***CONSUMERS' ATTITUDE AND ACCEPTANCE LEVEL FOR DISTRIBUTED PHOTOVOLTAIC POWER GENERATION INVESTMENT AND P2P POWER TRADING***

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## Overview

With the increasingly serious resource crisis and environmental pollution, achieving sustainable development is an important goal of our current economic and social development. The photovoltaic industry makes full use of solar energy, a clean and safe new energy source, and plays an important role in promoting the adjustment of energy structure and effectively transforming energy consumption. From "Global PV Demand Forecast 2020" released by IHS Markit, it can be seen that compared with last year, the new solar installed capacity is expected to increase by 14% this year, and by 2020, the global new solar installed capacity will reach 142GW. International Energy Network analyzed the latest photovoltaic installations in 23 countries and found that in the new photovoltaic installation statistics in 2019, the top five countries are China, the United States, India, Japan, and Vietnam. At the same time,it also shows that the solar installed capacity outside China will continue to maintain double-digit growth this year. Statistics show that in 2018, the penetration rate of photovoltaic power generation in countries around the world was lower than 10%, and some countries reached 7-8%, while China was only 2.6%, which is still in a low position. This shows that the potential of China's photovoltaic market is still great. As the main body of the adoption of solar photovoltaic power generation and P2P power trading, the public’s attitudes and willingness to adopt distributed solar photovoltaic power generation and P2P power transactions system directly affect the speed of development of photovoltaic power generation. Therefore, it is particularly necessary to carry out research on public attitudes, willingness to adopt solar photovoltaic power generation system on the roof and P2P power trading.

## Methods

In this study, a modified Technology Acceptance Model (TAM) is adopted to investigate the public attitudes and intension of househoders for investing distributed solar photovoltaic power generation and P2P power transactions system in China. The original version of TAM was applied in social psychology to information systems by Davis in his Ph.D thesis [1], in which, usability perception and usefulness perception are very important influencing factors in explaining the user's acceptance and use of information systems [2]. Some external variables affect users’ attitudes and behavioral intent to use information systems and behavioral intentions directly affect the actual use of information systems by users.

For more than 20 years, scholars have done a lot of researches on TAM, and verified its effectiveness in terms of explanatory ability or theoretical simplicity [3] [4]. In 2000, Venkatesh et al. proposed a technology acceptance extension model (TAM2) based on TAM [5]. In 2008, they further improved the TAM2 model and established the TAM3 theoretical framework [6]. In the TAM3 model, four dimensions affect usability perception and usefulness perception: individual differences, system characteristics, community influence, and convenience. Compared with TAM and TAM2, TAM3 is both comprehensive and potentially operable. Limited to the effect of the research, domestic research has rarely paid much attention to TAM3 [7]. As a statistical technique that integrates factor analysis and linear model regression analysis, structural equation model(SEM) can effectively identify and verify the causal relationship model [8], and its factor identity test can verify the model stability among different samples. In recent years, more and more studies have found that the SEM is easier to consider the relationship between the influencing factors in the case of multiple observation variables. The biggest advantage of the SEM method compared to the logistic regression analysis method is that it can process multiple dependent variables at the same time, and allows the explanatory variable and the interpreted variable to contain measurement errors. This error is included in the model for analysis, making its estimation results more accurate [9-10].

In this study, near 300 household samples are collected in Beijing involving 87 households in Beijing that have actually installed distributed solar photovoltaic power generation systems and more than 200 random households samples without distributed solar photovoltaic power generation systems as a control group. Based on a detailed survey of consumers 'perceived usefulness, perceived ease of use, perceived risk, and their individual characteristics, consumers' attitudes and willingness to adopt solar photovoltaic power generation and P2P power transactions are quantified. And using SEM to analyze the impact of consumers' perceived usefulness, perceived ease of use, and perceived risk on the adoption willingness of Solar PV and P2P Power Transactions. In the study, the measures of perceived usefulness (PU) include subjective norm and image, the measures of perceived ease of use include self-efficacy, perception of external control and perceived enjoyment, measures of perceived risk are performance risk,financial risk, time risk, social risk and security risk.The research results will help the government understand consumers’ attitudes towards solar photovoltaic power generation and P2P power trading better, and provide effective scientific basis for the government to increase the installed capacity of distributed solar photovoltaic power generation systems and use solar energy efficiently.

## Results

The results of the research show that subjective norm and image increase consumers' willingness to adopt distributed solar photovoltaic. self-efficacy, perception of external control and perceived enjoyment increase consumers' willingness to adopt distributed solar photovoltaic by affecting their perceived ease of use. Results showed that the perceived risk factors involving the performance risk and financial risk and security risk are the determinants for consumers to refuse investing the distributed solar photovoltaic generation system on the roof. Therefore, this article puts forward relevant suggestions to improve consumers' willingness to adopt the technology, and then improve the utilization efficiency of solar energy resources in China.

## Conclusions

In this study, from the perspective of consumers' attitudes towards investing distributed solar photovoltaic power generation and P2P power trading, the modified technology acceptance model is proposed and a new theoretical framework is built. The “perceived risk” variable is introduced into the model to build a consumer acceptance level model of distributed solar photovoltaic power generation systems based on TAM3 theory. Subjective norm, self-efficacy, perception of external control, perceived enjoyment, perceived risk are determinants for adopting the distributed PV generation system. Results shown that unitl now, the the consumer's acceptance level is still low and a lot of douts and concerns are expressed seriously consumers on the whole. The results of empirical analysis verified the main hypotheses proposed in this paper. Moreover, subjective norm and image improve consumer’ acceptance by positively affecting consumers' perceived usefulness of the system. The results show that pressure perceived from society and consumers’ vanity help maintain their social image, improve the usefulness of the system perceived by consumers, and ultimately increase the level of consumers’ acceptance. The results show that the ability of consumers, the resources and assistance provided by the outside can reduce the difficulty of consumers in using the system, and then increase the level of consumer acceptance of the system. In addition, perceived ease of use helps consumers to simply and quickly use the system to complete power generation.While bringing more benefits to consumers, it can increase consumers' perceived usefulness and thus increase their willingness to adopt the system. Finally, the perceived risk can positively affect consumers' perceived risk, which in turn increases their willingness to adopt in terms of performance, time, financial, and security increase the perceived risk of the system to consumers, and thereby these risks reduce signifiantly the level of consumers’ acceptance level.

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