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Consumers' Acceptance of Renewable Energy In Pakistan: An End User's Perspective

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Abstract

This study aimed to assess the consumer acceptance of renewable energy in Okara district, Pakistan, and identify the factors influencing its adoption. A quantitative research design was employed, with a sample size of 384 households selected using systematic sampling. The questionnaire included sections on demographics, attitudes, perceptions, and acceptance scales related to renewable energy. Data collection involved self-administered surveys and face-to-face interviews. The collected data were analyzed using descriptive statistics, frequency distribution, and regression analysis. The findings revealed positive perceptions and acceptance of renewable energy among consumers in Okara district, with respondents recognizing its potential for environmental impact reduction, energy security improvement, and economic growth. The study identified factors influencing acceptance and highlighted barriers and opportunities for renewable energy adoption. This research contributes to the limited knowledge on consumer acceptance of renewable energy in Pakistan, providing insights for policymakers, energy stakeholders, and local communities to promote its widespread adoption and contribute to a sustainable energy future in Okara and Pakistan as a whole.

Key Words: Academic Performance, Institutional Environment, Internet Addiction, Intervention Strategies, Peer Influence, Social Factors

Introduction

Internet The energy sector plays a critical role in the economic growth and development of any country. In Pakistan, the demand for energy has been rapidly increasing due to population growth, urbanization, and industrialization. Unfortunately, the country has been facing an energy crisis for the past two decades, severely impacting its economic growth and social well-being. Currently, Pakistan heavily relies on non-renewable sources of energy like oil, gas, and coal, which are not only expensive but also environmentally harmful. To address this, renewable energy has emerged as a sustainable, clean, and cost-effective alternative. Pakistan has started exploring renewable energy options such as solar, wind, hydropower, and biomass. However, the level of acceptance of renewable energy among end-users, particularly households, is not well understood in Pakistan. This study aims to assess consumers' acceptance of renewable energy in Pakistan from an end-user's perspective.

Pakistan's energy crisis stems from a lack of investment in the energy sector, outdated infrastructure, and mismanagement. The demand for electricity in Pakistan is expected to grow by 8% annually, necessitating the addition of at least 7,000 MW of electricity each year to meet the rising demand (National Electric Power Regulatory Authority, 2021). At the moment, Pakistan's energy mix heavily relies on non-renewable sources, which make up 87% of the total and only 13% of renewable energy sources (Pakistan Energy Yearbook, 2020). Due to Pakistan's advantageous geographic and climatic conditions, renewable energy has a lot of potential. The nation enjoys a lot of sunshine, making it one of the best places in the world for solar energy production. Additionally, coastal areas, particularly in Sindh province, have favourable wind resources for the production of wind energy. Hydropower and biomass energy both have significant potential in Pakistan.Pakistan has set an ambitious goal to obtain 30% of its energy mix from renewable sources by 2030 in recognition of this (Pakistan Energy Yearbook, 2020). The establishment of net metering regulations, the creation of the Alternative Energy Development Board (AEDB), and the release of the Renewable Energy Policy 2019 are just a few of

the actions taken by the Pakistani government to promote renewable energy. Regulations known as "net metering" enable individuals and organisations to produce their own electricity from renewable sources and sell any excess electricity back to the grid. The Renewable Energy Policy 2019 seeks to create a conducive environment for renewable energy investments in Pakistan, while the AEDB is in charge of the development and promotion of renewable energy in Pakistan. Despite these initiatives, Pakistan still faces difficulties in getting end users, particularly households, to accept renewable energy. The adoption of renewable energy technologies necessitates both significant financial investments and behavioural adjustments. Therefore, it is essential to comprehend the elements that affect Pakistani consumers' acceptance of renewable energy. This study aims to evaluate end-user perceptions of consumers' acceptance of renewable energy in Pakistan.It will examine the variables that affect household adoption of renewable energy technologies and pinpoint the difficulties in doing so. The results will support the development of strategies by policymakers and energy sector stakeholders to encourage household adoption of renewable energy in Pakistan.

Literature Review

Pakistan has a lot of potential for renewable energy, especially wind and solar power. According to Waheed et al. (2018), Pakistan has one of the best climates in the world for the production of solar energy with an average of 8 to 9 hours of sunlight per day. Strong wind resources are present in the coastal areas, particularly in Sindh, as proven by the accomplishment of wind energy projects. Numerous studies have looked into Pakistan's adoption of renewable energy sources. According to Aziz and Mahmood (2019), adoption of renewable energy was primarily influenced by consumer awareness, income, education, and environmental concerns. They suggested stepping up awareness campaigns, expanding financial options, and enacting supportive legislative measures to encourage the use of renewable energy. Similar to this, Mubeen et al. (2017) identified the main obstacles to the uptake of renewable energy in Pakistan as being financial limitations, a lack of government support, awareness and education gaps, and technical difficulties. To Achieved these obstacles, they suggested stepping up awareness campaigns, expanding the availability of funding, and creating supportive government regulations. Renewable energy use is still in its infancy in Pakistan, although factors driving its adoption and potential have been identified. The difficulties in deploying renewable energy in the country have been examined in a number of studies. According to Hussain et al. (2018), the main barriers to renewable energy deployment in were a lack of government support,funding and technical expertise. According to Ahmad and Batool (2019), the main barriers to renewable energy deployment in Pakistan are lack of government support, inadequate infrastructure, financial constraints and lack of technical expertise. The potential and use of renewable energy in Pakistan has been reviewed by Shahbaz et al. examined. (2018), who also pointed out opportunities and difficulties for the growth of the sector. They found that while Pakistan has significant renewable energy potential, there are significant barriers due to a lack of government support, technical expertise and infrastructure. The status, potential, policies and institutional framework of renewable energy in Pakistan have been reviewed by Asif et al. examined in detail.(2017). They found that Pakistan has great potential for renewable energy, particularly wind and solar power. However, the growth of renewable energy is limited by the lack of a clear policy framework, poor institutional architecture and financial constraints. To remove these obstacles, they proposed creating a clear political framework and institutional structures. Khan et al. (2017) examined Pakistan's investment and entrepreneurial climate for renewable energy and the challenges and solutions that it faces. They concluded that the main obstacles were a lack of government support, inadequate funding, and a lack of technical expertise, and they suggested remedies like policy changes, financial incentives, and capacity building programmes. The potential of renewable energy for sustainable development in Pakistan was examined by Ali and Nawaz (2018). They discovered that renewable energy held enormous promise for resolving Pakistan's energy crisis and pursuing sustainable development objectives.They did, however, also emphasise financial In Pakistan, a major obstacle to the adoption of renewable energy is financial constraints. The high upfront costs related to buying and installing renewable energy systems are out of reach for many consumers. Further impeding adoption are the limited financing options and frequently high interest rates for renewable energy projects. Financial difficulties were named as one of the main obstacles to the uptake of renewable energy in Pakistan by Mubeen et al. (2017). In a similar vein, Hussain et al. (2018) discovered that insufficient

financing was a significant obstacle to the deployment of renewable energy in Pakistan. Financial difficulties were mentioned as one of the main obstacles to Pakistan's adoption of renewable energy by Ahmad and Batool (2019). The government can introduce financial incentives like tax credits and subsidies to promote the use of renewable energy in order to get around these obstacles. Financial institutions can create financing options with favourable interest rates and adaptable repayment terms specifically for renewable energy projects. Technical problems are also causing problems for Pakistan in adopting renewable energy. A major challenge in using renewable energy is that many people do not have enough understanding or expertise in this area. Many people are hesitant to invest in renewable energy systems because they don't know how to install and take care of them. Khan and his team found similar things. In 2018, someone found out that Pakistan faced big problems in using solar power because they didn't have enough knowledge about the technology and the infrastructure was not good enough. The government can use money to support projects that help train and educate people in the renewable energy field, so they can overcome challenges. Educational institutions can offer classes about renewable energy to teach students what they need to know and how to do it. Furthermore, companies can collaborate with schools and research centers to improve the study and creation of renewable energy technologies. One major problem stopping renewable energy from being used in Pakistan is the lack of help from the government. Rehman and his colleagues found that In 2016, a big problem facing renewable energy in Pakistan was that the government didn't give enough help. Like this, Hussain and his colleagues. In 2018, it was found that the lack of help from the government was a big problem for using renewable energy in Pakistan. The government can fix this issue by making rules and systems that support the use of renewable energy sources. These rules might include ways for people to sell excess renewable energy they generate, incentives to encourage buying green energy, and other financial benefits. The government can make groups and divisions that work to support renewable energy, such as energy conservation departments.

Materials and Methods

A structured questionnaire was used in this study to assess consumers' acceptance of renewable energy in the Okara district of Pakistan. The target population consisted of Okara household heads who use or have the potential to use renewable energy sources. Using systematic sampling, a sample size of 384 households was determined with an interval of 1,284 households.The questionnaire included demographic information, attitude, perception, and acceptance scales, all of which were pre-tested for clarity and reliability. Self-administered surveys and face-to-face interviews were used to collect data, and data analysis will include descriptive statistics, frequency distribution, and regression analysis using SPSS 23 software.

Table 1
Frequency and percentage distribution of gender, education and occupation of therespondents

Variable	Frequency	Percent
Gender		
Male	315	82.0
Female	69	18.0
Total	384	100.
Education		
Illiterate	6	1.6
Primary	28	7.3
Middle	52	13.5
Secondary	73	19.0
Higher Secondary	115	29.9
Bachelor’s Degree or higher	110	28.6
Total	384	100.
Occupation		
Government employee	77	20.1

Private employee	148	38.5
Businessman	83	21.6
Unemployed	76	19.8
Total	384	100.

The frequency and percentage distribution of respondents by gender, education, and occupation is shown in Table 1. Regarding gender. According to the data, the survey drew a diverse range of respondents in terms of gender, education, and occupation. The majority were men, with a diverse range of educational levels and occupational backgrounds. These factors must be considered when analysing the responses and comprehending the respondents' perspectives on renewable energy.

Table 2
Frequency and percentage distribution living Area, Marital Status and family structure of Respondent

Variable	Frequency	Percent
Living Area		
Rural	221	57.6
Urban	163	42.4
Total	384	100.
Marital Status		
Single	83	21.6
Married	272	70.8
Divorced/Separated	22	5.7
Widow	7	1.8
Total	384	100.
Family Structure		
Nuclear	162	42.2
Joint	222	57.8
Total	384	100

Based on their residence, marital status, and family structure, Table 2 shows the frequency and percentage distribution of respondents. According to the information in Table 2, respondents from both urban and rural areas were included in the survey, representing a variety of living situations. The respondents' family structures, which included a roughly equal representation of nuclear and joint families, and marital status (the majority of whom were married), were also varied. It is essential to take these factors into account when analysing the responses in order to gain understanding of how people feel about renewable energy in various living and family situations.

Table 3
Stepwise linear regression of attitude and perception on acceptance of renewable energy

Predictors	Unstandardized Coefficients					
	M1	M2	M3	M4	M5	M6
I believe that using renewable energy will help me save money on my energy bills.	2.666 (.332)	2.489 (.328)	2.489 (.328)	1.706 (.323)	1.656 (.319)	1.523 (.318)
Using renewable energy sources is good for the economy?		1.171 (.357)	1.171 (.357)	1.175 (.333)	1.202 (.328)	1.247 (.325)
I believe that the government should prioritize investment in renewable energy sources.			1.097 (.354)	.889 (.331)	.694 (.332)	.677 (.328)
How do you perceive the potential of renewable energy to contribute to the economic growth and development of the local area?				2.318 (.305)	2.007 (.314)	1.857 (.315)
How do you perceive the use of renewable energy in reducing the country's dependence on imported fuel?					1.067 (.311)	1.023 (.308)
How do you view the potential for renewable energy to increase energy access in Pakistan?						.950 (.310)
R	.380	.423	.446	.552	.571	.585
R^2	.144	.179	.199	.305	.326	.342
Adj. R^2	.142	.175	.193	.298	.317	.332

Note: All models are significant at 0.05.

The table 3 presents the unstandardized coefficients for various predictors in multiple regression models (M1 to M6) along with the corresponding standard errors in parentheses. The predictors include statements or perceptions related to renewable energy. In Model M1, the belief that using renewable energy will help save money on energy bills has a coefficient of 2.666, indicating a positive association with the outcome variable. The coefficient remains relatively stable across the subsequent models (M2 to M6). In Model M2, the perception that using renewable energy sources is good for the economy has a coefficient of 1.171, suggesting a positive relationship with the outcome variable. This coefficient remains consistent in Models M3 to M5. Model M3 suggests that it is important for the government to focus on investing in renewable energy sources. This belief is strongly connected to the outcome variable in a positive way. In Model M4, there is a positive relationship between the perception of how renewable energy can help the local economy grow and develop, with a coefficient of 2. 318 The Model M5 helps reduce how much a country needs to buy fuel from other places by using more renewable energy sources. This belief has a score of 1. 067, indicating a positive connection.

In Model M6, there is a positive connection between renewable energy and energy access in Pakistan. This is shown by the coefficient of 0. 950. The values of R (correlation coefficient) increase from 0.380 in M1 to 0.585 in M6, suggesting an improvement in the overall fit of the models. Similarly, R-squared (proportion of variance explained) increases from 0.144 in M1 to 0.342 in M6, indicating an increasing amount of variability in the outcome variable accounted for by the predictors. The adjusted R-squared values also increase gradually, indicating a better fit of the models as additional predictors are included.

Table 4
Regression analysis of the acceptance of renewable energy

Predictors	Unstandardized Coefficients		t	p.
	B	Std. Error		
Constant	7.797	1.306	5.970	.000
Attitude Toward Renewable Energy Adoption	.464	.086	5.375	.000
Perception Toward Renewable Energy Adoption	.642	.070	9.118	.000
R	.524			
R^2	.275			
Adj. R^2	.271			

In table 4 the regression analysis examines the acceptance of renewable energy as the outcome variable with two predictors: attitude toward renewable energy adoption and perception toward renewable energy adoption. The constant term in the regression model is 7.797, indicating the expected value of the outcome variable when both predictors are zero. The standard error associated with the constant is 1.306.

The coefficient for attitude toward renewable energy adoption is 0.464, suggesting a positive association between this predictor and the acceptance of renewable energy. The standard error for this coefficient is 0.086. The t-value of 5.375 indicates that the coefficient is significantly different from zero, with a p-value of 0.000 (highly statistically significant). coefficient for perception toward renewable energy adoption is 0.642, indicating a positive relationship with the acceptance of renewable energy. The standard error for this coefficient is 0.070. The t-value of 9.118 indicates that the coefficient is highly statistically significant ($p < 0.001$). The value of R (correlation coefficient) is 0.524, indicating a moderate positive correlation between the predictors and the outcome variable. R-squared (proportion of variance explained) is 0.275, meaning that the predictors account for approximately 27.5% of the variability in the acceptance of renewable energy. The adjusted R-squared value of 0.271 suggests that the model provides a good fit to the data, considering the number of predictors. Overall, the results of the regression analysis indicate that both attitude toward renewable energy adoption and perception

toward renewable energy adoption significantly contribute to the acceptance of renewable energy. Higher positive attitudes and perceptions are associated with a greater acceptance of renewable energy.

Conclusion

The Results provides information on the respondents' perceptions toward renewable energy. It includes variables such as "How do you perceive renewable energy sources?" and "How do you perceive the impact of using renewable energy on energy security in Pakistan?" The options for responses are "Very Positive," "Positive," "Negative," and "Very Negative." For the statement "How do you perceive renewable energy sources?", 58.3% of respondents have a very positive perception, and 38.0% have a positive perception. Only 3.4% hold a negative perception, and 0.3% have a very negative perception. Regarding the environmental impact of using renewable energy compared to traditional energy sources, 53.1% perceive it very positively, and 43.5% perceive it positively. A few people, about 2. 9%, think negatively, and only 0. 5% have a very negative view. Regarding how using renewable energy can impact energy security in Pakistan, 55. 5 out of every 100 people have a very positive view, whereas 40 people have a similar viewpoint. 9% of people have a positive view of it. Similarly, a small quantity, approximately 3. 4% is viewed negatively, and only 0. Three percent have a very negative view of it. The research discovered that a lot of the people who were asked have positive thoughts about renewable energy. People believe it can tackle these problems such as climate change, dirty air, and not having to depend on other nations for energy. They also believe that using sustainable energy sources can make it more convenient for more people in Pakistan to have power and contribute to the economic development. This study suggests that it is very important to consider people's Attitudes and believes about renewable energy before deciding to use it. The research present how people feel and think about renewable energy is important factor in deciding whether they will agree with it and use it. This study found that people who believe renewable energy can save them money are more likely to support it. Moreover, individuals who think that using renewable energy can result in economic advantages and assist the nearby community are more inclined to support it. These findings indicate that having a positive mindset and strong convictions about renewable energy is crucial for overcoming barriers to its widespread use. This study shows that people's opinions and emotions towards renewable energy play a big role in whether they will support and use it. This text is saying that by using renewable energy, we can ensure that we have sufficient energy for the future, protect our environment, and ensure that everyone's needs are meet.

In conclusion, this study has uncovered information about how people feel about renewable energy and what factors influence their opinions. The research has given us useful information about the things that affect how people think and feel about using renewable energy. The research found that people's thoughts and opinions are important in determining whether they support the use of renewable energy. In simpler terms, many people strongly believe that using renewable energy can help reduce the amount of money they spend on energy bills. Moreover, having a positive view of the financial advantages of renewable energy and believing that it can help the local economy grow were connected to being more accepting of it. These findings show that it is important to encourage people to have positive thoughts and opinions about renewable energy. This will help make renewable energy more widely used. By highlighting the financial benefits like saving money and boosting the local economy, people can better explain the advantages of renewable energy and address any obstacles that may come up.

The study's findings add to what we already know by showing that people's attitude and perception are important in deciding whether they accept renewable energy. They also show how renewable energy can assist with sustainable development, ensuring a steady supply of energy, and protecting the environment. From this information, we can give some helpful suggestions. This means using money to educate people about renewable energy, creating rules and rewards to encourage renewable energy use, improving infrastructure for renewable energy, collaborating with different groups, and conducting more research in the field. It's necessary to note that this study had some restrictions. This means using the information that people have shared about themselves and only studying a certain group of people from one place. In the future, researchers should try to solve these

problems by including larger and more diverse groups of people in their studies and by using clear methods to measure how much energy is used and accepted.

In simple terms, this study helps people learn and embrace renewable energy. It also gives useful information for people who make decisions about energy and others who are involved in the subject. If we do what we have suggested and deal with the things that we have identified, we can make a good place for using renewable energy. This will help us switch to sustainable energy systems faster and make the future greener and more sustainable.

Recommendations

Increasing efforts to educate the public about the benefits of renewable energy through awareness campaigns and educational programs can help dispel misconceptions and build knowledge.

Secondly, governments should develop and implement supportive policies that incentivize the adoption of renewable energy, such as financial incentives and tax breaks. Investing in the development of renewable energy infrastructure, fostering community engagement, and supporting research and development in renewable energy technologies are crucial steps. Collaboration and partnerships between different stakeholders, along with financial support for individuals and businesses, can also accelerate the adoption of renewable energy. Additionally, integrating renewable energy into existing energy systems and long-term planning for a renewable energy-based economy are recommended. Continued research on renewable energy acceptance and its impacts is also encouraged.

By implementing these suggestions and recommendations, policymakers, energy practitioners, and communities can create an environment conducive to renewable energy adoption. This will contribute to mitigating climate change, reducing reliance on fossil fuels, fostering sustainable economic development, and improving energy security for future generations.

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