# Intention to Adopt Sustainable Energy : Applying the Theory of Planned Behaviour Framework

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## Abstract

**Numerous factors influence the adoption intention of the household solar energy products. This research paper studied these factors by adopting the theory of planned behaviour framework. The primary data for this paper was collected using the structured questionnaires which were administered to 250 respondents from Telangana State, out of which 165 were usable. The data thus collected was analyzed using structured equation modeling (SEM) and analysis of moment squares (AMOS). The results of the study aligned with the theory of planned behaviour framework. It was found that apart from perceived benefits, demographic variables played a dominant role in intention for adoption of solar energy products. The outcomes of the study indicated that (a) perceived benefit had a significant positive relationship with customer attitude; (b) perceived risk had a negative relation to attitude; (c) normative beliefs and moral obligation had a significant positive relationship with subjective norms; (d) control force and control belief had a significant positive relationship with perceived behavioral control; (e) customers' attitude, subjective norms, and perceived behavioral control had a significant positive relationship with customers' purchase intentions. Though, the past research highlighted the adoption of solar energy with different variables, but in isolation. However, the current study utilized all the major constructs of the theory of planned behaviour in the conceptual framework. This study contributes to the literature on solar energy from the customers' perspective. In addition, the proposed framework could be the basis for future research in the field of consumer behaviour in the solar- energy sector.**

***Keywords :*** **solar energy, sustainability, adoption, intention, theory of planned behaviour**

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Energy is an essential element for the socioeconomic growth of our country. India's energy demand is growing at a rapid pace of 6-7% annually. Bridging the gap between demand and supply is a challenging task with the limited conventional energy sources. Sustainable energy sources are the need of the hour to meet the future energy requirements. Renewable energy is considered to be a promising basis of sustainable energy as electricity generated from renewable energy sources is eco-friendly, which thus saves the environment. Solar energy, one of the forms of renewable energy, has a tremendous growth potential in India due to its geographical advantage. As the demand for energy in emerging nations like India is increasing tremendously, it is of immense importance to understand the customers' attitude towards and intention to use solar energy. Residential energy-efficient and renewable energy products, in particular, solar energy products play an important role in energy conservation and environmental protection. Solar energy has emerged as an alternative energy resource. Realizing the importance of conserving natural energy sources, India is the first country in the world to have established an exclusive Ministry of New and Renewable Energy (MNRE) – in 1992. Jawaharlal Nehru National Solar Mission (JNNSM), the country's flagship programme, was launched in 2010 to promote sustainable development and to meet the country's present and future energy requirements. Despite the efforts by the states, customer adoption of

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solar energy is very limited due to several barriers. As part of the research, an extant review of literature was done to study the various factors influencing customers' adoption of solar energy products at the domestic level. The current study employs the theory of planned behaviour framework to study the relationship of attitude and subjective & perceived behavioural control towards the adoption of solar energy systems.

## Review of Literature

The term 'sustainability' embodies a paradigm whereby individuals and other social actors seek to meet current needs with an awareness of necessary actions to take to preserve the ability of future generations to meet their needs.

Dincer and Rosen (1999) opined that energy is a key factor in discussions of economic, social, and environmental dimensions of sustainable development. In developing countries like India, the energy issue is particularly important since the energy demand is rising rapidly and acute energy shortage could be a bottleneck to economic and social development (Drysdale & Huang, 1995). Therefore, the use of renewable energy sources is considered as an indispensable basis of sustainable energy systems (Lund, 2006).

Green energy plays an important role for meeting energy requirements in both industrial and local applications, thus leading to sustainable development. Therefore, development and utilization of green energy strategies and technologies should be given a high priority for sustainable development in a country. The need for sustainable energy development is increasing rapidly in the world. Widespread use of green energy sources and technologies is important for achieving sustainability in the energy sectors in both developing and developed countries. Ajzen and Fishbein (1980) defined in their theory of planned behaviour (TPB) that behavioral intention is one's willingness to perform a specific behavior, and proposed it to be the main predictor of actual behavior. Behavioral intention is influenced by attitude, subjective norms, and perceived behavior control (PBC). According to Mehrens, Cragg, and Mills (2001), perceived benefit and perceived risk have an impact on one's attitude. Furthermore, normative beliefs and moral obligation influence subjective norm ; Ajzen (2002) observed that control force and control belief influenced perceived behavioural control. The theory of planned behaviour incorporates three key dimensions - attitude, subjective norm, and perceived behavioural control - to determine the behavioural intentions (Ajzen, 1985 ; Ajzen & Driver, 1991). TPB is appropriate in predicting customers' adoption intention towards solar energy. Therefore, this paper uses TPB as a conceptual framework for a well - defined structure and to predict the customers' adoption intention towards solar energy products.

Kansal, Pathania, and Saini (2017) examined the awareness level and the major barriers which limit the solar-energy product diffusion in case of Punjab. They opined that the lack of financial support by the government and high initial costs are the major barriers which limit the diffusion of these solar energy products. Tara, Singh, and Kumar (2015) examined the ways of protecting the environment and attaining sustainable development, and in this regard, they examined the role of green marketing philosophy. They opined that industries are being forced to make eco-friendly products and that will be the order of the future as consumers today are looking at green alternatives for sustainable development. Solar energy products also fall under this category. Yadav and Pathak (2013) looked at varied phases of going green, starting with ecological, then environmental, and then sustainable green marketing. They discussed varied measures being adopted by the Government of India towards making sustainable environmental practices. One can look at solar energy products as one such product, which is a step towards sustainable environmental practices.

The Table 1 gives an overview of research carried out researchers by applying the theory of planned behaviour model to study customer purchase of different green products.

**Table 1. Review of Literature : Applying the TPB Framework on Purchase Intention and Behaviour Towards Environmentally Friendly Products**

| S. No. | Citation | Focus of the Study | Research Design | Outcome |
|---|---|---|---|---|
| 1 | Lynne, Casey, Hodges, and Rahmani (1995) | Focused on the adoption of water saving technology and behaviour towards technology investment. | Empirical study of Farmers in Florida, U.S. | Actual behaviour was influenced by perceived behavioral control. |
| 2 | Vermeir and Verbeke (2008) | To study the factors influencing sustainable behaviour in dairy consumption. | Empirical study of highly educated young adults from Flanders, Belgium. | The variance in intention to use sustainable dairy was explained by personal attitudes, perceived consumer effectiveness, perceived social influences, and perceived availability. |
| 3 | Kumar (2012) | Explored the determinants of purchase intention and behaviour for environmentally sustainable products. | Empirical study, Sample size: 152, Students (PG, PhD), Questionnaire, India. | Environmental knowledge was positively related to attitude towards environmentally sustainable products, and attitude was the key determinant of the purchase intention for environmentally sustainable products. |
| 4 | Alam and Rashid (2012) | Studied the perception towards renewable energy. | Empirical study, Sample size: 200, Factor analysis, Multiple regression, Malaysia. | Attitude positively mediated the intention to use. Further, relative advantage and perceived behavioural controls positively mediated attitude towards renewable energy. |
| 5 | Yun and Lee (2015) | Studied the socio-technical factors influencing the diffusion of renewable energy. | Empirical study, Questionnaire, USA. | Customer intention to use renewable energy was influenced by attitude, subjective norms, and perceived behavioral control ; whereas, subjective norms were influenced by technical factors of renewable energy. |
| 6 | Wu and Chen (2014) | To study the factors influencing green consumption with the help of theory of planed behaviour framework. | Empirical study, Sample size: 560, Adult students, Questionnaire, Taiwan. | Perceived benefit was positively related to attitude ; whereas, perceived risk had a negative relationship with attitude. Normative belief and moral responsibility both were positively related to subjective norms. Control strength and control belief were also positively related to consumer behavior control. Further, attitude, subjective norms, and behavior control had a significant positive relationship with consumer behavior intention. |
| 7 | Sharma and Gadenne (2014) | To study the various factors influencing customer perception and attitude towards green practices and behaviours. | Empirical study, online survey, sample size: 218, Australia. | Customer green practices and behaviours were influenced by social influence. |
| 8 | Pagiaslis and Krontalis (2014) | To examine the various factors influencing the purchase intention and behaviour of biofuels. | Empirical study, Questionnaire, sample size:1695, Greece. | Environmental concern was positively related to environmental knowledge and intention. |
| 9 | Current study | Examines the factors influencing the purchase intention of solar energy products. | Empirical study | There is a highly significant relation between attitude and purchase intention. |

## TPB and Adoption of Sustainable Energy : Conceptual Framework

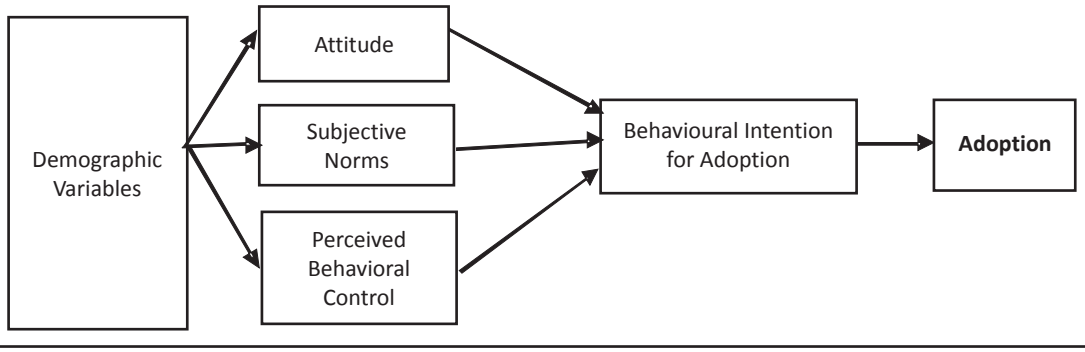
The current paper studies the relationship between various independent variables and a dependent variable with

the mediating variables for which the theory of planned behaviour proposed by Ajzen (1991, 2002) was used to design the conceptual framework. Conceptually, one can look at the role of demographic variables on attitude, subjective norms, and perceived behavioural control on the behavioural intention for adoption, leading to the adoption as illustrated in the Figure 1.

Many studies used the theory of planned behaviour framework to study the different pro-environmental actions such as purchasing environmentally friendly products, water usage, recycling, sustainable behaviours (Ajzen, 1991 ; Bamberg, Azjen, & Schmidt, 2003 ; Kaiser & Gutscher, 2003 ; Ramayah, Lee, & Lim, 2012).

Empirical findings in previous studies proved that there is a positive relationship among attitude, subjective norms, perceived behavioral control, and intention, showing the significance of these variables within the TPB in explaining individuals' decision-making process (e.g., Chan & Bishop, 2013; Chen & Peng, 2012 ; Kim, Njite, & Hancer, 2013).

**Figure 1. Conceptual Framework**




## Research Hypotheses

**(1) Relationship of Perceived Benefit (PB), Perceived Risk (PR) with Attitude (AT) :** Past research indicated that perceived benefit has a positive relationship with attitude ; whereas, perceived risk has a negative relationship with attitude.

- **H1a:** The perceived benefit of solar energy adoption intention is positively related to customer attitude.
- **H1b:** The perceived risk of solar energy adoption intention is negatively related to customer attitude.

**(2) Relationship of Normative Belief (NB), Moral Obligation (MO) with Subjective Norms (SN) :** According to Newhouse (1990), there is a correlation between strong beliefs and social expectations ; thus, normative belief is a key factor affecting an individual's behavior (Festinger, 1954). In TPB, as defined by Ajzen and Fishbein (1975), subjective norm includes the social pressure exerted usually by a social group that affects the performance of an individual's behaviour.

An individual's personal judgement standards are reflected by moral obligations and moral codes. Schwartz and Tessler (1972) reported that a person's behavioural intention is influenced by attitude and subjective norms. Therefore, the present study posits the following relationships :

- **H2a :** Customers' normative beliefs of solar energy adoption intention are positively related to subjective norms.
- **H2b :** Customers' moral obligations regarding solar energy adoption intention are positively related to subjective norms.

**(3) Relationship of Control Force (CF), Control Belief (CB) with Perceived Behavioral Control (PBC) :** As posited by Ajzen (1991), perceived behavioural control encompasses control force and control belief. Control force is one's confidence and ability to exhibit a specific behaviour, and control belief is termed as one's self-assessment of his/her ability towards a specific behavior.

- **H3a :** Customers' control force regarding intention for adoption of solar energy is positively related to perceived behavioral control.
- **H3b:** Customers' control belief regarding intention for adoption of solar energy is positively related to perceived behavioral control.

**(4) Relationships Among Attitude, Subjective Norms, PBC, and Intention for Adoption (IA)**

**(i) Attitude and Purchase Intention for Environmentally Sustainable Products :** Several studies concluded that a favourable attitude towards a product which is environmentally sustainable adds to sustainable consumption behaviour (Chan, 2001; Tanner & Kast, 2003; Vermeir & Verbeke, 2008).

**(ii) Subjective Norms and Purchase Intention for Environmentally Sustainable Products :** Subjective norms have been extensively analyzed in the studies on environmentally responsible behaviour (Biel &Thøgersen, 2007). Various studies such as the study on sustainable food by Vermeir and Verbeke (2008), Gotschi, Vogel, and Lindenthal's study (2007), and so on indicated a relationship between subjective norms and consumers' intention to engage in that behaviour which is both significant and positive.

**(iii) Perceived Behavioral Control and Purchase Intention for Environmentally Sustainable Products :** Several researchers have pointed that an individual's confidence in his or her ability to control and thereby display the behaviour has a positive relationship with the purchase intention or the purchase behaviour (e.g., Taylor & Todd, 1995). The theory of planned behaviour was proposed by Ajzen (1991) to predict and measure the individual's behaviour using attitude, subjective norms, and perceived behaviour control.

Many authors have tested the TPB framework in multiple contexts. Ajzen and Driver (1991) ; Cheng, Lam, and Hsu (2005) ; Baker, Al-Gahtani, and Hubona (2007) ; and Cronan and Al-Rafee (2008) all endorsed the findings recommended by the TPB model in different contexts. Majority of the studies found that there is a positive relation between attitude and purchase behaviour (Kozar & Connell, 2013; Tanner & Kast, 2003).

The current study focuses on solar energy products' intention for adoption and postulates the following relationships :

- **H4a:** Customer attitude and intention for adoption of solar energy are positively related.
- **H4b:** Subjective norms of the customers towards intention for adoption of solar energy are positively related.
- **H4c:** Customers' perceived behavioural control is positively related to intention for adoption of solar energy.

The objective of the research is to study the factors affecting customer adoption of solar energy at the household level.

## Research Methodology

**(1) Data Collection Method and Administration :** Solar energy customers of 250 households from different parts of Telangana state were requested to participate in the study, however, 165 questionnaires were found to be valid

for final data analysis. The data collection were undertaken during October 2016 - March 2017. Responses were collected using a structured questionnaire which included a set of statements under each variable to capture the opinion of the respondents. Participants' responses were taken using a 5 - point Likert rating-scale ranging from 5 *(strongly agree)* to 1 *(strongly disagree)*.

**(2) Respondents' Profile :** The study included current and potential users of solar energy at the household level. The survey included a wide range of statements to assess the purchase intention levels of customers – including attitude, subjective norms, and perceived behavioural control. Participants for the study were selected on judgment basis since the population for the study was unlimited. Of those who were administered the questionnaire ($n = 250$), a total of 78 women and 92 men completed the survey questionnaire ($n = 165$; final response rate = 66%). Participants ranged from 18 to 75 years, with majority ($n = 157$, 92%) having basic education or above the level of graduates (or equivalent). The final sample of participants came from household customers with a wide range of different income levels and occupational backgrounds. Majority of the customers who adopted solar energy lived in their own homes. More than three-fourth of the sample had four or more number of members in the family.

**(3) Measures :** Theory of planned behaviour (TPB) framework was used to conduct the study and to discuss the factors influencing customer purchase intention towards domestic solar energy. Constructs of TPB framework were used appropriately in the context with the literature support.

**(i) Perceived Benefit of Using Solar Energy :** To assess the current subscription levels of solar energy products, participants were given a different set of statements related to quality of solar systems, delightfulness of the usage, economic benefits derived from using solar energy, and durability of solar energy products. The basic idea was to check the benefits sought or derived by the customers using solar energy systems.

**(ii) Perceived Risk of Purchase Intention :** To assess the customers' perceived risk, the prospective and current users were asked questions related to safety and health of using solar energy, approval of the community, personal image of using solar energy systems, and customer satisfaction levels.

**(iii) Customers' Attitude Towards Purchase Intention :** The participants' attitude towards the willingness to purchase were evaluated using a set of items, such as, "use of solar energy by me will help me and helps to conserve the environment," and "using solar energy makes me feel good about myself."

**(iv) Customers' Normative Beliefs :** Participants' normative beliefs were measured using the items : "my friends expect me to use solar energy," "my family members expect me to use solar energy," "I give importance to the opinion of my family members and friends before purchasing solar energy."

**(v) Moral Obligation and Purchase Intention of Solar Energy :** To evaluate the customers' responses towards the moral obligation of using solar energy systems, two rating questions were included : "I think by purchasing solar energy products, I am fulfilling my responsibility to the environment" and "purchasing solar energy is helpful for environmental protection."

**(vi) Subjective Norms :** To measure customers' subjective norms, a set of different statements were made including: "appropriateness of purchasing solar energy" and "necessity of purchasing solar energy systems."

**(vii) Control Force and Purchase Intention :** Customers' responses regarding control force were evaluated using

rating statements such as: availability of financial resources, customers' information and knowledge towards solar energy systems, and overall resources available to purchase solar energy systems.

**(viii) Control Beliefs :** Degree of control beliefs were assessed using 5 - point items including: "It is easy to operate solar energy" and "differentiation between solar energy systems and other products".

**(ix) Perceived Behavioural Control :** Respondents were questioned to assess their controlled behaviours with respect to solar energy. The items included: customers' independent decision making towards the purchase of solar energy, willingness to pay more to adopt solar products, and customers' controlled decision making of solar energy adoption.

## Data Analysis and Empirical Results

The Table 2 illustrates the demographic profile of the respondents, that is, gender, age, income, qualification, type of house, number of members in house, occupation, etc. of the respondents, which helped us to draw conclusions based on the demographic profile while the data was analyzed.

**Table 2. Descriptive Statistics of the Sample**

| | Sample | |
|---|---|---|
| **Characteristics** | ***N*** | **%** |
| **Gender** | | |
| Male | 94 | 57.0 |
| Female | 71 | 43.0 |
| **Age (in years)** | | |
| 18-25 | 15 | 9.0 |
| 26-30 | 26 | 15.7 |
| 31-40 | 42 | 25.4 |
| 41-50 | 48 | 29.0 |
| Above 51 years | 34 | 20.6 |
| **Monthly Household Income (in ₹)** | | |
| Below 10,000 | 23 | 14.0 |
| 10,001 - 20,000 | 25 | 15.0 |
| 20,001 - 30,000 | 29 | 17.5 |
| 30,001 - 40,000 | 34 | 20.6 |
| 40,001 - 50,000 | 36 | 21.8 |
| Above 50,000 | 18 | 11.0 |
| **Educational Qualification** | | |
| Below SSC | 8 | 5.0 |
| SSC | 15 | 9.0 |
| Intermediate | 28 | 17.0 |
| Graduate | 61 | 37.0 |
| Post Graduate | 36 | 21.8 |
| Any other | 17 | 10.3 |
| **Type of House** | | |
| Own | 108 | 65.4 |
| Rented | 57 | 35.5 |

| | | |
|---|---|---|
| **No. of Members in Family** | | |
| 2 | 12 | 7.2 |
| 3 | 25 | 15.1 |
| 4 | 38 | 23.0 |
| 5 | 57 | 34.5 |
| Above 5 | 35 | 21.2 |
| **Occupation** | | |
| Government employee | 45 | 27.2 |
| Private employee | 35 | 21.2 |
| Own business | 42 | 25.4 |
| Retired | 16 | 9.6 |
| Housewife | 13 | 7.8 |
| Any other | 14 | 8.4 |
| | **165** | **100** |

**Table 3. Reliability and Validity Assessment of the Survey**

| Description of Variables | Item Total | Factor Loading | Eigen Value | Cumulative Variance Explained | Cronbach's Alpha |
|---|---|---|---|---|---|
| **Perceived Benefit (PB)** | | | 3.671 | 63.231 | 0.796 |
| Solar energy systems are efficient. | 0.632 | 0.687 | | | |
| Using solar energy is delightful. | 0.709 | 0.806 | | | |
| Adoption of solar energy is economical. | 0.791 | 0. 807 | | | |
| I think solar energy is durable. | 0.752 | 0.818 | | | |
| **Perceived Risk (PR)** | | | 3.785 | 64.985 | 0.832 |
| I think using solar energy is approved by the community. | 0.521 | 0.627 | | | |
| I feel using solar energy will enhance my personal image. | 0.597 | 0.709 | | | |
| I think using solar energy ensures safety. | 0.708 | 0.793 | | | |
| Using solar energy will improve my health. | 0.632 | 0.709 | | | |
| Performance of solar energy systems is satisfactory. | 0.743 | 0.827 | | | |
| **Attitude (AT)** | | | 3.552 | 84.562 | 0.912 |
| I think that using solar energy helps to reduce pollution and protect the environment. | 0.803 | 0.883 | | | |
| Use of solar energy conserves the natural resources. | 0.762 | 0.835 | | | |
| I feel good when I use solar energy. | 0.735 | 0.836 | | | |
| **Normative Beliefs (NB)** | | | 3.721 | 88.567 | 0.901 |
| My friends expect me to use solar energy. | 0.832 | 0.908 | | | |
| My family members expect me use solar energy. | 0.812 | 0.925 | | | |
| I give preference to the opinions of my family members on the usage of solar energy. | 0.839 | 0.924 | | | |
| I consider the opinion of my friends on the usage of solar energy. | 0.813 | 0.927 | | | |
| My society expects me to use solar energy. | 0.958 | 0.924 | | | |
| **Moral Obligation (MO)** | | | 2.986 | 84.765 | 0.908 |
| Adoption of solar energy accomplishes my responsibility towards the environment. | 0.767 | 0.832 | | | |
| Adoption of solar energy is helpful to protect the environment. | 0.843 | 0.932 | | | |

| | | | | | |
|---|---|---|---|---|---|
| **Subjective Norms (SN)** | | | 3.453 | 78.543 | 0.907 |
| Adoption of solar energy is the right decision. | 0.808 | 0.934 | | | |
| I think adoption of solar energy is necessary. | 0.721 | 0.828 | | | |
| I think adoption of solar energy is beneficial to me and others. | 0.762 | 0.876 | | | |
| **Control Force (CF)** | | | 3.435 | 61.654 | 0.816 |
| My financial resources allow me to adopt solar energy. | 0.685 | 0.765 | | | |
| I have enough resources (time) to adopt solar energy. | 0.631 | 0.772 | | | |
| I have adequate information and knowledge about solar energy. | 0.669 | 0.839 | | | |
| I consider I have all the resources to adopt solar energy. | 0.676 | 0.754 | | | |
| It's easy for me to operate solar energy systems. | 0.709 | 0.787 | | | |
| **Control Belief (CB)** | | | 3.234 | 78.798 | 0.867 |
| Operating solar energy systems is very easy. | 0.669 | 0.809 | | | |
| I can differentiate between solar energy systems and other renewable products. | 0.756 | 0.909 | | | |
| I have considerable knowledge of solar energy. | 0.724 | 0.908 | | | |
| **Perceived Behavioural Control (PBC)** | | | 3.445 | 68.222 | 0.876 |
| I can take the decision to adopt solar energy systems or not. | 0.756 | 0.867 | | | |
| Adoption of solar products is completely based on my decision. | 0.743 | 0.838 | | | |
| I will use solar products even if they are relatively expensive. | 0.734 | 0.868 | | | |
| I have the resources, knowledge, and ability to use solar energy systems. | | | | | |
| **Purchase Intention (PI)** | | | 3.238 | 81.557 | 0.885 |
| I would like to purchase solar energy systems. | 0.787 | 0.876 | | | |
| I would like to use solar energy systems. | 0.836 | 0.931 | | | |
| I would like to recommend others to adopt solar energy systems. | 0.858 | 0.949 | | | |

**(1) Reliability and Validity Assessment :** Reliability and validity were tested and the results are presented in the Table 3. Here, the perceived benefits and perceived risks are acceded. According to Nunnally (1978), the minimum threshold of 0.7 is required for all constructs. In the present study, it exceeds this figure in all the cases. The minimum threshold of 0.5 for the item-to-total correlation coefficient is also met. Thus, the reliability of the questionnaire was accepted.

Convergent validity of the questionnaire was met as the extracted factors should be at least over 1, factor loadings should be 0.5, and the variance explained values should be above 0.5. To meet the discriminant validly of the questionnaire, correlation between any two constructs should not be more than the Cronbach's alpha. This criterion was also satisfied.

**(2) Confirmatory Factor Analysis :** Analysis of moment squares (AMOS) version 20 was used to perform the

**Table 4. Measures of Model Fit**

| Goodness of fit measures | $\chi^2/df$ | GFI | AGFI | NFI | CFI | RMSEA | RMR |
|---|---|---|---|---|---|---|---|
| Recommended value* | ≤5.00 | ≥0.9 | ≥0.9 | ≥0.9 | ≥0.9 | ≤0.08 | ≤0.1 |
| CFA model | 2.574 | 0.936 | 0.907 | 0.923 | 0.906 | 0.067 | 0.10 |

Note: * Recommended values are based on Hair et al. (1998).

confirmatory factor analysis. According to Hoang, Igel, and Laosirihongthong, the (2006) ratio between goodness of fit and degrees of freedom should not be more than 3 and SRMR and RMSEA values should be 0.5 or more. As specified by Bagozzi and Yi (1988), GFI, AGFI, NFI, and CFI values should be more than 0.9.

The present study analyzes the results using structural equation modelling using AMOS version. The measures of model fit and confirmatory factor analysis (CFA), as illustrated in Table 4, show that the recommended values and the CFA values are calculated using AMOS. The complete results are presented in the Table 5.

**(3) Structural Model Analysis :** In the Table 5, all the hypotheses under study have been presented along with the results of the hypothesized relationship between the variables and the final concluding result based on the application of the theory. An overview of the entire study has been presented in the Table 5.

**(4) Hypotheses Testing and Inductive Analysis :** The empirical results are presented and illustrated in Table 5. The hypothesis H1a holds good as the path coefficient is positive, which means that the relation between perceived benefit of solar energy products and customer attitude is significantly positive. The hypothesis H1b holds good as the path coefficient is negative, which means that the relation between perceived risk and customer attitude is significantly negative.

The hypothesis H2a holds good as the path coefficient is positive, which means that the customers' normative belief of solar energy adoption intention is positively related to subjective norms. The hypothesis H2b holds good as the path coefficient is positive, which means that the customers' normative beliefs and moral obligations have a significant positive relationship with subjective norms.

The hypothesis H3a holds good as the path coefficient is positive, which means that the control force and control belief have a significant positive relationship with perceived behavioral control. The hypothesis H3b holds good as the path coefficient is positive, which means that the customers' control belief regarding intention for adoption of solar energy has a significant positive relationship with perceived behavioral control.

The hypothesis H4a holds good as the path coefficient is positive, which implies that the customers' attitude has a significant positive relationship with customers' intention for adoption of solar energy products. The hypothesis H4b holds good as the path coefficient is positive, which implies that the subjective norms of the customers has a significant positive relationship with customers' intention towards the adoption of solar energy products. The hypothesis H4c holds good as the path coefficient is positive, which implies that the customers' perceived

**Table 5. Structural Model Analysis**

| Hypothesis/Hypothesized Relationship | Path Coefficient | Effect | Result |
|---|---|---|---|
| H1a: PB → AT | 0.721 | + | Supported |
| H1b: PR → AT | **- 0.179** | - | **Not Supported** |
| H2a: NB → SN | 0.312 | + | Supported |
| H2b: MO → SN | 0.679 | + | Supported |
| H3a: CF → PBC | 0.373 | + | Supported |
| H3b: CB → PBC | 0.317 | + | Supported |
| H4a: AT → IA | 0.623 | + | Supported |
| H4b: SN→ IA | 0.368 | + | Supported |
| H4c: PBC → IA | 0.237 | + | Supported |

Note : Result of SEM analysis ($p < 0.001$).
PB: Perceived Benefit ; PR: Perceived Risk ; AT: Attitude ; NB: Normative Belief ; SN: Subjective Norm ; MO : Moral Obligation ; CF: Control Force ; CB: Control Belief ; PBC: Perceived Behavioural Control ; IA: Intention for Adoption

behavioural control has a significant positive relationship with customers' intention towards the adoption of solar energy products. At the end, it is found that customers' perceived benefit of using solar energy systems has a high influence on purchase intention.

## Managerial Implications

The results of the study offer several important implications to marketers and policy makers. The findings of the study are in line with the theoretical background, therefore, the study can be used as a reference to research the validity of the TPB model with respect to consumer behaviour in the solar products category. The findings of the study provide valuable insights on the determinants of customers' intention for adoption of solar products in the Indian context. The findings may aid the policy makers to design the policy to increase the purchase intention and behaviour of the customers towards solar energy products. The study would help marketers and policy makers to understand the behavioural aspects of the solar customers. More and more awareness needs to be created among the target customers regarding awareness and benefits of using solar energy products. Policy makers need to focus on the behavioural aspects of the customers with regard to environmental concern and environmental knowledge. The current study may help the policy makers as well as the marketers to formulate their policies and strategies with regard to actions which would enhance the purchase and usage behaviour of the consumers towards solar energy products.

## Conclusion

Solar energy products are a way to meet the current and future energy demand to achieve sustainability. Environmental concern is very low in majority of the customers in India. The study also found that consumers' attitude plays a major role in purchase of solar energy products. Solar energy purchase intention was positively related to perceived benefit and perceived behavioural control. Customers' awareness and knowledge levels were very low towards solar energy products. Consumer concern had a relatively low impact on purchase intention. Cost related factors play an important role in the adoption of solar power products. Alteration in people's attitudes, beliefs, and behaviors may increase the adoption rate of solar energy systems.

## Limitations of the Study and Avenues for Future Research

The current study has a number of limitations. First, the study was conducted in a single state, that is, in a specific geographical area with a limited sample size ; hence, the findings cannot be representative of the pan India population. The current study considered only the variables of the theory of planned behaviour framework ; there are other variables such as government policy and subsidy mechanism, which also have an influence on customers' adoption intentions. The study focused mostly on attitudinal dimensions. Future studies could attempt to examine different product categories of solar energy systems. Customers' purchase intention varies according to their knowledge, awareness levels, living conditions, social status, and educational & occupational background. In order to derive more insights from the customers related to the value and belief systems, qualitative studies through in-depth interviews can be conducted. Initial cost and government policy play a major role in the installation of solar systems, and studies can be conducted with these variables. Exclusive studies can also be directed towards rural customers. Research is also required in other renewable energy sectors from a consumer perspective.

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