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Public Perception about Solar Photovoltaic (PV) Technology: An In-Depth Study of Youth in Delhi

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Abstract:

The transition to renewable energy requires not only technological innovations and strong policy measures but also overarching public acceptance and active participation. Today, renewable energy innovation plays a crucial role in promoting sustainable development and reducing greenhouse gas emissions. This study investigates the key factors, including drivers and barriers, that affect the adoption of solar photovoltaic (PV) technology among the young population in Delhi, a major metropolitan region confronted with pressing energy and environmental challenges. The intention is to help influence policy formulation and strategic actions to improve public acceptance and support India's shift to renewable energy. Grounded in the theory of planned behaviour (TPB), the research explores how personal attitudes, perceived control, social influences, and other factors influence people's intentions regarding solar PV adoption. Researcher collected online data using a structured questionnaire with 28 likert-scale items covering six TPB factors. The findings show strong support of the respondents for attitude, awareness, and environmental concern. However, there was less agreement on subjective norms and perceived behavioural control. Attitude, environmental concern, and subjective norms were identified as key predictors of the intention to adopt solar PV technology. This study enhances the application of the theory of planned behaviour (TPB) to solar PV technology adoption and offers insights for policymakers and stakeholders to create better strategies that promote wider use of renewable energy technologies (RETs).

Keywords: *Solar PV technology; Theory of planned behaviour; Public perception; Renewable energy technology; Technology adoption; Sustainability; Energy Transition*

Introduction

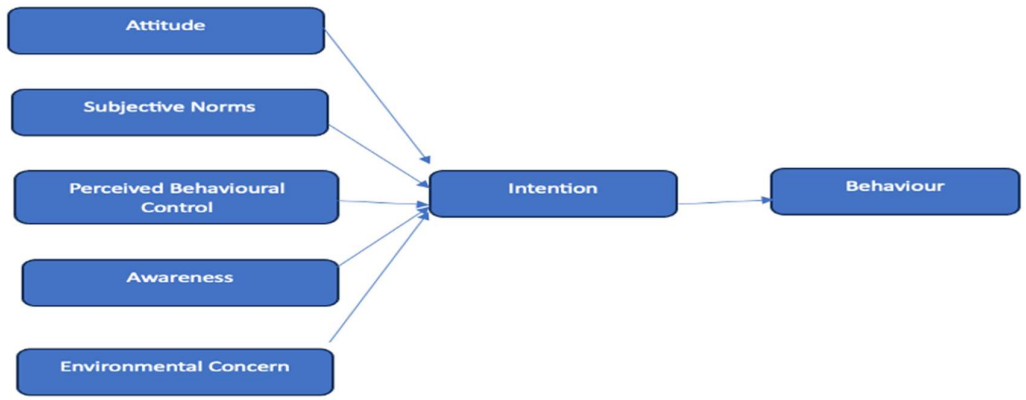
Energy transitions are crucial for tackling global climate change, promoting sustainable development, and ensuring long-term energy security. For a fast-growing economy like India, the dual challenge is providing reliable electricity access while simultaneously reducing greenhouse gas emissions. Among renewable energy options, solar photovoltaic (PV) technology has emerged as a frontrunner because of its large resource potential and declining generation costs. The Government of India has committed to reaching 500 GW of renewable energy capacity by 2030, with solar PV expected to play a major role under the Jawaharlal National Solar Mission (MNRE, 2024). Generally, innovation and technologies in renewable energy products are recognized as the only reliable measures to decrease the release of greenhouse gases into the atmosphere (Han et al., 2025). Using solar energy in all forms can help solve this emission problem and achieve carbon neutrality in the coming thirty years (Saad & Myat, 2025). To achieve this, public acceptance is important for developing solar energy products. Even the most sustainable renewable energy

technologies initiatives might fail to achieve their goals without optimum public support (Marzouk et al., 2024).

This study aims to identify the acceptance and challenges to Solar PV technology adoption, informing policymakers and other stakeholders to enhance public support and promote the country's initiative towards energy transition. This public acceptance is mainly derived from their awareness, knowledge and perception of solar PV technology. The public perception and decision-making process is internal, wherein studies have highlighted the public adoption of renewable energies from the perspective of theories such as the theory of reasoned action, social cognitive theory and self-efficacy theory. This paper applies the theory of planned behaviour (TPB) to discuss the theoretical understanding of how certain factors shaped young people perceptions of renewable energy technologies, policies, and innovation. It is pertinent to analyse the awareness and perception of solar energy products among the students as knowledge regarding them helps young people understand their importance, encourages them to change their behaviour, and helps them adapt to a global emergency. Additionally, in the coming years, the young population will be the major consumers on the planet. Hence, the demographic statistics are focused on renewable energy awareness, sustainability, and green technology adoption among young individuals. This study has mainly focused on public awareness, environmental concerns, and core factors of the theory about solar PV technology.

The theory of planned behaviour (TPB) is a socio-psychological theory that was first proposed by Ajzen in 1985 (Ajzen, 1985). Hence, the theory used in this analysis is called the extended theory of planned behaviour. The theory has been extensively used in other fields, including green products, organic food, health, medicine, climate change, energy efficiency, solid waste, e-waste, and others. The following figure 1 presents the theoretical framework used in the study.

Figure 1: Theoretical Framework of the Extended Theory of Planned Behaviour



Source: Compiled by author

The following discusses the core and extended factors of the theory of planned behaviour (TPB). Studies have proven that a positive attitude towards installing rooftop solar energy possibly has the intention of consuming this product (Rai & Beck, 2015); Sun et al. (2020). Many studies have also found a significant influence of attitude in determining energy-saving behaviours. Attitude was the strongest factor influencing the individual intention to purchase energy-saving appliances (Zhao et al., 2019). Attitude was found to have a stronger influence than social norms, moral norms, and perceived behavioural control. Specifically, attitude positively influenced the intention to save electricity (Wang et al., 2018). Several studies have highlighted that attitude is important in affecting the purchase of energy-efficient devices (Tan et al., 2017; Bhutto, 2019). Similarly, Olawale (2020) reported that the attitudes of staff members significantly impacted their energy-related behaviours. Therefore, it can be said that attitude influences people's intention to engage in energy-saving practices, including solar energy.

Studies have also proven that subjective norms promote behaviour adoption, particularly in renewable energy consumption (Ru et al., 2018; Korcaj et al., 2015). Subjective norms has also been used as a factor in other studies, including hotel guest energy-saving behaviour (Wang et al., 2021), household source separation intentions (Razali et al., 2020), recycling behaviour (Tonglet et al., 2004), food waste reduction and source separation behaviour (Wang et al., 2020), and particulate matter reduction behaviour (Ru et al., 2018). The study by Canova & Manganelli (2020) among Italian people found that PBC has the strongest predictive power of intention to perform energy-saving behaviours. The study in Hongkong was also found PBC as the strongest influence on energy-saving behaviour (Du & Pan, 2021). Similarly, a study among teenagers of Indonesia found PBC significantly influencing the energy-saving behaviours Setyawan et al., (2018). Hence, we have developed the following hypotheses;

H1: Attitude strongly influences young people intention to promote/utilise solar PV products.

H2: Subjective Norms positively influence people's intentions to accept solar PV products.

H3: Perceived behavioural control positively impacts the intention of the people to engage in solar energy pro-behaviour.

H4: Environmental Awareness strongly influences people's intention to purchase solar PV products and

H5: Environmental Concern influences people's intention to adopt solar PV products.

Study Area

Delhi, the capital of India, is one of the fastest-growing metropolitan areas in the world. Its population exceeds 30 million in the National Capital Region (NCR). As a centre of economic, cultural, and political life, Delhi faces rapid urbanization, increasing energy demand, and high levels of industrial and vehicle activity. These factors have led to serious environmental issues. The city struggles with ongoing air pollution, high greenhouse gas emissions, and rising electricity use. With its semi-arid climate and high levels of solar radiation, Delhi has great potential for using solar energy. This makes it a fitting place to explore the potential for solar photovoltaic (PV) adoption.

Figure 2: Location of the Study Area

Source: Mapsofindia.com [https://www.mapsofindia.com/maps/delhi/delhilocation.htm]

At the same time, Delhi faces dual challenges of providing reliable energy access for its growing population and addressing urgent environmental issues. The city relies on fossil fuels for electricity generation, which worsens local air quality problems and increases its carbon footprint. In response, national and local governments have supported renewable energy transitions through initiatives like the Jawaharlal Nehru National Solar Mission (JNNSM) and various state-level solar policies. Young people, particularly 18 to 24 years old in Delhi make up a large part of the urban population. They are not just significant energy consumers but also future decision-makers. Their understanding and acceptance of solar PV technology are crucial for developing sustainable energy solutions in the region.

Methodology

This study used a cross-sectional method to investigate the perception and intention of renewable energy technologies across India among a diverse population. The cross-sectional study permits data collection in a single survey, providing information on current perceptions, attitudes and behaviours related to solar PV products.

The sample was comprised mostly of male and female students at the University of Delhi, Delhi, India. A random group of 536 young people were chosen to facilitate the study, comprising 47.8% of male and 52.2% female. Most of the respondents (95.5%) were young (18-24), followed by middle-aged (25-44) and other adults (above 44). Concerning education, most of the respondents were graduation (70.9%), intermediate (11.9%),

high school (8.2%), master's degree (4.9%), doctorate (1.9%), diploma professional (0.7%), and others (1.5%). With respect to the subject, most of the respondents were commerce (57.3%) followed by arts (29.7%), science (12.3%), and others (0.7%).

The respondents were asked a fixed set of established items to understand their awareness, environmental concern, attitudes, subjective norms, and perceived behavioural control. The questionnaire comprised 28 items, the responses were collected on a 5-point likert scale across 6 factors, namely: awareness (6 items), environmental concern (5 items), attitudes (5 items), subjective norms (5 items), perceived behavioural control (4 items), and intention (3 items).

The questionnaire was designed to capture perceptions and intentions related to renewable energy technologies. It was administered online to ensure easy access and minimise the data collection process's environmental impact.

Methods of Processing and Analysing: Using Likert Scale Scoring, the responses (strongly disagree to strongly agree) into a quantitative score, "1=Strongly Disagree", "2=Disagree", "3=Neutral", "Agree=4", and "5=Strongly Agree". The collected data was coded and analysed using statistical software packages, including SPSS version 26. The following analytical methods were employed.

To understand the data and address the research objectives and hypotheses, several analytical methods were used. Descriptive statistics summarized the basic features of the data, including the mean and standard deviation. Frequency distribution analysis examined the distribution of responses across the Likert scale for each survey item. To check the adequacy and internal consistency of the survey items, reliability and validity analyses were conducted using the Kaiser-Meyer-Olkin (KMO), Bartlett's Test of Sphericity, and Cronbach's Alpha. Additionally, the total variance explained and a scree plot were created to help interpret and verify item groupings. Finally, correlation and regression analyses explored the relationships and strength of associations between key factors. These methods offered a strong framework for analysing the data and drawing meaningful conclusions.

Results and Discussion

The following sections present the findings of the respondents' perceptions and intentions towards renewable energy technologies.

Table 1 presents the percentage distribution of all 28 items used in the established factors of the perception and behaviour analysis of renewable energy technologies. The percentage calculation is based on the combination of "agree" and "strongly agree". Regarding awareness, a high percentage of respondents (77.6%) supported the item "AW1: I am aware that solar PV is a green technology." This shows strong general awareness of its environmental benefits. Meanwhile, 57.2% agreed with the item "AW5: I am aware of innovations and technological changes in solar PV technology." Additionally, 50.9% reported awareness of national initiatives like the National Solar Mission and Net-Zero Targets (AW3). Furthermore, 48.9% expressed awareness of solar policies, including the feed-in tariff and the Production Linked Incentive (PLI) Scheme (AW2). The lowest level of awareness was recorded for the item "AW4: I am aware of domestic crystalline silicon and thin-film technology." This suggests a knowledge gap in the technical aspects of solar PV components among the respondents.

Table 1: Percentage Distribution of Items

Items	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
AW1: I am aware that solar PV is a green technology	4.9	3.2	14.4	40.3	37.3
AW2: I am aware of solar policies such as feed in tariff, production linked incentive scheme, etc.	2.2	13.6	35.3	36.6	12.3
AW3: I am aware of National Solar Mission and Net-Zero Targets.	3.4	20.5	25.2	38.8	12.1
AW4: I am aware about domestic crystalline silicon and thin film technology	9.5	25.0	30.4	27.4	7.6
AW5: I am aware about innovations and technological changes in solar PV technology	3.7	12.9	26.3	44.1	13.1
EC1: I know that solar PV adoption offers environmental protection specially reduction in carbon emission	2.6	4.9	21.5	49.4	21.6
EC2: I know that solar PV installation requires excessive space or land	1.3	13.2	29.9	42.5	13.1
EC3: I have adequate knowledge about recycling in solar waste	4.1	21.1	40.5	28.0	6.3
EC4: I know the symbols and eco-mark of solar PV products	3.5	17.4	32.8	37.1	9.1
EC5: I am concerned about Renewable Energy Technologies (RETs) and its sustainability issues	2.1	6.0	28.0	46.5	17.5
ATT1: Solar PV adoption is a good idea	3.4	2.4	9.7	37.1	47.4
ATT2: I enjoy using solar off-grid from solar PV installation	1.1	11.6	40.9	31.7	14.7
ATT3: Solar PV adoption is towards sustainable lifestyle	0.9	1.9	12.7	39.7	44.8
ATT4: Government incentives or subsidy on solar energy attract me.	1.5	6.0	24.1	45.5	22.9
ATT5: Solar PV adoption is a smart solution	1.3	1.7	11.9	46.6	38.4
PBC1: Solar PV Technology adoption is a feasible solution to meet the energy demands in India	2.6	4.5	22.4	50.0	20.5
PBC2: I have the resources to install solar PV technology in my home	6.0	25.9	26.9	32.3	9.0
PBC3: Waste generated from solar PV are very harmful to our environment	5.2	18.7	45.0	25.6	5.6
PBC4: Solar PV installation is not expensive in maintenance.	6.2	24.4	37.7	24.6	7.1
SN1: I have seen my friends and neighbours using solar PV	8.8	17.5	22.9	37.7	13.1
SN2: My friends and neighbours told me that solar PV is a clean technology	4.5	13.4	26.9	40.1	15.1

Items	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
SN3: My friends and neighbours are convenient to adopt solar PV technology	3.4	14.0	34.7	37.1	10.8
SN4: My friends and neighbours persuade me to purchase solar PV technology	8.2	23.3	32.8	28.0	7.6
SN5: My friends and neighbours told me that electricity generation from solar PV reduces electricity bill.	4.1	9.7	23.1	43.7	19.4
IN1: I intend to install solar PV even it requires backup energy sources	2.2	8.8	30.4	43.3	15.3
IN2: I intend to adopt solar PV to improve my lifestyle	1.1	2.8	20.1	47.8	28.2
IN3: I intend to use solar PV to save energy costs in the future	1.5	2.6	11.6	47.9	36.4

Note: AW=Awareness, EC=Environmental Concern, ATT=Attitude, PBC=Perceived Behavioural Control, SN= Subjective Norms, IN= Intention.

Regarding Environmental Concern, majority of respondents (71%) agreed with the item, “EC1: I know that solar PV adoption offers environmental protection, especially a reduction in carbon emissions.” This shows strong awareness of the environmental benefits of solar energy. Additionally, 64% expressed concern about the sustainability of Renewable Energy Technologies (RETs) (EC5). This indicates a growing awareness of long-term environmental impacts. Furthermore, 55.6% acknowledged that solar PV installations require a lot of space or land (EC2). In addition, 46.2% reported that they are familiar with the symbols and eco-marks associated with solar energy products (EC4). The item that received the least agreement was “EC3: I have adequate knowledge about recycling in solar waste.” This highlights a potential knowledge gap in solar waste management among respondents.

Regarding Attitude, majority of the respondents (85%) agreed that "Solar PV adoption is a smart solution" (ATT5). Similarly, 84.5% supported both "Solar PV adoption is a good idea" (ATT1) and "Solar PV adoption supports a sustainable lifestyle" (ATT3). However, slightly fewer (68.4%) agreed with "Government incentives or subsidies on solar energy attract me" (ATT4). The lowest level of agreement was found for "I enjoy using solar off-grid from solar PV installation" (ATT). In terms of Perceived Behavioural Control, majority (70.4%) observed solar PV technology adoption as a viable solution for meeting India’s energy needs (PBC1). However, only 41.3% felt they had the resources to install solar PV at home (PBC2). Just 31.7% believed that solar PV installation is not costly to maintain (PBC4). The least concern was for the agreement that waste from solar PV is very harmful to the environment (PBC3).

For the Subjective Norms, the item that respondents support the most (63.1%) was "My friends and neighbours told me that electricity generation from solar PV reduces the electricity bill" (SN5). This was closely followed by 55.2% who agreed with "Solar PV is a clean technology" (SN2). Half of the respondents (50.8%) had seen others using solar PV (SN1). Additionally, 47.9% thought

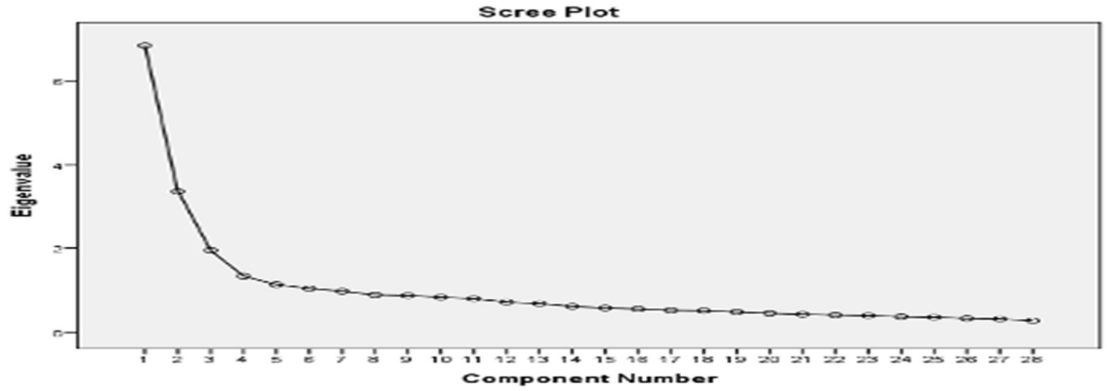
their peers found it easy to adopt (SN3). The least agreement was for "My friends and neighbours persuade me to purchase solar PV technology" (SN4). For the intention, most respondents support the item “I intend to use solar PV to save energy costs in the future” at 84.3% (IN3). Additionally, 76% intended to adopt solar PV for lifestyle improvement (IN2). Furthermore, 58.6% are willing to install it even if backup energy sources are needed (IN1).

Reliability, Convergent and Discriminant Validity

The Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy results were 0.888 which indicates high sampling adequacy, and Bartlett’s Test of Sphericity was statistically significant (χ^2 = 5204.584, df = 378, $p < 0.001$), indicating the data possess sufficient correlations among the variables to conduct factor analysis. These results indicate it is appropriate to conduct Exploratory Factor Analysis (EFA) for the data collected. Additionally, the statistical results indicate a sizeable enough sample to find the factors impacting respondents' perceptions and intentions toward renewable energy technologies. This analysis is relevant to conducting further statistical analyses that explain the intention of public engagement with renewable energy adoption.

According to Kaiser’s (1974) recommendation for Exploratory Factor Analysis (EFA), Eigenvalues below 1.0 may suggest unstable factors. Applying this criterion, the study identified and extracted six factors from analysing the perception of renewable energy technologies, each with Eigenvalues exceeding 1.0 (Figure 3). This result is important because it confirms that six factors affect the respondents' intention to use renewable energy technologies. Each factor plays a significant role in explaining the overall differences in the data.

Figure 3: Scree Plot showing six factors above Eigenvalue 1



Source: Compiled by author

These factors together explained 55.943% of the total variance, significantly contributing to comprehending respondents’ perceptions of solar energy technologies. Table 4 presents the overall

details of the variance each factor explains, providing an understanding of each item description for further statistical analysis.

In conducting the factor analysis of the intention towards solar energy technologies, the researchers employed Varimax rotation and Principal Components Extraction, given the theoretical correlation among the factors. To ensure the accuracy and interpretability of the factors, items with a factor loading above the recommended threshold of 0.50 were extracted for analysis from the scale (Buyukozturk, 2009). All the items in the established factors were found to be above the threshold values, which shows the internal consistency of the items. Table 2 provides a comprehensive overview of the items and their respective factors.

Table 2. Factor Analysis and Cronbach's Alpha

	COMPONENTS					
Rotated Component Matrix						
Scale Items	**1**	**2**	**3**	**4**	**5**	**6**
AW1: I am aware that solar PV is a green technology	0.636					
AW2: I am aware of solar policies such as feed in tariff, production linked incentive scheme, etc.	0.720					
AW3: I am aware of National Solar Mission and Net-Zero Targets.	0.650					
AW4: I am aware about domestic crystalline silicon and thin film technology.	0.759					
AW5: I am aware about innovations and technological changes in solar PV technology	0.721					
EC1: I know that solar PV adoption offers environmental protection specially reduction in carbon emission		0.617				
EC2: I know that solar PV installation requires excessive space or land		0.727				
EC3: I have adequate knowledge about recycling in solar waste		0.508				
EC4: I know the symbols and eco-mark of solar PV products		0.585				
EC5: I am concerned about Renewable Energy Technologies (RETs) and its sustainability issues		0.601				
ATT1: Solar PV adoption is a good idea			0.788			
ATT2: I enjoy using solar off-grid from solar PV installation			0.593			
ATT3: Solar PV adoption is towards sustainable lifestyle			0.767			

Rotated Component Matrix	Components					
Scale Items	**1**	**2**	**3**	**4**	**5**	**6**
ATT4: Government incentives or subsidies on solar energy attract me.			0.594			
ATT5: Solar PV adoption is a smart solution			0.713			
PBC1: Solar PV Technology adoption is a feasible solution to meet the energy demands in India				0.629		
PBC2: I have the resources to install solar PV technology in my home				0.517		
PBC3: Waste generated from solar PV are very harmful to our environment				0.636		
PBC4: Solar PV installation is not expensive in maintenance.				0.557		
SN1: I have seen my friends and neighbours using solar PV					0.753	
SN2: My friends and neighbours told me that solar PV is a clean technology					0.778	
SN3: My friends and neighbours are convenient to adopt solar PV Technology					0.766	
SN4: My friends and neighbours persuade me to purchase solar PV technology					0.748	
SN5: My friends and neighbours told me that electricity generation from solar PV reduces electricity bills.					0.715	
IN1: I intend to install solar PV even it requires backup energy sources						0.659
IN2: I intend to adopt solar PV to improve my lifestyle						0.628
IN3: I intend to use solar PV to save energy costs in the future						0.628
Cumulative Variance Explained	24.422	36.457	43.412	48.182	52.224	55.943
Cronbach's Alpha (No. of Items)	0.875 (28)					

Descriptive Statistics and Correlation

The descriptive statistics of the established factors show that the mean scores range from 3.258 to 3.994, and the standard deviations fall between 0.551 and 0.831. This indicates that the items have strong internal consistency. The findings also suggest that most respondents agreed with the items across the factors. Additionally, all factors were significantly correlated at the 95% confidence level. The correlation analysis showed a strong positive relation between Attitude (ATT) and Intention (IN) to adopt solar energy products ($r = 0.543$, $p < 0.01$). This suggests that people with favourable attitudes toward solar PV are much more likely to intend to adopt it. A strong

correlation was also found between Awareness (AW) and Environmental Concern (EC) ($r = 0.536$, $p < 0.01$), along with Awareness and Attitude ($r = 0.495$, $p < 0.01$). These results indicate that being more aware of renewable energy technologies improves individuals' environmental concerns and helps create positive attitudes toward solar energy.

Moderate correlations appeared between Awareness and Intention ($r = 0.363$, $p < 0.01$), Environmental Concern and Intention ($r = 0.356$, $p < 0.01$), and Subjective Norms (SN) and Intention ($r = 0.313$, $p < 0.01$). These relationships suggest that while awareness and concern for the environment do not lead to adoption as strongly as attitude, they still play important roles in influencing intention. Social influence through subjective norms also has a moderate effect on decision-making, highlighting the importance of peer behaviour and social acceptance. The weakest correlation was between Perceived Behavioural Control (PBC) and Intention ($r = 0.243$, $p < 0.01$). This shows that even with positive attitudes and sufficient awareness among the people, practical barriers like cost or access may limit their readiness to perform. In summary, the findings indicate a causal relationship where awareness improves environmental concern and positive attitudes, which in turn drive the intention to adopt solar energy products. Although subjective norms have a moderate influence, perceived behavioural control appears to be a weaker factor, likely due to real limitations in affordability or feasibility.

Table 3: Path Analysis and Hypotheses Testing

Path	Standard Beta	Standard Error	*t-value*	Sig	Decision
ATT → IN	0.042	0.438	10.282	*p<0.001*	H1 Supported
SN → IN	0.032	0.085	2.048	*p<0.01*	H2 Supported
PBC → IN	0.044	0.05	1.072	*p=0.284*	H3 Not Supported
AW → IN	0.043	0.044	0.923	*p=0.923*	H4 Not Supported
EC → IN	0.051	0.099	2.229	*p<0.01*	H5 Supported

Table 3 shows a relationship of how different factors affect respondents' intention to adopt solar energy products. Among these, Attitude was the strongest predictor of intention (SE = 0.438, B =0.042, t =10.282, $p < 0.001$). This confirms that a positive attitude drives behavioural intention. Thus, H1 is supported. The second most influential factor was Environmental Concern (SE = 0.099, B = 0.051, t = 2.229, $p < 0.01$), followed closely by Subjective Norms (SE = 0.085, B = 0.032, t = 2.048, $p < 0.01$). So, H2 and H5 are supported. On the other hand, Perceived Behavioural Control (SE = 0.05, B = 0.044, t = 1.072, p = 0.284) and Awareness (SE = 0.044, B = 0.043, t = 0.923, p = 0.923) had no significant effects on intention. Therefore, H3 and H4 are not supported. The findings show that attitude is the strongest factor in the intention to adopt solar energy. Environmental concern and subjective norms also have significant effects. However, perceived behavioural control and awareness do not have a strong impact on intention. Based on the estimated R^2 value of 0.52, the regression analysis explains about 52% of the variation in respondents' intention to adopt solar energy products. This shows that the established

factors have a moderately strong ability to explain this intention.

General Discussion

This paper evaluates the influence of core factors (attitude, subjective norms, perceived behavioural control) and additional factors (awareness, environmental concern) on young people's intention in Delhi to adopt renewable energy technologies, especially solar PV. The findings show high levels of awareness, particularly regarding the understanding that solar PV is a green technology. However, there are specific knowledge gaps in technical and policy-related areas, specifically AW2 (awareness of policies such as feed-in tariffs and the Production Linked Incentive Scheme) and AW4 (knowledge of crystalline silicon and thin-film technologies). These gaps agree with findings from Aggarwal et al., (2019), who also noted that while general awareness is high, knowledge of technical and policy matters remains limited among the Indian public.

Similarly, for the Environmental Concern (EC) factor, most respondents agreed on the environmental benefits of solar PV, especially its role in reducing carbon emissions (EC1). However, there was less concern or limited knowledge about solar product labelling (EC4) and solar waste recycling (EC3). This result support the work of Jain et al., (20222) wherein waste management and end-of-life issues of renewable technologies are often overlooked in public discussions.

In terms of attitude, respondents observed a positive view of renewable energy technologies. However, their agreements seemed to drop when it came to practical usage, like the enjoyment of using off-grid solar PV systems (ATT2). This supports the idea that positive attitudes do not always lead to actual behaviours. This result is reflected in studies by Kollmuss and Agyeman (2002). The results for Perceived Behavioural Control (PBC) show that while respondents believe solar PV can meet India's energy demands (PBC1), practical issues like lack of resources (PBC2), perceived high maintenance costs (PBC4), and environmental concern about waste (PBC3) decrease their sense of control. This finding aligns with the work of Elavarasan et al., (2019) that economic and infrastructure barriers greatly affect adoption decisions in Indian households, even when attitudes are positive. On Subjective Norms, support was high, except for social influence from peers and neighbours (SN3 and SN4). This suggests that social support for adopting solar energy is weak. This might be due to a lack of visible installations in the community or limited peer influence.

Regarding Intention, the result shows a strong intention among respondents to adopt solar PV technologies. Most agreed with all the intention-related items. This finding supports the result of Sardianou & Genoudi (2013) that intention levels are high when awareness and environmental concern are strong, even when the actual adoption often falls due to perceived barriers.

The results from reliability and validity testing, including Cronbach's Alpha, KMO, and Bartlett's Test, confirmed that all constructs showed internal consistency, validity, and statistical adequacy. This supports the structural adequacy of the survey instrument. These findings align with studies that used EFA in energy behaviour research, like Wolske et al. (2017). This reinforces the strength of these factors as predictors in renewable energy adoption models.

The correlation analysis showed that all the factors employed were significantly related at the 95% confidence level. The strongest correlation was found between Attitude and Intention. This was followed by the correlation between Awareness and Environmental Concern, and Awareness and Attitude. These results suggest that greater awareness of renewable energy technologies helps improve environmental concern and attitudes. In turn, these factors greatly impact behavioural intention. Moderate but significant relationships were also found between Awareness and Intention, Environmental Concern and Intention, Subjective Norms and Intention, and Perceived Behavioural Control and Intention. Overall, the results reveal that Awareness, Environmental Concern, and Subjective Norms play a role in shaping the respondents' intention to adopt solar energy products. However, Perceived Behavioural Control seems to have the least impact.

The regression analysis further supports these results by identifying Attitude as the strongest predictor of intention to adopt solar energy products. It is followed by Environmental Concern and Subjective Norms. In contrast, Perceived Behavioural Control and Awareness showed weaker predictive power. This suggests that even though people may be aware of solar technologies and recognize practical aspects, these factors alone do not strongly motivate their intention to adopt without supportive attitudes and environmental factors.

This study enhances the application of the theory of planned behaviour (TPB) in understanding how young people in Delhi adopt solar technology. The result shows that positive attitudes, environmental concern, and awareness play a significant role in shaping their intentions to adopt solar PV. However, these intentions do not always lead to action. This happens because of low perceived control and weak social norms. Practical challenges like limited technical knowledge, high perceived costs, and lack of peer support reduce people's confidence in their ability to adopt solar technologies. For policymakers and practitioners, these findings emphasize the need to raise general awareness and tackle specific gaps in policy understanding. It is also important to improve accessibility and affordability and encourage community support.

Conclusion

This paper underscores the core and additional factors of the theory of planned behaviour (TPB) that influence young people's intentions in Delhi to adopt solar PV technologies. It provides useful insights for policy and strategic actions. The findings show that young respondents strongly support attitude, awareness, and environmental concern regarding the adoption of renewable energy technologies (RETs). In contrast, subjective norms and perceived behavioural control received lower acceptance. All factors employed in the study were reliable and valid with significant correlation among them. This study found attitude, environmental concern, and subjective norms to be the main predictors of the intention to adopt solar PV technologies. However, awareness and perceived behavioural control did not significantly affect public perception or intention. This suggests there are gaps in knowledge, access, or empowerment that may hinder adoption.

For effective policy formulation, it is important to tackle specific issues that received lower support. These include limited awareness of government

policies and solar technologies, such as feed-in tariffs and domestic silicon and thin-film technologies. There is also insufficient understanding of environmental symbols and recycling practices related to solar waste. Additionally, there are perceived financial or logistical barriers to installation and a lack of social encouragement from peers or communities. To address these barriers, targeted actions are necessary. These could involve enhanced public education campaigns, better access to technical knowledge, and greater transparency about the environmental benefits and lifecycle of solar PV products. Offering strong financial incentives and promoting the long-term economic and aesthetic benefits of solar technologies can significantly boost public acceptance.
By addressing these important gaps, policymakers can encourage wider public involvement with solar technologies. This would contribute to national energy security and support India's effort towards sustainable development goals.

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