 to 35 years old, accounting for 32.16% of the total sample size, 50 years old to the sample sizes of 60 years old, 18 to 25 years

old, and over 60 years old accounted for 11.5%, 9.16% and 7.8% of the total sample size respectively. From the perspective of educational level, the educational level is divided into five educational levels: high school, college, undergraduate, master and doctor. Among them, the samples with high school education account for 12.09% of the total sample size, the samples with college education account for 29.63% of the total sample size, and the samples with bachelor education account for 41.91% of the total sample size, Master's degree and doctor's degree account for 15.4% and 0.97% of the total sample size respectively. From the distribution of marital status, married accounts for 78.36% of the total sample size, and single people account for 21.64% of the total sample size, which is roughly the same as the age distribution of this sample. In terms of monthly income level, it is based on the median per capita disposable income of 2019 in the "Main data of Chinese Household Survey in 2020" issued by China's National Bureau of Statistics (2500 RMB). The survey data show that the distribution of respondents' income level is roughly the same as that of China's average wage level in 2019, showing jujube core-like distribution characteristics. Among the four pre-set grades, they are lower than 2500, 2501-1000, 5001-1000, and higher than 10000. They account for 7.02% of the total sample size, respectively, 43.86% of the total sample size, 31.77% of the total sample size, 17.35% of the total.

Generally speaking, the survey data in terms of age, gender, education and other aspects, women are slightly more than men, young and middle-aged respondents aged between 20 and 55 are in the majority, and the number of samples with college education or above accounts for the absolute majority. It can be seen that the distribution status of

the sample can basically reflect the characteristics of China's population structure. Therefore, the sample data is representative and widely applicable.

5.2.2 Descriptive statistics of measurement items

This study conducted descriptive statistics on measurement items, mean, standard deviation, skewness, and kurtosis of EC, KRE, PR, ATT, SN, PBC, REAI and other variables. The specific results are shown in Table V-3. This study uses the covariance-based structural equation model (CB-SEM) method for empirical research and analysis. According to the suggestions of (Peng & Lai, 2012). CB-SEM usually requires a multivariate normal distribution of sample data. In order to satisfy the hypothesis of normality of CB-SEM data, this study first checks the normality of data by calculating kurtosis and skewness. According to (Hu & Bentler, 1999), the ideal range of skewness and kurtosis between -2 and 2 means that the data meet the normality requirements, while (Huang, 2005) provides a broader standard for testing the normality of sample data, which satisfies that the standard deviation is greater than 0.5. If the absolute value of skewness is less than 3 and the absolute value of kurtosis is less than 10, the sample obeys normal distribution. According to the statistical results, it is found that the distribution of each variable is more balanced, and the sample data is close to the normal distribution. it can be continued with the next stage of empirical analysis.

Table V-3 Descriptive statistics of measurement items

Construct	Items	Mean	Standard deviation	Skewness	Kurtosis
	EC1	3.93	1.096	-0.923	0.239
EC	EC2	4.22	0.951	-1.333	1.582
	EC3	4.02	0.977	-0.830	0.312

	EC4	4.12	0.899	-0.992	0.871
	EC6	4.00	1.000	-1.024	0.816
	KRE1	3.05	1.146	-0.146	-0.678
	KRE2	3.01	1.252	-0.204	-1.045
KRE	KRE3	3.32	1.154	-0.398	-0.532
	KRE5	3.09	1.238	-0.175	-0.922
	PR1	2.32	1.025	0.455	-0.186
PR	PR2	2.35	0.983	0.613	0.249
	PR3	2.53	1.100	0.383	-0.483
	PR4	2.19	0.963	0.682	0.403
	GT1	4.05	0.908	-1.072	1.504
GT	GT2	3.89	0.909	-0.776	0.793
	GT3	3.87	0.931	-0.698	0.555
	GT4	3.98	0.897	-0.875	0.947
	SN1	3.87	0.908	-0.770	0.860
SN	SN2	4.07	0.887	-1.122	1.747
	SN3	4.06	0.919	-1.096	1.384
	SN4	4.18	0.876	-1.153	1.522
	ATT1	3.96	0.919	-0.715	0.452
ATT	ATT2	4.19	0.846	-1.106	1.566
	ATT3	4.13	0.858	-1.103	1.802
	ATT4	4.17	0.849	-1.035	1.260
	PBC1	3.86	0.888	-0.427	0.007
PBC	PBC2	3.32	1.139	-0.391	-0.457
	PBC3	3.99	0.891	-0.704	0.539
	REAI1	4.14	0.811	-0.950	1.302
REAI	REAI2	3.96	0.937	-0.774	0.566
	REAI3	4.06	0.867	-1.045	1.594
	REAI4	4.26	0.794	-1.156	1.775

5.3 Analysis of the measurement model

In pilot study analysis, this research conducted an exploratory factor analysis of the measurement model, which preliminarily verified that the items of each latent variable have strong internal reliability, and the principal component analysis method proved that the items have good structural validity. In this part, the Researcher will use confirmatory factor analysis (CFA) to further estimate the reliability and validity of the model. Among them, the reliability index still uses Cronbach's α to indicate the internal reliability level of each measurement structure. Validity analysis is mainly from two aspects: convergence validity and discriminant validity.

5.3.1 Common Method Bias

Common method bias is often concerned in cross-sectional data studies, especially in the study in which respondents state their attitudes and intentions. According to (Bagozzi & Yi, 1990), Common method variance is defined as attributed to systematic measurement errors rather than the variance of the research structure represented by measurements, the deviation caused by common method variance is called common method deviation or single method deviation (Podsakoff, 2003). Since the latent variables discussed can rarely be measured directly, researchers need to measure the latent variables with the help of measurement items that reflect the concept. Therefore, the test of theoretical relations often depends on survey tools (Conway & Lance, 2010). Considering the single methodological nature and project characteristic effect of the study, this study uses Harman's method to test whether there is a common method deviation among the variables involved in the theoretical model. The method involves the following steps: first, exploratory factor analysis of all measurement items; second,

to extract the contribution rate of the first factor; third, the contribution rate of the first factor is compared with the reference value of 50%. If greater than 50% indicates that there is a common method deviation, if less than 50% indicates that there is no common method deviation (Harman, 1976). According to the above steps and criteria, an exploratory factor analysis was performed on the 32 items in this study, and the results are shown in Table V-4. Eight factors with characteristic roots greater than 1 are extracted from all the measurement items, and the number of factors is consistent with the number of variables in this study. Eight factors explain 72.609% of the total variance, and the first factor only explains 22.173% of the variance, which is below the 50% threshold standard. the results show that the common method deviation is unlikely to become a serious problem in this study.

Table V-4 Total variance explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	7.095	22.173	22.173	7.095	22.173	22.173
2	3.173	9.917	32.089	3.173	9.917	32.089
3	2.948	9.211	41.301	2.948	9.211	41.301
4	2.794	8.732	50.033	2.794	8.732	50.033
5	2.519	7.871	57.904	2.519	7.871	57.904
6	1.726	5.393	63.297	1.726	5.393	63.297
7	1.657	5.177	68.474	1.657	5.177	68.474
8	1.323	4.135	72.609	1.323	4.135	72.609

5.3.2 Reliability and Convergence Validity

Composite reliability (CR) and Cronbach's α are used to check the internal consistency of items in each construct, and convergence validity is estimated by using factor load and constructed average variance extraction (AVE) on the corresponding construction (Fornell & Larcker, 1981). The reliability and convergence validity index structure of each structure is shown in Table V-5. In this study, the following criteria were used to evaluate the convergence validity of the scale:

(1) The factor loading (λ) of all indicators should be significant and exceed the 0.5 threshold standard (Fornell & Larcker, 1981), and a value greater than 0.7 is interpreted as very good (Kang & Ahn, 2021);

(2) Composite reliability (CR) of the construct should exceed the minimum recommended threshold of 0.70 (Hair, 2009);

(3) Due to the measurement error of the construct, the average variance (AVE) extracted by each structure should be greater than the recommended value of 0.5 (Chin, 1998).

Table V-5 Construct reliability and convergent validity

Construct	Item	Standardized loading	S.E.	t-value	CR	AVE	Cronbach's α
EC	EC1	0.742					
	EC2	0.747	0.055	15.928***			
	EC3	0.754	0.056	16.078***	0.863	0.557	0.861
	EC4	0.740	0.052	15.786***			
	EC6	0.748	0.058	15.959***			
KRE	KRE1	0.788					
	KRE2	0.877	0.056	21.672***	0.901	0.696	0.901
	KRE3	0.867	0.052	21.421***			

	KRE5	0.801	0.056	19.481***			
PR	PR1	0.763			0.878	0.643	0.876
	PR2	0.857	0.056	19.293***			
	PR3	0.808	0.062	18.274***			
	PR4	0.775	0.055	17.504***			
GT	GT1	0.766			0.865	0.615	0.864
	GT2	0.824	0.060	18.077***			
	GT3	0.778	0.061	17.163***			
	GT4	0.767	0.058	16.934***			
SN	SN1	0.727			0.852	0.591	0.851
	SN2	0.831	0.065	17.130***			
	SN3	0.765	0.067	16.015***			
	SN4	0.750	0.063	15.710***			
ATT	ATT1	0.708			0.854	0.593	0.851
	ATT2	0.789	0.064	15.940***			
	ATT3	0.776	0.065	15.718***			
	ATT4	0.805	0.065	16.201***			
PBC	PBC1	0.874			0.907	0.766	0.899
	PBC2	0.864	0.050	25.206***			
	PBC3	0.887	0.039	26.097***			
REAI	REAI1	0.752			0.870	0.627	0.869
	REAI2	0.827	0.069	18.386***			
	REAI3	0.817	0.064	18.178***			
	REAI4	0.768	0.059	17.072***			

it can be seen from Table V-5, for potential variables, the index of reliability Cronbach's α is significantly higher than 0.7, and the Cronbach's α of 8 variables is between 0.851 and 0.901, indicating that the data have good internal consistency. In the test of convergence validity, the factor load, CR and AVE of all 8 variables met their respective evaluation criteria, and the t values were significant at the level of $p < .001$. Specifically, the factor load of the environmental concern variable is between 0.742 and

0.754, which is greater than the recommended threshold of 0.5. the values of CR and AVE are 0.863 and 0.557 respectively, and both meet the recommended threshold of CR > 0.754 and AVE > 0.5. The factor loading of renewable energy knowledge variables is between 0.788-0.877, CR and AVE are 0.901 and 0.696, respectively, which meets the recommended threshold standard. The factor loading of the perceived risk variable is between 0.763-0.857, and CR and AVE are 0.878 and 0.643, respectively. The factor loading of government trust variable is between 0.766-0.824, and CR and AVE are 0.865 and 0.615 respectively, which are greater than the corresponding recommended threshold. The factor loads values of the three TPB variables of subjective norm, attitude and perceived behavior control are between 0.708 and 0.887, the CR coefficient is between 0.852 and 0.907, and the AVE coefficient is between 0.591 and 0.766, all satisfying the corresponding recommended threshold standards. The factor loadings of renewable energy acceptance intention variables are distributed between 0.752 and 0.827. CR and AVE are 0.87 and 0.627, respectively, which are greater than the corresponding recommended thresholds. The above results confirm that all measurement items have strong convergence validity.

5.3.3 Discriminant validity

Discriminant validity refers to the degree to which two or more structures should not be related to each other in theory (De Leeuw et al., 2015). The discriminant validity is judged by diagonal matrix analysis. According to (Fornell & Larcker, 1981), the correlation between projects in any two structures should be lower than the square root of the average variance shared by projects in one structure. That is, the discriminant

validity of latent variables is supported by judging whether the square root of AVE of each potential variable located on the diagonal is greater than the correlation between structures (Paulraj et al., 2008). It can be seen from Table V-6 that the range of values on the diagonal is between 0.75 and 0.88, and the absolute value of each correlation coefficient under the diagonal is between 0.02 and 0.53. The results show that the square root of the AVE value is average Greater than the value of each correlation coefficient. This shows that the discriminant validity between the various variables is good.

Table V-6 Discriminant validity

Constructs	EC	KRE	PR	GT	SN	ATT	PBC	REAI
EC	**0.75**							
KRE	0.14	**0.83**						
PR	-0.15	-0.02	**0.80**					
GT	0.02	0.02	0.03	**0.78**				
SN	0.30	0.13	-0.21	0.02	**0.77**			
ATT	0.24	0.26	-0.13	-0.09	0.45	**0.77**		
PBC	0.11	0.07	-0.24	-0.03	0.38	0.41	**0.88**	
REAI	0.31	0.23	-0.31	0.04	0.51	0.44	0.53	**0.79**

From Table V-5 to Table V-6, it can be seen that the Environmental Concern Scale, Renewable Energy Knowledge Scale, Perceived Risk Scale, Government Trust Scale, Subjective Norm Scale, Attitude Scale, and Perceived Behavior Control Scale and the Renewable Energy Acceptance Intention Scale has good reliability and validity. This conclusion provides reliable measurement support for the hypothesis test in the next step.

5.4 Hypothesis testing

According to the research idea of this paper, the empirical test will be divided into four parts: the first part, the fitting test and analysis of the constructed structural model; The second part is a theoretical model with renewable energy acceptance intention as the dependent variable and environmental concern, renewable energy knowledge, perceived risk, subjective norms, attitude and perceived behavior control as the independent variables to verify whether the direct influence relationship between the variables. The third part, based on the hypothesis of this study, test whether the relationship between environmental concern, renewable energy knowledge, perceived risk, subjective norms, attitude and perceived behavior control and renewable energy acceptance intention variables is in line with the bivariate causality model. Verify the mediating role of various factors (subjective norms, attitudes, perceived behavior control) of the original TPB model between external situational factors (environmental concerns, renewable energy knowledge, perceived risk) and renewable energy acceptance intentions. The fourth part analyzes the moderating role of government trust between perceived risk and attitude, perceived behavior control, and willingness to accept renewable energy. The research design of hypothesis testing is shown in Figure V-1.

5.4.1 Analysis of the structural equation model

After completing the validity and reliability analysis of the measurement model, assessing the model by the goodness-of-fit metric is the main process that should be performed when interpreting the SEM results. In this study, the overall goodness of fit
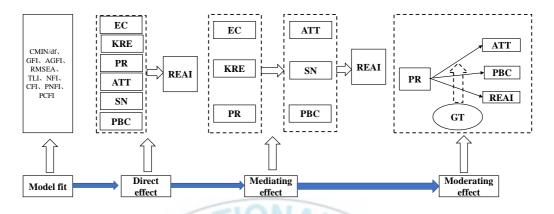
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Figure V-1 Research design of hypothesis test

of the developed model was examined with the help of AMOS 26.0. The overall goodness of fit of the model can be assessed using the chi-square test, which assesses the adequacy of a hypothetical model based on its ability to reflect the variance and covariance of the data (M.-C. Lee, 2009). Chi-square statistics (χ^2), as the most basic fitting index, its main problem is that it increases with the sample size and the number of indicators. Therefore, other fit indices must be considered to make a decision (Shi & Maydeu-Olivares, 2020). Therefore, the following fit indices and corresponding evaluation threshold criteria were selected in this study based on relevant literature recommendations to better assess the degree of goodness of fit of the model in this study(Bentler & Bonett, 1980; Dash & Paul, 2021; Hong, 2000; Schermelleh-Engel et al., 2003). The results of the fit indices and the acceptable threshold criteria selected in this paper are given in Table V-7. The results show that the hypothetical model proposed in this study is supported by adequate model fit.

Table V-7 Model fitting results and threshold of acceptance

Type	Index	Result	Threshold of Acceptance	Evaluation
	χ^2	.000	$p<.05$	Excellent
Absolute	CMIN/df	1.610	<3	Excellent
Fit	GFI	0.928	>0.90	Excellent
Measures	AGFI	0.912	>0.90	Excellent
	RMSEA	0.035	<0.08	Excellent
Incremental Fit	TLI	0.970	>0.90	Excellent
Measures	NFI	0.933	>0.90	Excellent
	CFI	0.973	>0.95	Excellent
Parsimonious Fit	PNFI	0.824	>0.50	Excellent
Measures	PCFI	0.860	>0.50	Excellent

5.4.2 Direct effects analysis

The final structural equation model for this paper was constructed using AMOS26 statistical software as shown in Figure V-2 based on the results of the previous tests of the degree of fit of the hypothetical model.

Figure V-2 Final model path

Furthermore, the structural equation model analysis is used to verify the relevant hypotheses of the influence between variables under the path of the theoretical model. Because the fitness of the final model constructed in this study is acceptable, the research hypothesis can be tested by the path coefficients in the model (Table V-8).

Table V-8 Final model path coefficient

Path	Point estimation	S.E.	ST-Estimate	t-value	p-value
ATT<---KRE	0.163	0.036	0.227	4.549	***
ATT<---EC	0.167	0.041	0.21	4.055	***
SN<---EC	0.263	0.043	0.322	6.092	***
PBC<---EC	0.085	0.048	0.089	1.779	.075
PBC<---KRE	0.052	0.041	0.061	1.263	.206
PBC<---PR	-0.232	0.049	-0.232	-4.679	***
ATT<---PR	-0.088	0.041	-0.106	-2.141	.032
REAI<---EC	0.093	0.035	0.131	2.687	.007
REAI<---KRE	0.079	0.028	0.124	2.82	.005
REAI<---PR	-0.115	0.033	-0.155	-3.445	***
REAI<---SN	0.237	0.042	0.271	5.607	***
REAI<---PBC	0.259	0.034	0.348	7.534	***
REAI<---ATT	0.124	0.042	0.139	2.951	.003

From the path coefficients between the variables in the above results, it is clear that the variables EC ($\beta = 0.131$, ST-Estimate, $p < .01$), KRE ($\beta = 0.124$, $p < .01$), PR ($\beta = -0.155$, $p < .001$), SN ($\beta = 0.271$, $p < .001$), PBC ($\beta = 0.348$, $p < .001$) and ATT ($\beta = 0.139$, $p < .001$) with the dependent variable REAI had a direct effect relationship in this study, and all were supported at the $p < .05$ level of significance.

In addition, there was also a direct effect relationship between dependent variable ATT and variables KRE ($\beta = 0.227$, $p < .001$), EC ($\beta = 0.210$, $p < .001$) and PR ($\beta =-0.106$, $p < 0.05$), and all of them were supported at the significant level of $p < 0.05$. The direct effects of dependent variable SN and variable EC ($\beta = 0.322$, $p < .001$), and dependent variable PBC and variable PR ($\beta =-0.232$, $p < .001$) were also supported at the significant level of $p < 0.001$. Therefore, all the verified hypotheses in the direct effects are shown in Table V-9.

Table V-9 Direct effect hypothesis test results

	Hypotheses	*t*-value	Result
H5a	There is a positive correlation between renewable energy knowledge and public attitude towards renewable energy technology.	4.550***	support
H4b	There is a positive correlation between environmental concerns and public attitudes towards renewable energy.	4.053***	support
H4a	There is a positive correlation between environmental concern and public subjective norms.	6.089***	support
H6b	There is a negative correlation between public's perceived risk and perceived behavioral control of renewable energy.	-4.676***	support
H6a	There is a negative correlation between public's perceived risk of renewable energy and its attitude towards renewable energy.	-2.141*	support
H4	There is a positive correlation between environmental concern and the acceptance intention of renewable energy technologies.	2.970**	support
H5	There is a positive correlation between renewable energy knowledge and the acceptance intention of renewable energy technologies.	2.353*	support
H6	There is a negative correlation between public's perceived risk and the acceptance intention of renewable energy technologies.	-2.535*	support
H1	There is a positive correlation between the subjective norms of the public and the acceptance intention of renewable energy technologies.	5.119***	support
H3	There is a positive correlation between public perceived behavior control and renewable energy technology acceptance intention.	7.455***	support
H2	There is a positive correlation between public attitude towards renewable energy and acceptance intention of renewable energy technology.	4.283***	support

A summary of the research hypotheses that were not supported by the path coefficient test is shown in Table V-10.

Table V-10 Summary of research hypotheses not supported

	Hypotheses	t-value	p-value	Result
H5b	There is a positive correlation between renewable energy knowledge and the public's perceived behavioral control of renewable energy.	1.263	.206	Not supported
H4c	There is a positive correlation between the public's environmental concerns and their perceived behavioral control of renewable energy.	1.779	.075	Not supported

5.4.3 The mediating effect analysis

In the direct effects analysis in the previous section, the results of the path coefficient test for the structural equations revealed three possible mediating effect paths.

(1) Environmental concerns (EC) influence renewable energy acceptance intentions (REAI) through attitudes (ATT), and subjective norms (SN), respectively;

(2) Knowledge of Renewable Energy (KRE) influences Renewable Energy Acceptance Intentions (REAI) through Attitudes (ATT);

(3) Perceived Risk (PR) influences Renewable Energy Acceptance Intention (REAI) through Attitude (ATT), Perceived Behavioral Control (PBC), respectively.

Therefore, this study will test these three paths one by one for mediating effects. According to the suggestion of related scholars, since the Bootstrap method does not

require the sampling distribution of indirect effects to satisfy the assumption condition of normal distribution, and scholars found that the Bootstrap method has the strongest statistical effect compared with other methods after simulation comparison (Cheung & Lau, 2008; Hayes, 2009; MacKinnon, 2012), therefore, this study used bootstrap method to verify the mediating effect. According to (Xu et al., 2020), mediating effects analysis was performed in two steps. First, it is tested whether the dependent and mediating variables are significantly influenced by the independent variables; secondly, further test whether the relationship between the dependent variable and the intermediary variable is significant. If the dependent variable is significantly influenced by the mediating variable and insignificantly influenced by the independent variable, it is called a full mediating effect. If the dependent variable has a significant relationship with both the mediating variable and the independent variable, it is called partial mediating effect. If the dependent variable or the mediator is not significantly influenced by the independent variable, there is no mediating effect. The results of the intermediate effect test are shown in Table V-11.

Table V-11 Mediating effect analysis

| Path | Effect types | ST-Estimate | Bootstrapping | | | |
| | | | Bias-corrected 95% CI | | Percentile 95% CI | |
			Lower	Upper	Lower	Upper
EC-->REAI	Total effect	0.278	0.122	0.434	0.118	0.431
EC-->REAI	Direct effect	0.131	0.017	0.240	0.017	0.240
EC-->SN-->REAI	Indirect effect	0.087	0.040	0.172	0.034	0.157
EC-->ATT-->REAI	Indirect effect	0.029	0.006	0.076	0.003	0.066
KRE-->REAI	Total effect	0.176	0.067	0.286	0.067	0.286
KRE-->REAI	Direct effect	0.124	0.028	0.227	0.027	0.227
KRE-->ATT-->REAI	Indirect effect	0.031	0.006	0.077	0.004	0.070
PR-->REAI	Total effect	-0.251	-0.394	-0.101	-0.390	-0.096
PR-->REAI	Direct effect	-0.155	-0.301	-0.016	-0.298	-0.011
PR-->PBC-->REAI	Indirect effect	-0.081	-0.150	-0.038	-0.138	-0.033
PR-->ATT-->REAI	Indirect effect	-0.015	-0.054	0.002	-0.047	0.005

From the above results, it can be seen that in the mediation pathway of EC-->REAI, the value interval of the Bias-corrected method and Percentile method of the three effects in Bootstrapping do not include 0, indicating that environmental concern on renewable energy acceptance intention has a significant direct effect. And environmental concern has a significant indirect effect on renewable energy acceptance intention through attitude and subjective norms. That is, attitudes and subjective norms play a partially mediating role in the EC---> REAI mediation pathway.

From the above results, we can see that in the mediation pathway of EC---> REAI, the interval of values of Bias-corrected method and Percentile method of the three effects in Bootstrapping do not include 0, indicating that renewable energy knowledge has a significant direct effect on renewable energy acceptance intention, and that

renewable energy knowledge has an indirect effect on renewable energy acceptance intention through the mediation of attitude. That is, attitudes play a partially mediating role in the KRE ---> REAI mediation pathway.

In the mediation pathway of PR---> REAI, perceived risk has a negative direct effect on renewable energy acceptance intention, and the value range of Bias-corrected method and Percentile method does not include 0. The mediating effect of perceived risk on renewable energy acceptance intention through perceived behavior control is significant. The ranges of values in Bias-corrected method and Percentile method are [- 0.150 and 0.038] and [- 0.138 and 0.033], neither of which includes 0, which means that perceived behavioral control play a partially mediating role in the PR---> REAI mediation pathway. However, in the mediation pathway PR--->ATT--->REAI, the interval of values in both Bias-corrected method and Percentile method includes 0, so this mediation pathway is not significant.

5.4.4 The moderating effect of government trust

In this section, the moderating effect of government trust will be tested. according to (P. Cohen et al., 2014), this study uses the method of hierarchical regression analysis to verify the moderating effect of government trust. The variables of three levels are gradually incorporated into the regression model, and whether the coefficient of the interaction term is significant or not is used to verify the existence of the moderating effect. The variables at the three levels of this study are: (1) control variables (sex, age, education, marital status, monthly income); (2) independent variables and moderating variables; and (3) interaction terms between independent variables and moderating

variables. In addition, in order to minimize the problem of multiple collinearities in the process of regression analysis, the researchers carried out mean centralization for all variables (including interactive terms) (Aiken et al., 1991). According to the theoretical model designed in this study (Figure V-3), this paper examines the moderating effect of government trust on perceived risk and attitude, the moderating effect of government trust on perceived risk and perceived behavior control, and the moderating effect of government trust on perceived risk and renewable energy acceptance intention.
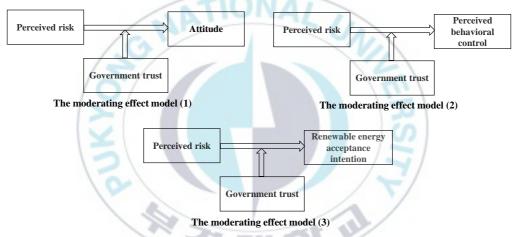

Figure V-3 The moderating effect model of government trust

(1) *The moderating effect of government trust on perceived risk and attitude.*

This study uses moderate hierarchical regression analysis to test the regulatory role of government trust between perceived risk and attitude through three hierarchical regression models. The results are shown in Table V-12.

Table V-12 The moderating role of GT in PR to ATT

Variable	Model 1		Model 2		Model 3		VIF
	β	t	β	t	β	t	
Gender	-.004	-.100	-.007	-.148	-.005	-.125	1.040
Age	.140	2.600*	.143	2.676**	.125	2.360*	1.533
Education level	.091	1.886	.088	1.844	.084	1.780	1.209
Marital Status	.044	.832	.046	.895	.045	.886	1.437
Monthly income	-.061	-1.293	-.061	-1.294	-.051	-1.101	1.191
PR			-.117	-2.695**	-.115	-2.663**	1.008
GT			-.080	-1.841	-.088	-2.031*	1.012
PR*GT					.156	3.613***	1.018
R^2	0.031		0.051		0.075		
Adjusted R^2	0.021		0.038		0.061		
ΔR^2	0.031		0.021		0.024		
$F(\Delta R^2)$	3.227**		5.495**		13.051***		

The results show that the regression coefficient of PR＊GT interaction term is significant ($\beta = 0.156$, $p < .001$), indicating that GT has a regulatory effect between PR and ATT. Further comparing the R^2 of model 2 and model 3 to analyze the moderating effect, the $F(\Delta R^2)$ value ($F = 13.051$, $p < .001$) of model 3 was significant (P. Cohen et al., 2014), indicating that government trust significantly mitigates the negative impact of perceived risk on public renewable energy attitude. Therefore, hypothesis H6a of this study was supported. In addition, the variance inflation factor (VIF) for each regression coefficient ranges from 1.008 to 1.533, which is well below the maximum acceptable threshold of 10 recommended by (Neter et al., 1996), indicating that no collinearity between variables.

In this study, based on the program described by (Aiken et al., 1991), an interactive diagram that is widely used to describe the interaction effect between the regulatory variable GT and the independent variable PR was created, the interactive diagram can intuitively show the control variable Trends of influence on the relationship between independent variables and dependent variables at different levels. Specifically, the researchers calculated the regression equation of the relationship between perceived risk and public attitudes towards renewable energy under high-level government trust and low-level government trust. Figure V-4 shows that under low government trust levels, Perceived risk and attitude are negatively correlated; with a high level of government trust, there is a positive correlation between perceived risk and attitude, that is, government trust eases the relationship between perceived risk and public attitudes toward renewable energy.
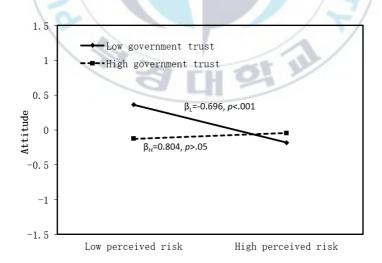

Figure V-4 Interaction effects plot (PR-ATT)

(2) *The moderating effect of government trust on perceived risk and perceived behavior control*

This study uses moderate hierarchical regression analysis to test the regulatory role of government trust between perceived risk and perceived behavior control through three hierarchical regression models. The results are shown in Table V-13.

Table V-13 The moderating role of GT in PR to PBC

Variable	Model 1		Model 2		Model 3	
	β	t	β	t	β	t
Gender	.098	2.26*	.094	2.216*	.095	2.271*
Age	.270	5.176***	.270	5.289***	.252	4.981***
Education level	.170	3.639***	.162	3.562***	.158	3.518***
Marital Status	-.034	-.673	-.027	-.541	-.028	-.569
Monthly income	-.041	-.897	-.050	-1.102	-.040	-.897
PR			-.213	-5.111***	-.210	-5.111***
GT			-.028	-.672	-.035	-.860
PR*GT					.157	3.813***
R^2	0.087		0.133		0.157	
Adjusted R^2	0.078		0.121		0.144	
ΔR^2	0.087		0.046		0.024	
$F(\Delta R^2)$	9.656***		13.413***		14.539***	

The results showed that the regression coefficient of PR*PBC interaction term was significant ($\beta = 0.157$, $p < .001$), indicating that GT has a moderating effect between PR and PBC. Furthermore, by comparing the R^2 of model 2 and model 3 to analyze the moderating effect, the $F(\Delta R^2)$ value ($F = 14.539$, $p < .001$) of model 3 was significant, assuming that H6b was supported. It shows that under the regulation of government

trust, the negative impact of perceived risk on public perceived behavior control has been significantly mitigates.

By constructing an interaction plot of the interaction effect between GT and the independent variable PR (Figure V-5), it can be seen that at lower levels of government trust, perceived risk is negatively related to perceived behavioral control (β=-0.696, p<.001); while at high levels of government trust, the relationship between perceived risk and perceived behavioral control tends to be positively related (β=0.036, p>.05), but the interaction The trend of the interaction effect was relatively flat, indicating that government trust moderated the relationship between perceived risk and perceived behavioral control to some extent.
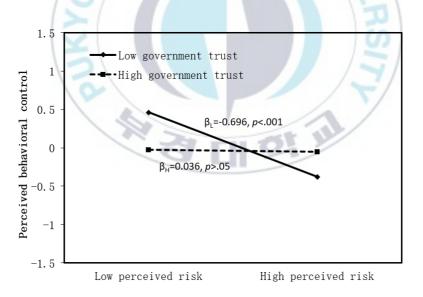

Figure V-5 Interaction effects plot (PR-PBC)

(3) *The regulating effect of Government Trust on perceived risk and Renewable Energy acceptance intention*

This study uses moderate hierarchical regression analysis to test the regulatory role of government trust between perceived risk and renewable energy acceptance intention through three hierarchical regression models. The results are shown in Table V-14.

Table V-14 The moderating role of GT in PR to REAI

Variable	Model 1		Model 2		Model 3	
	β	t	β	t	β	t
Gender	-.002	-.040	-.008	-.180	-.007	-.162
Age	.234	4.397***	.231	4.522***	.218	4.276***
Education level	.133	2.807**	.122	2.676**	.119	2.627**
Marital Status	-.035	-.682	-.024	-.486	-.025	-.504
Monthly income	-.103	-2.193*	-.120	-2.663**	-.113	-2.52*
PR			-.286	-6.892***	-.284	-6.886***
GT			.039	.933	.033	.809
PR*GT					.113	2.729**
R^2	0.053		0.135		0.148	
Adjusted R^2	0.044		0.123		0.134	
ΔR^2	0.053		0.082		0.013	
$F(\Delta R^2)$	5.688***		23.998***		7.448**	

The results showed that the regression coefficient of PR*GT interaction term was significant ($\beta = 0.113$, $p < 0.01$), indicating that GT has a significant moderating effect between PR and PBC. Furthermore, by comparing the R^2 of model2 and model3 to analyze the moderating effect, the $F(\Delta R^2)$ value ($F = 7.448$, $p < .01$) of model 3 was significant, assuming that H6c was supported. It shows that under the regulation of

government trust, the negative impact of perceived risk on public renewable energy acceptance intention has been significantly mitigates.

By constructing an interaction plot of the interaction effect between GT and the independent variable PR (Figure V-6), it can be seen that at lower levels of government trust, perceived risk is negatively related to renewable energy acceptance intention (β=-0.696, p<.001); while at high levels of government trust, the relationship between perceived risk and renewable energy acceptance intention tends to be positively related (β=0.804, p<.01), but the interaction the trend of the interaction effect was relatively flat, indicating that government trust moderated the relationship between perceived risk and perceived behavioral control to some extent
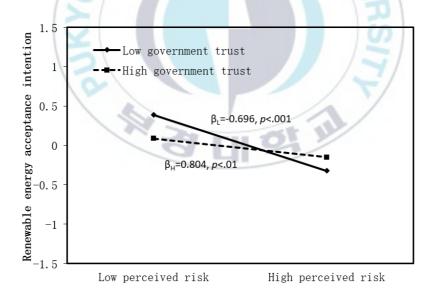

Figure V-6 Interaction effects plot (PR-REAI)

5.5 Results of data analysis

On the basis of the above analysis, this study tested each of the research hypotheses proposed in Chapter 3 through empirical analysis, and the specific hypothesis testing results are shown in Table V-15.

Table V-15 Summary of all hypothesis

Hypothesis	Hypothesis content	Test results
H1	There is a positive correlation between the subjective norms of the public and the acceptance intention of renewable energy technologies.	Support
H2	There is a positive correlation between public attitude towards renewable energy and acceptance intention of renewable energy technology.	Support
H3	There is a positive correlation between public perceived behavior control and renewable energy technology acceptance intention.	Support
H4	There is a positive correlation between environmental concern and the acceptance intention of renewable energy technologies.	Support
H4a	There is a positive correlation between environmental concern and public subjective norms.	Support
H4b	There is a positive correlation between environmental concerns and public attitudes towards renewable energy.	Support
H4c	There is a positive correlation between the public's environmental concerns and their perceived behavioral control of renewable energy.	No support
H5	There is a positive correlation between renewable energy knowledge and the acceptance intention of renewable energy technologies.	Support

H5a	There is a positive correlation between renewable energy knowledge and public attitude towards renewable energy technology.	Support
H5b	There is a positive correlation between renewable energy knowledge and the public's perceived behavioral control of renewable energy.	No support
H6	There is a negative correlation between public's perceived risk and the acceptance intention of renewable energy technologies.	Support
H6a	There is a negative correlation between public's perceived risk of renewable energy and its attitude towards renewable energy.	Support
H6b	There is a negative correlation between public's perceived risk and perceived behavioral control of renewable energy.	Support
H7a	Government trust positive moderates the relationship between the public's perceived risk of renewable energy technology and the control of perceived behavior.	Support
H7b	Government trust positive moderates the relationship between the public's perceived risks and attitudes towards renewable energy technologies.	Support
H7c	Government trust positive moderates the relationship between the public's perceived risks and the acceptance intention of renewable energy technologies.	Support

Summarizing the hypothesis test results, of the 15 research hypotheses proposed in this paper, 13 hypotheses are established after testing, and 2 hypotheses are not. Most of the hypotheses proposed in the research design have been verified in the empirical test. The final model formed by the research results is shown in Figure V-7.
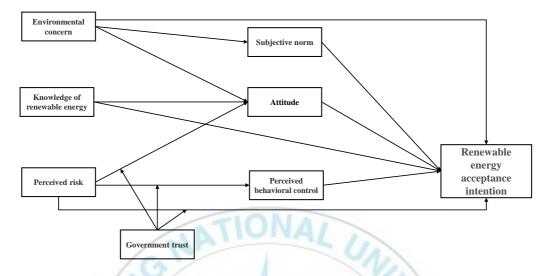
Figure V-7 Proven final theoretical framework

5.5.1 Results and Discussion

Exploring public acceptance intention of renewable energy technologies is a complex and multifaceted process, which is affected by many factors. Therefore, the purpose of this study is to explore the factors that affect the public's willingness to use renewable energy. Through the summary of previous studies, we propose an extended model based on TPB, which adds four new influencing factors (environmental concern, renewable energy knowledge, perceived risk, government trust) to the original TPB model. The hypothetical model was empirically analyzed by collecting 513 public sample data from different regions of China. The results show that the R^2 (0.403) of the theoretical framework model finally formed in this research exceeds (J. Cohen, 2013). It is recommended that the R^2 value should not be less than the threshold of 0.35. It shows that the explanatory variables constructed in this study have significant explanatory power for the outcome variable of public intention to accept renewable

energy. Therefore, in the next part of the discussion of results, the researcher will discuss the results of the study according to this logic:

(1) The relationship between attitude, subjective norm, perceptual behavior control and willingness to accept renewable energy in the original TPB model;

(2) The direct and indirect relationship between environmental concern, renewable energy knowledge, perceived risk and renewable energy acceptance intention;

(3) Moderating effect of government trust as a moderating variable on the relationship between perceived risk and attitudes, perceived behavioral control, and willingness to accept renewable energy.

(1) *The relationship between attitude, subjective norm, perceptual behavior control and willingness to accept renewable energy in the original TPB model*

The direct effect between the three influencing factors of TPB and the acceptance intention of renewable energy is tested by structural equation. The results show that the direct path coefficient of subjective norms on the intention of public acceptance of renewable energy (β=0.271, p<.01), indicating that subjective norms have a significant positive effect on the intention of acceptance of renewable energy, and the assumption that H1 is supported. The path coefficient (β=0.139, p<.01) of the direct effect of public attitude on the intention to accept renewable energy, indicates a significant positive relationship between the two, and hypothesis H2 is supported. And the direct effect path coefficient (β=0.348, p<.001) between perceived behavioral control and intention to accept renewable energy, has a significant relationship and hypothesis H3 is supported.

Further comparison of the magnitude of the path coefficients for each direct effect shows that perceived behavioral control has the highest degree of influence on renewable energy acceptance intention, followed by subjective norms, and finally attitudes. This result is interesting, as the third influencing factor in TPB theory, PBC has the highest effect on renewable energy acceptance intention in this study, and perceived behavioral control has a significant positive relationship with renewable energy acceptance intention. (Alam et al., 2014) in its research conclusions, it is also acknowledged that the strong influence of perceived behavior control indicates the importance of non-motivational factors in the individual's intention to use renewable energy. In addition, the control of perceived behavior is related to the external environment. As China currently implements regulatory measures on the electricity market on the electricity sales side, the general public cannot voluntarily choose whether the source of electricity comes from fossil fuels or green renewable energy. Therefore, based on the results of this study, the researchers believe that expanding the liberalization of the electricity market in the future can further promote the public's willingness to accept renewable energy.

The results of this study indicate that the role of subjective norms on the public's intention to accept renewable energy is positive and significant. Individuals' social pressure from friends and family members is more helpful in promoting the intention to accept renewable energy. Especially in a social and cultural atmosphere like China that pays more attention to collectivism, individuals' acceptance intention and willingness to use renewable energy are more likely to be affected by social pressure from the outside.

This result is also confirmed in the study of (Halder et al., 2010), compared with countries that emphasize individualism, the public in countries that emphasize collectivism is more susceptible to subjective norms.

In the results of this study, there is also a significant positive correlation between attitudes and renewable energy acceptance intentions, indicating that positive attitudes may promote the public's acceptance intentions for renewable energy. This conclusion is also supported by previous research conclusions. (Alam et al., 2014) it is found that environmental attitude and renewable energy knowledge are one of the main factors for the intentional use of renewable energy. A large number of research conclusions also show that internal factors such as attitudes may be affected by environmental concerns, and there is a significant positive correlation between environmental concern and the intention to use renewable energy (W. Liu et al., 2013; Yazdanpanah et al., 2015). And as an attitude of internal emotional motivation, it plays a more intermediary role between external factors and behavioral intentions (Rezaei & Ghofranfarid, 2018). This is also verified in the results of this study, and we will further explore the direct and indirect effects of external factors on the acceptance intention of renewable energy.

(2) *The direct and indirect relationship between environmental concern, renewable energy knowledge, perceived risk and renewable energy acceptance intention*

Firstly, the direct relationship between the three explanatory variables and the acceptance intention of renewable energy is analyzed. The structural equation is used to test the direct effect between environmental concern, renewable energy knowledge,

perceived risk and renewable energy acceptance intention. The results show that the direct path coefficient of environmental concern to the public's intention to accept renewable energy (β=0.131, P<.01), indicating that environmental concerns have a significant positive impact on renewable energy Acceptance Intention, and H4 is supported. The direct path coefficient of renewable energy knowledge to renewable energy acceptance intention (β=0.124, P<.01) indicates that there is a significant positive relationship between the two, and the hypothesis H5 is supported. The direct effect path coefficient between perceived risk and renewable energy acceptance intention (β=-0.155, P<.001) indicates that perceived risk has a significant negative impact on renewable energy acceptance intention. The greater the perceived risk, the greater the weaker the intention to accept renewable energy, the hypothesis H6 is supported.

Although this study did not propose the hypothesis of the three factors of TPB as mediating variables between the contextual factors and the intention to accept renewable energy, it was found that the path coefficients of the three direct effects are generally low, and it is considered that there may be a mediating path through the TPB factor. Therefore, the researchers used the Bootstrap method to examine the mediating effects of the three variables of TPB on environmental concern, renewable energy knowledge, perceived risk and renewable energy. The results show that in the intermediary path of EC---> REAI, the indirect effects of attitude and subjective norms in Bias-corrected method and Percentile method do not include 0, and there are two intermediary paths: EC---> ATT---> REAI, and EC---> SN--->REAI. It is generally believed that public

acceptance of renewable energy is strongly influenced by environmental concerns and generally increased environmental awareness. In the results of our survey, most of the respondents showed concern about environmental degradation and a positive attitude towards improving the current situation of the environment. These internal emotions are indirectly reflected in public support for renewable energy technologies through attitudes. According to (Karasmanaki & Tsantopoulos, 2019), their research also believes that students support renewable energy because of their concern for the environment and generally enhanced environmental awareness. In addition, the public recognizes that renewable energy technologies as a representative of green energy can reduce carbon dioxide and other greenhouse gases emitted by power plants into the atmosphere. Especially in recent years, there have been many extreme weather events caused by climate warming, such as the severe rainstorm that occurred in Zhengzhou, China in 2021 has given the public a more personal experience of the impact of climate warming.

It is precisely because more and more Chinese people pay attention to the environment and the resulting increased influence of green consumption behavior that individual subjective norms are greatly influenced. This is also reflected in the direct path coefficient of environmental concern and subjective norms in this study ($\beta = 0.322$ $p < .001$). The path coefficient is second only to the path coefficient of perceived behavior control on the acceptance intention of renewable energy ($\beta = 0.348, p < .001$), which is much larger than other direct effects Path coefficient. Therefore, based on this result, the researchers believe that increasing publicity on environmental protection and

the benefits of renewable energy to the environment through the media and other communication channels will help promote public Acceptance intention of renewable energy on a larger scale.

In the mediated path of KRE--->ATT--->REAI, the interval of values in the Bias-corrected method and Percentile method of indirect effects do not include 0, indicating that attitude plays a mediating role in renewable energy knowledge and renewable energy acceptance intention. It also shows that continuous technological innovation in society will bring uncertainty to public judgment. Renewable energy technology as an innovative energy technology, the general public lacks the necessary information and knowledge to objectively assess the true degree of risks and benefits brought by this complex technology. these are also actively reflected in the public attitude towards renewable energy technology, and then affect the acceptance intention of renewable energy. Therefore, in the process of promoting renewable energy technologies, the government should pay attention to the publicity of renewable energy technologies to avoid obstacles that hinder the acceptance of renewable energy due to insufficient public understanding of renewable energy (Kapassa et al., 2013). In particular, to strengthen the education and guidance of youth groups. According to (Longo et al., 2008), respondents did recognize the importance of promoting renewable energy policies and were willing to pay for such policies and the resulting benefits for future generations. This is particularly prominent in the Chinese social and cultural context, and the child factor is the primary driving factor for many Chinese consumers to make consumer behavior choices (X. Wang et al., 2021; Xu et al., 2020).

In the mediation path of PR---> REAI, the results of this study only support the existence of the mediation path of PR---> PBC---> REAI. Perceived risk has a significant negative effect on the path coefficient of perceived behavior control (β =-0.232, p < .001). In this study, our consideration of the public's perceived risk is mainly composed of the following two aspects: 1, lack of understanding of renewable energy technologies. Worry that because of cloudy days or not enough wind cannot to drive photovoltaic or wind power generation equipment; 2, worry about the installation of renewable energy power generation equipment or the use of renewable energy power will increase their daily electricity costs. In this study, perceived risk influences public intention to accept renewable energy through direct and indirect effects. In response to this finding, the researchers suggest that in addition to providing subsidy programs for the installation and use of renewable energy in the future promotion of small-scale renewable energy technologies, emphasis should be placed on educational guidance on renewable energy technologies and utilization pathways, such as in the use of new energy vehicles, which can well assume the function of energy consumption and storage of rich energy in the process of renewable energy generation.

(3) *Moderating effect of government trust*

In this study, moderate hierarchical regression analysis was used to determine whether there is a regulatory effect by investigating the significance of the coefficient of interaction between independent variables and regulatory variables. The results show that between PR and REAI, the regression coefficient of PR*GT (β = 0.113, p < .01), between PR and ATT, the regression coefficient of PR*GT (β = 0.156, p < .001), and

between PR and PBC, the regression coefficient of PR*GT ($\beta = 0.157$, $p < .001$). government trust had a significant positive moderating effect in all three direct paths, and hypotheses H7a, H7b, and H7c were supported. In other words, the higher the public trust in the government, the more positively the negative impact brought by perceived risks can be mitigated. This finding also shows that the complexity of technology in modern society is getting higher and higher, and the public's acceptance intention of new technologies generally depends on experts and authorities from the government and regulatory agencies to draw conclusions. Because the general public has low awareness of the risks and benefits of renewable energy, and the public's perceived risk has a significant negative impact on the intention to accept renewable energy. Therefore, the researchers suggest that governments and regulatory agencies need to publicize the advantages and environmental benefits of renewable energy technologies, in particular, to solve the problem of how to offset the cost of public money and environmental benefits (Ho et al., 2019). At the same time, targeted measures should be taken to reduce the perceived risks that are commonly feared by the public. For example, the government and regulators should develop stricter regulatory systems and response contingency plans to reduce public concerns about the stability of power supply. Adopt appropriate ways to provide information about these regulatory systems and contingency plans to the public to enhance their openness and transparency.

Ⅵ. Conclusion

The key to the stable economic development of any country depends on a reliable energy supply. Energy security is a key element of economic development and social stability, as it is the most fundamental factor input in all production processes. With the increasing trend of global warming, the use of renewable energy technologies as alternative energy sources has become a technological innovation activity with significant impact on the environment, public health and energy security. Household energy consumption is the most important link in the renewable energy supply chain. Understanding the factors that affect the public's acceptance of renewable energy technologies is of great significance to the government and regulatory agencies in the process of implementing specific power generation technologies. This study conducted a social survey on the intention of accepting renewable energy in China's specific national conditions and social and cultural backgrounds, in order to explore the factors that influence the intention of the Chinese public to accept renewable energy. This is of great practical significance to the "carbon neutral" energy strategy that China is currently actively implementing. Especially considering that there may be fundamental economic, environmental, cultural and social differences between different countries, especially between developing and developed countries.

6.1 Research conclusion

On the basis of previous studies, this study proposes a research framework based on TPB model extension. This paper studies the direct and indirect effects of

environmental concern, renewable energy knowledge, perceived risk and three factors in TPB model on renewable energy acceptance intention, as well as the regulatory effect of government trust on perceived risk. This paper puts forward the research hypothesis on the influence of Chinese public renewable energy acceptance intention, and draws the conclusion of this study through descriptive statistical analysis, reliability and validity analysis, correlation analysis, structural equation model and hierarchical regression analysis.

(1) Attitude, subjective norm and perceived behavior control have significant direct influence on the public's intention to accept renewable energy in China.

Since the theory of planned behavior (TPB) was proposed, it has been widely used in the prediction of various consumer behavior intentions and actual behaviors, and has been widely verified. This study takes the Chinese public as the research object and collects relevant data through questionnaires. Through empirical analysis, it is found that perceived behavior control, as the most important influence factor, has a significant positive impact on the Chinese public's intention to accept renewable energy. Perceived behavioral control is often related to external factors, and the public's concerns about the additional costs they will have to pay when accepting renewable energy, as well as concerns about the stability of renewable energy sources beyond their control, can indirectly influence the renewable energy acceptance intention through perceived behavioral control. Subjective norms also have a significant positive impact on renewable energy acceptance intentions, especially in a sociocultural context like China where collectivism is emphasized. Attitudes, as a third influencing factor, also have a

significant impact on the intention to accept renewable energy. The research results also found the mediating effects of attitudes, subjective norms, and perceived behavior control among environmental concerns, renewable energy knowledge, perceived risks, and renewable energy acceptance intentions. Therefore, this research finding also provides a more complete understanding of the formation mechanism of the Chinese public's intention to accept renewable energy. It is helpful to better predict the Chinese public's intention to accept renewable energy and control factors.

(2) Environmental concerns have a significant positive impact on the public's intention to accept renewable energy in China.

Renewable energy is one of the important solutions to alleviate climate warming. Therefore, the public's degree of concern for the environment and their attitudes towards environmental protection affect the acceptance of renewable energy to varying degrees. Previous studies have concluded that people in developed countries generally pay more attention to the environment than in developing countries. However, similar results were found in the results of this study. With the rapid development of China's economy, public environmental awareness and environmental concern have also increased rapidly. There is a significant positive impact between the environmental concern of the Chinese public and the acceptance intention of renewable energy. In addition, environmental concern, as an external factor, has a significant positive impact on attitude and subjective norms, but also indirectly affects the acceptance intention of renewable energy.

(3) The knowledge of renewable energy has a significant positive impact on the public's intention to accept renewable energy in China.

In this study, the researcher did a survey on the Chinese public knowledge of different types of renewable energy technologies. The survey results found that the Chinese public has a certain degree of knowledge of renewable energy technologies, but generally shows concerns about the intermittent nature of solar and wind power, which to some extent also affects the public's attitude towards renewable energy and the intention to accept. The results show that the more the Chinese public knows about renewable energy, the easier it is to accept renewable energy technology as an alternative energy. In view of the lack of public awareness of renewable energy, measures such as distributing brochures on the introduction of renewable energy technologies to the public and conducting public awareness activities in crowded places such as schools and parks can be taken to popularize public knowledge of renewable energy, to increase the willingness to accept renewable energy.

(4) Perceived risk has a significant negative impact on the Chinese public's intention to accept renewable energy.

The results of this study found that the Chinese public generally has a positive willingness to accept renewable energy technologies. The large-scale utilization of renewable energy technologies will not impose environmental damage on future generations, and relative to nuclear energy, it does not have disastrous and terrible consequences. This study sets the perceived risk as the public's concern about rising electricity costs and the stability of renewable energy power generation due to the acceptance of renewable energy. Under this definition, the findings show a significant negative effect of perceived risk on the intention to accept renewable energy and an

indirect effect on the intention to accept renewable energy through the mediator of attitude. In addition, the adequate configuration of energy storage facilities, as well as the ability of consumer terminals to consume electricity is an important part of renewable energy technology applications. The role of energy storage facilities in maintaining the security and stability of the power grid should be given full attention to ensure the stability of residents' electricity demand; in the future, it is also necessary to improve the public's ability to consume the surplus renewable energy generation through the popularization of new energy vehicles. By increasing the direct participation of the public, the public's concern about the perceived risk is reduced and the acceptance intention of renewable energy is improved.

(5) The moderating effect of government trust on perceived risk.

Government trust has a significant moderating effect on moderating the negative effects of perceived risk. The findings found that in the Chinese social context, the public is more likely to be positively influenced by trust in government, and that government trust significantly moderates the negative effects of perceived risk on attitudes, perceived behavioral control, and renewable energy acceptance intentions. At the government level, more stringent regulatory systems and safety standards should be established, renewable energy power plants should be regulated and emergency plans should be made. For the perceived risk of the public, the perceived risk of the public should be reduced by improving the degree of public participation and the transparency of the policy. In particular, we should give a positive and rapid response to the negative public opinion trends of renewable energy technology, so as to avoid hindering the

acceptance intention of renewable energy due to the information asymmetry of public knowledge about renewable energy. With the help of the authoritative role of the government and regulators, let the public realize that their voices have been heard, and their hopes and concerns have been fully addressed.

6.2 Research contribution

6.2.1 Theoretical contribution

This study explores the impact of external situational factors and internal TPB factors on the Chinese public's intention to accept renewable energy, and examines the role of the corresponding intermediary mechanism and moderating mechanism.

(1) Based on the social acceptance theory of renewable energy and the goal framework theory of directing environmental behavior, the theory of planned behavior is introduced into the study of Chinese public's intention to accept renewable energy technology. it enriches the theoretical support and research situation of the planned behavior theory model on the influence mechanism of behavior intention, and provides a new theoretical framework and support for the follow-up research. The research on the intention of consumers' green consumption behavior by using the theory of planned behavior has been carried out in a number of national samples. the research on the acceptance intention of renewable energy has also been widely related to the local cultural background in various countries. However, it is not easy to apply the results of research conducted in one country to another and may lead to biased conclusions (Bronfman et al., 2012). In particular, given that there may be fundamental economic, environmental, cultural and social differences between different countries, the results of

the study may not be replicable. In this study, a survey on the intention to accept renewable energy was conducted with the Chinese public as a research sample. The results obtained enrich the research results on renewable energy acceptance intentions and provide reliable findings in the Chinese research context.

(2) Based on the basic framework of the TPB model, the public's cognitive factors and environmental emotional factors are introduced into the TPB model, and a new and expanded TPB model is constructed, which expands the research framework of TPB model on the mechanism of renewable energy technology acceptance intention.

This study also takes the three controlling factors of the TPB model as the intermediary variable between the external situational factors of the public and the acceptance intention of renewable energy technology for the first time, and introduces the government trust as the regulating variable. The results show that the final theoretical model proposed in this study has a good explanatory power to the Chinese public acceptance intention of renewable energy, which has a R^2 of 40.3%. It shows that the addition of the four factors of environmental concern, renewable energy knowledge, perceived risk and government trust has important theoretical significance for a more accurate understanding of the intention of the Chinese public to accept renewable energy technology.

6.2.2 Practical significance

Renewable energy is an important part of low-carbon energy supply in the future, which can effectively optimize the energy structure and balance the contradiction between supply and demand. The Chinese government's massive renewable energy

development and energy efficiency improvements are combined with end-use electrification, which is essential for successful energy transformation and reduction of energy-related carbon dioxide emissions. The Chinese government plans to achieve its ambitious goal of "carbon neutrality" by 2060. Therefore, when the government implements a large-scale renewable energy development and utilization plan, there is an urgent need to link the policies on the demand side and the supply side so as to gain public support for renewable energy technology. this is very important to guide the transformation of energy consumption on the demand side, technological upgrading and the expansion of the public's cognitive boundaries of renewable energy. Based on this purpose, this study examines the Chinese public's viewpoint of renewable energy and the factors that affect the acceptance intention of renewable energy. it also discusses the influence mechanism between environmental concern, renewable energy knowledge, perceived risk, government trust, attitude, subjective norms, perceived behavior control and public acceptance intention of renewable energy. The results of this study provide important implications for the Chinese government and regulators to improve public acceptance of renewable energy and to promote the development of renewable energy in China.

6.3 Limitations of the research and suggestions for future research

6.3.1 Limitations of the research

Although this study is a useful exploration of the factors influencing the public's intention to accept renewable energy in China. However, in the research, restricted by uncontrollable factors such as research time, funds and capacity, and there are still some limitations that need to be acknowledged and paid attention to.

First of all, this study only depends on the cross-sectional data and the data collected by the questionnaire. Although a lot of preparatory work has been done on the content validity and internal consistency of the questionnaire, the collected data will inevitably be affected by the subjective bias of the interviewees.

Second, this study only focuses on the influence and mechanism of action of external contextual factors and TPB model factors on the public's intention to accept renewable energy in China. The difference of the impact of demographic characteristics on the intention of public acceptance of renewable energy is not analyzed.

6.3.2 Suggestions for future research

The study of the public's intention to accept and willingness to pay for renewable energy has become a hot topic of research in different disciplines, but the research on Chinese public renewable energy acceptance intention is still in its infancy. hereby, the researcher puts forward the following two suggestions for future research:

First, it is suggested to further refine the study of the Chinese public sample, to clarify the differentiated characteristics of the Chinese public under different demographic characteristics through specific data support. In the future research, it can also take the characteristics of consumer behavior under the Chinese social and cultural background as the context to study the influence mechanism of consumer behavior on the public's intention to accept renewable energy. This will have a certain positive significance for enriching the research on the green consumption behavior system of the Chinese public.

Second, China has a vast territory, and the resource endowment and the level of economic development in different regions show a great imbalance. The western region is rich in wind and solar energy resources, but the level of economic development is lower than that in the eastern region. Therefore, taking into account the differences in resource endowments and the degree of economic development in different regions, the public's acceptance of renewable energy and influencing factors should also be different. In addition, in this study did not distinguish between urban and rural characteristics, while socio-economic characteristics, such as knowledge, education and income, may show different characteristics due to urban and rural areas. All these are worthy of in-depth research and discussion in the future.

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Research on influencing factors of Chinese public renewable energy acceptance intention: based on theory of planned behavior approach

Xin-Cheng Meng

Graduate School of Management of Technology

Pukyong National University

Abstract

Renewable energy is an important part of low-carbon energy supply in the future, and it is also one of the solutions to alleviate global climate warming. The diffusion of renewable energy is a society-oriented process. In this process, personal views play an important role, which directly affects the public acceptance of renewable energy and is a key factor in the development of renewable energy，contribute to the use and spread of renewable energy. As the country with the largest carbon dioxide emissions in the world, China accounts for 27.2% of global emissions. From the perspective of volume and growth trends, China's carbon emissions control will have a key impact on global carbon emissions trends. In China, the energy consumption terminal represented by the household sector generates a huge amount of carbon dioxide emissions due to energy consumption, which is much larger than that of other sectors. Although the proportion of renewable energy technologies in China's energy structure is increasing, it is uncertain whether the Chinese public understands renewable energy technologies, and there is a lack of

investigation and Research on the acceptance of renewable energy technologies. Therefore, this study aims to explore the factors that influence the Chinese public's willingness to use renewable energy.

Firstly, this article uses the method of bibliometrics to search the keywords such as planned behavior theory, green consumption behavior and renewable energy on Scopus database, and makes a bibliometric analysis of 1397 related literatures from 1991 to 2021 by using CiteSpace software. It also reveals the characteristics and trends of the research theme affecting the public acceptance intention of renewable energy technology from the aspects of research popularity, influential contributors in this field, research hotspots and research frontiers, knowledge clustering and so on.

Based on the summary of previous research, this paper proposes an extended model based on the theory of planned behavior (TPB), adding four new influencing factors (environmental concerns, renewable energy knowledge, perceived risk, government trust) to the original TPB model. On the basis of literature review, this study uses the maturity measurement items of classical article which has been rigorously translated into a questionnaire suitable for the Chinese public context. The questionnaire was distributed online, and a total of 513 public sample data from different regions of China are collected.

This study adopts confirmatory theory testing methods, and conducts empirical analysis on the hypothetical structural model constructed based on empirical evidence using structural equation modeling (SEM). The results show that the R^2(0.403) of the theoretical framework model finally formed in this study shows that the explanatory variables constructed in this study have obvious explanatory power for the outcome variables of public renewable energy

acceptance intentions.

Specifically, this article focuses on evaluating and comparing the direct and indirect relationships between environmental concerns, knowledge of renewable energy knowledge, perceived risk, and renewable energy acceptance intentions, as well as the moderating role of government trust. The results show that perceptual behavior control, subjective norms and attitudes significantly and positively affect the acceptance intention of renewable energy, and perceptual behavior control is the main influencing factor. In addition, there are significant direct and indirect effects between environmental concerns, renewable energy knowledge, perceived risk, and renewable energy acceptance intentions. The three factors of TPB play the role of intermediary variables in the indirect effects. Regarding the moderating effect of government trust, the results of this study found that government trust can significantly alleviate the negative impact of public perception risk on attitudes, perceived behavior control, and renewable energy acceptance intentions. Based on the empirical results, the impact and future research directions are also discussed.

Keywords: Renewable energy; Theory of planned behavior; Bibliometric analysis; Environmental concern; Renewable energy acceptance intention; Chinese public
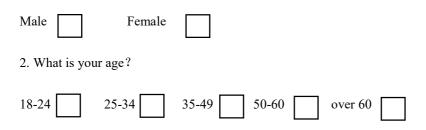
Appendix

MS / MR:

Hello! Thank you for being so generous with your time to complete this survey! I am a doctoral student at PUKYONG NATIONAL UNIVERSITY of South Korea. I am conducting a survey on the public's intention to accept renewable energy technologies. The survey object is the potential users of renewable energy technologies, and this survey will be completely anonymous and confidential to ensure the security of your personal information. The data collected will only be used for academic research and will not be used commercially. There are no right or wrong answers. Please answer the questions according to your situation. This questionnaire contains 39 questions and is expected to take about 7 minutes.

Renewable energy is not only one of the globally recognized tools to effectively mitigate climate change, but also one of the main tools to achieve the goal of "carbon neutralization" in China. Therefore, the development of renewable energy technology is an important part of China's long-term energy strategy. It is of great significance for the promotion of this innovative energy technology to understand whether the public supports or opposes the renewable energy technology.

For research purposes, we define renewable energy technology as technologies that use renewable and almost inexhaustible resources to generate energy, such as hydroelectric power, photovoltaic power generation, wind power generation, biomass energy generation and so on.

Basic information

1. What is your gender？

Male ☐   Female ☐

2. What is your age？

18-24 ☐   25-34 ☐   35-49 ☐   50-60 ☐   over 60 ☐

3. What is your educational level？

Senior high school or below ☐   Associate bachelor degree ☐

Bachelor degree ☐   Master's degree ☐   PhD ☐

4. What is your marital status?

Single ☐   Married ☐

5. What is your monthly income？

Less than ¥2,500 ☐   ¥2,501–¥5,000 ☐   ¥5,001–¥10,00 ☐   More than ¥10,000 ☐

The first part: Situational Factors

Please select the score you think is appropriate between Strongly disagree (1 point) and Strongly agree (5 points) according to your judgment, and mark the selected option in the box "□").

Item	Measurement item	5-point scale
EC1	The earth is like a spaceship with only limited room and resources.	Strongly disagree(5)，Disagree(4)，Unsure(3)，Agree(2), Strongly agree(1)
EC2	Humans are severely abusing the environment.	
EC3	If things continue on their present course, we will soon experience a major ecological catastrophe.	
EC4	Major social changes are necessary to protect the natural environment.	
EC5	The electric company should use less expensive energy even if the traditional energy may increase environmental pollution.	
EC6	How concerned are you about water and air pollution in your city?	Very unconcerned (5), Unconcerned (4), Unsure (3), Concerned (2), Very concerned (1)

Note: EC5 is a reverse scored item.

Please select the score you think is appropriate between Very unfamiliar (1 point) and Very unfamiliar (5 points) according to your judgment, and mark the selected option in the box "□").

Item	Measurement item	5-point scale
KRE1	How knowledgeable are you about renewable energy?	
KRE2	How knowledgeable are you about wind-generated electricity?	
KRE3	How knowledgeable are you about solar-generated electricity?	very unfamiliar (1), unfamiliar (2), Unsure (3), familiar (4), Very familiar (5)
KRE4	How knowledgeable are you about biomass-generated electricity?	
KRE5	How knowledgeable are you about the environmental impact of renewable and thermal power generation？	

Please select the score you think is appropriate between Very impossible (1 point) and Very possible (5 points) according to your judgment, and mark the selected option in the box "□").

Item	Measurement item	5-point scale
PR1	I am worried that the 100% renewable energy supply will be unstable, because wind and sun are not available at all times.	
PR2	I am worried that renewable energy source can bring some unexpected additional costs in the future.	Very impossible (1), Impossible (2), Unsure (3), Possible (4), Very possible (5)
PR3	In general, how risky do you consider electricity generation from the use of renewable energy to be for society as a whole in China?	
PR4	In general, how risky do you consider electricity generation from the use of thermal power to be for the environment in China?	

Please select the score you think is appropriate between Strongly disagree (1 point) and Strongly agree (5 points) according to your judgment, and mark the selected option in the box "□").

Item	Measurement item	5-point scale
GT1	I feel confident that the government has the competence to make good decisions related to electricity generation from renewable energy source.	
GT2	I feel confident that the government has the competence to properly assess risks and benefits related to electricity generation from renewable energy source.	Strongly disagree(5)，Disagree(4)，Unsure(3)，Agree(2), Strongly agree(1)
GT3	I feel confident that the government has the competence to solve problems related to electricity generation from renewable energy source.	
GT4	I feel confident that the government is concerned about safeguarding the interests of the citizens and the environment when it comes to assessing risks and benefits and regulating electricity generation from renewable energy source.	

The second part: TPB Factors

Please select the score you think is appropriate between Strongly disagree (1 point) and Strongly agree (5 points) according to your judgment, and mark the selected option in the box "□").

Item	Measurement item	5-point scale
ATT1	I have a favourable attitude toward use renewable energy source as an alternative energy source.	
ATT2	Purchasing green is a good idea.	Strongly disagree(5)，Disagree(4)，Unsure(3)，Agree(2), Strongly agree(1)
ATT3	I like the idea of use renewable energy source as an alternative energy source.	
ATT4	To slow down the trend of climate warming, use renewable energy source as an alternative energy source is beneficial.	

Please select the score you think is appropriate between Strongly disagree (1 point) and Strongly agree (5 points) according to your judgment, and mark the selected option in the box "□").

Item	Measurement item	5-point scale
SN1	Most people who are important to me think I should use renewable energy source as an alternative energy source in the near future	
SN2	People whose opinions I value would prefer that I use renewable energy source as an alternative energy source in the near future	Strongly disagree(5)，Disagree(4)，Unsure(3)，Agree(2)，Strongly agree(1)
SN3	It is expected of me that I use renewable energy source as an alternative energy source to improve environmental pollution.	
SN4	I feel under social pressure to use renewable energy source as an alternative energy source to improve environmental pollution.	

Please select the score you think is appropriate between Strongly disagree (1 point) and Strongly agree (5 points) according to your judgment, and mark the selected option in the box "□").

Item	Measurement item	5-point scale
PBC1	I have resources, time and Acceptance of renewable energy source.	
PBC2	I feel that Acceptance of renewable energy source is not totally within my control.	Strongly disagree(5)，Disagree(4)，Unsure(3)，Agree(2)，Strongly agree(1)
PBC3	If it were entirely up to me, I am confident that I will acceptance of renewable energy source.	

Please select the score you think is appropriate between Strongly disagree (1 point) and strongly agree (5 points) according to your judgment, and mark the selected option in the box "□").

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Item	Measurement item	5-point scale
REAI1	I will consider using renewable energy source because they are less polluting in coming times.	Strongly disagree(5), Disagree(4), Unsure(3), Agree(2), Strongly agree(1)
REAI2	I expect to use renewable energy source in the future because of its positive environmental contribution.	
REAI3	Renewable energy source is a good solution for environmental problems.	
REAI4	I would encourage development of renewable energy source.	

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