Journal of Research and Rural Planning
Volume 9, No. 3, Summer 2020, Serial No. 30, Pp. 105-123
eISSN: 2383-2495 **ISSN: 2322-2514**
http://jrrp.um.ac.ir

Social Capacities to Facilitate the Establishment of Solar Energy Technology and its Effects on Sustainable Rural Development (Case Study: Kerman Desert Region, Iran)

Naser Shafieisabet [*1]- Neginsadat Mirvahedi [2]- Saeideh Haratifard [3]

1- Assistant Proffesor in Geography and Rural Planning, Shahid Beheshti University, Tehran, Iran.
2- Ph.D. Candidate in Geography and Rural Planning, Shahid Beheshti University, Tehran, Iran.
3-Ph.D. in Geography and Rural Planning, Shahid Beheshti University, Tehran, Iran.

Received: 22 April 2020 ***Accepted: 22 June 2020***

Abstract

Purpose: The use of solar energy has long been human interest. Some countries are trying to gradually replace fossil energy with solar energy because of special benefits such as lack of environmental pollution, frequency, immortality, and sustainable access. The potential of solar energy provides a good platform for the development of marginal villages and regions that are deployed away from urban centers or rural population centers. However, in some countries, despite the favorable weather conditions, for various reasons, the use of solar energy technology is still not commensurate with the potentials.

Design/Methodology/Approach: This research adopted a descriptive-analytical method to explain the potentials of solar energy technology for sustainable rural development in the study area on 400 randomized samples. The potential and process of developing and expanding solar energy technology, as an effective factor, was determined by 34 items under indicators such as education and awareness-raising, knowledge and skills, trust-building, capacity building, participation, and partnership in investment. The dependent research variable was also measured through 106 items in ecological, socioeconomic, and physical dimensions of settlement development.

Findings: The results suggested that the utilization of solar energy technology was effective in promoting sustainable development indicators of rural settlements in the study area. Hence, it is suggested to pay further attention to improving training and raising awareness as well as building support for villagers to increase the level of employment, participation, and investment in the utilization of solar energy technology.

Keywords: Solar energy, Sustainable rural development, Kerman desert region, Iran.
Paper type- Scientific & Research.

Use your device to scan and read the article online

How to cite this article:
Shafieisabet, N., Mirvahedi, N. & Haratifard, S. (2020). Social capacities to facilitate the establishment of solar energy technology and its effects on sustainable rural development (Case study: Kerman desert region, Iran). *Journal of Research & Rural Planning,* 9(3), 105-123.

http://dx.doi.org/10.22067/jrrp.v9i4.86523

Corresponding Author:
Shafieisabet, Naser, Ph.D.
Address: Department of Human Geography & Spatial Planning, Faculty of Geosciences, University of Shahid Beheshti, Tehran, Iran.
Tel: +98912 672 2483
E-mail: n_shafiei@sbu.ac.ir

1. Introduction

The promotion of rural development dimensions is regarded as one of the main objectives for governments, especially among the developing countries since villages are encountering with different problems such as poverty, unemployment, poor economic infrastructure, inadequate internal services, low productivity in the agricultural sector and rural production sector, climate change and lack of sustainable energy, as well as the destruction of natural resources despite relatively rich natural and agricultural resources. Also, challenging problems have largely impeded the development of rural areas (Byrd, Bosley, & Dronberger, 2009).

During the last decades, paying attention to indigenous knowledge of residents and raising their awareness for the optimal use of diverse environmental resources such as solar energy to achieve socio-economic development has been regarded as one of the key strategies presented for the sustainability of socioeconomic and environmental dimensions as well as the development of local settlements (Amundsen & Martinsen, 2015). Using solar energy technology includes huge capacity for building wealth and reducing poverty among underdeveloped villages, especially in those villages which are far from urban centers and rely more on fossil-fuel supply centers (Kruckenberg, 2015). Also, raising people's awareness about using this energy through innovative agricultural strategies and providing equal opportunities for all people will enable them to improve providing social services and increasing information levels to support food security (Bakhshizadeh, Hosseinpour, & Pahlevanzadeh, 2011). Further, revisiting policies for collaborative investment in the field of modern energy can be helpful (Katikiro, 2016). Thus, during recent years, using solar energy technology has expanded significantly across different countries, which has generated huge benefits in these countries, especially among remote rural centers. Accordingly, these countries have paid more attention to maximize the benefits of solar energy technology by utilizing efficient and effective technologies (Mutula & Van Brakel, 2006).

A large number of experts in the area of rural development argue that the appropriate use of solar energy capacities, along with adopting new techniques and methods can help improve the quality of life and the variety of productions in the rural areas (Pasten & Santamarina, 2012). The process of improving the quality of life among villagers is accelerated when people have sufficient access to sustainable energy (Bridges, 2005). Accordingly, the use of solar energy technology can be considered as a measure for public prosperity and social welfare among other things, and a powerful means for monitoring socio-economic development planning and a gauge for assessing the fulfillment of psychological, spiritual and material needs within the community, which rely on both subjective-qualitative and objective-quantitative indicators (Epley & Menon, 2008; Streimikiene, 2015).

Therefore, during recent years, the development of communication tools has improved the infrastructure and the possibility of receiving solar energy technology in all rural areas has exerted an enormous impact on the level of development, quality of life among the villagers, and their life satisfaction. In this regard, the villages of the area under study in Kerman province are assumed to include great potentials for receiving solar energy due to their favorite climatic conditions and numerous sunny days. The rural areas in this region employ a variety of methods to use solar energy technology for diverse purposes. However, many challenges are facing solar energy technology to expand infrastructure and provide the underlying structural services among the villages in this region. These challenges are mainly concerned with training and awareness-raising, knowledge and information, capacity building and empowerment, and participation of villagers in using solar energy. Moreover, planners' and policymakers' attention to the role of villagers for investing in new and solar energy infrastructures and the lack of close relationships between planners and the people, as well as underestimating the potentials of rural residents are regarded as the major reasons for the lack of training and controlling these people over solar energy. Furthermore, these factors have compromised the sustainability and the socio-economic development of rural settlements. Therefore, addressing solar energy technology as a stimulus for economic activity and the basis for

transformation and rural development can play a significant role on improving housing and the environment, agricultural activities, livestock, horticulture and an improved level of welfare among the villagers as well as reducing national costs and saving fossil fuels. Thus, the present study seeks to answer the following questions:

1. Which indicators can facilitate and influence using solar energy technology in the studied area?
2. To what extent, do the establishment and expansion of using solar energy technology contributes to the promotion of sustainable development in the rural settlements within the study area?

2. Research Theoretical Literature

The sustainable development approach has attracted the attention of associations and experts as a result of international congress and discussion on environment and development since the 1970s. Using renewable energy plays a significant role in those experts advocating the integration of environmental and ecological factors into the development trends of urban and rural activities. Accordingly, the approach developed into a paradigm with several applications in various urban and rural areas as well as natural resource management, which provides various paradigms in an integrated manner (Zizumbo-Villarreal & Roja-Caldelas, 2011). According to Najam & Cleveland (2005), it is essential to consider the diversity of sustainable development dimensions regarding the application of new and renewable energy. Thus, the diversity of socioeconomic, cultural, natural, and environmental dimensions is as follows:

1. Environmental sustainability: The use of new and solar energy technology should be compatible with the conservation of environmental, biological, and related processes.
2. Sustainability of cultural and social factors: The use of new and solar energy increases the humans' control over their lives and determines the identity within the society without any conflict with the cultural and value factors which are affected by these factors.
3. Economic sustainability: The use of solar energy technology should be economically emphasized and necessary monitoring measures should be taken to preserve for future generations (Najam & Cleveland, 2005).

Based on this method, enormous potentials are available for meeting global demand for energy. The energy provides an opportunity for developing economies, meeting the energy needs, creating employment, and setting up manufacturing and service industries which have attracted a lot of attention in developing countries, especially in remote and rural areas (Pfeiffer & Mulder, 2013). Therefore, it offers huge potentials for developing the regions, especially employing in remote and rural areas (Alper & Oguz, 2016). Based on the previous studies, the implementation of the projects related to the use of solar energy technology in deprived and rural areas with higher unemployment rates will contribute to the stability of the population in these areas, and the alleviation of depopulation in these areas and an increase in growth and productivity (Akella, Saini, & Sharma, 2009). Further, it can provide important implications for providing energy infrastructure among the countries which are using these resources (Cook, 2011). Hence, solar energy can play a pivotal role in accelerating sustainability, developing social and economic dynamics, as well as developing the physical condition of these countries if they are used effectively (Heshmatian, Shamsi, & Shamsi, 2012).

Also, the development of solar energy can meet a large part of this demand without any need for displacing the villages. Further, the abundance of this energy in some regions can be observed as a relative advantage of these areas and a stimulus for their further development (Sartipipour, 2012). Solar energy technology can be used at the micro and macro levels which contribute to an improvement in efficiency and participation in development, the promotion of lifestyle, and cost reduction in the service sector (Zhao, Zuo, Feng, & Zillante, 2011). Further, solar energy can play an integral role in accelerating development, increasing social and economic dynamism, and improving the physical condition of developing countries in the case of appropriate use (UNECA, 2006). To design a strategy for the development of solar energy technology in line with the objectives of sustainable rural development, financial and legal means, development and awareness-raising, empowerment, capacity

building, and training should be taken into consideration (Süsser, Döring, & Ratter, 2016).

In Iran, the necessary conditions are available for providing financial incentives through the establishment of the Renewable Fund. The development of the financial support system and expansion of solar energy technology organizations as well as the adoption of innovative approaches will contribute to the establishment of sustainable structure and financial mechanisms and the preparation of the ground for domestic and foreign investors (Mohebbigargarii, Coul, & Sistani, 2016). Also, raising the level of knowledge and awareness among villagers and their capability for incorporating the technology in socioeconomic activities which can aid rural development as well as fostering the capacity of residents to adopt solar energy technology concerning agricultural and non-agricultural activities should be considered as the top priorities (Amundsen & Martinsen, 2015).

Thus, empowering villagers for efficient and effective use of solar energy can improve their productivity and boost rural development indicators (Bansal & Kumar, 2011). Empowering villagers as a way of fostering self-reliance and self-confidence, and diminishing dependence can help marginalized groups to strengthen their organization and unshackle themselves from the dominance of structures or relationships (Sharma & Kirkman, 2015). Improving the villagers' knowledge and skills can facilitate establishing NGOs and adopting appropriate strategies in addition to accessing resources and solar energy (Rossberger & Krause, 2015). Thus, empowering villagers as an effective means can play a pivotal role in adopting solar energy technology in rural settlements, which has attracted growing attention due to the increasing demand of the villagers to ascertain and advance the goals of social and economic life. In practice, it has raised the awareness, knowledge, and information of societies about the integral role of it in which solar energy has contributed to sustainable rural development in addition to raising the villager's level of satisfaction and willingness through adopting solar energy.

2.1. Background Review

Inconsistent results were reported on the renewable energy potentials for local stakeholders as well as its effects on rural sustainable development. For example, Fang (2011), in his study in East Asia and China, addressed the role of empowering local stakeholders to participate in technical training for renewable energy and suggested that local stakeholders' participation and co-operation in disseminating education significantly contribute to gain the benefits of solar energy to optimize the pattern of economic consumption in rural settlements. Mondal and Klein (2011) in their study in South Asia and Bangladesh indicated that drawing on solar energy technology has environmental implications in terms of reducing air pollution in addition to contributing to the optimal use of energy sources. Also, the results demonstrated that the use of modern sources of energy significantly affected the local economy (Mondal & Klein, 2011).

Further, the findings of Chandrasekar and Kandpal (2007) study in India emphasized that education and awareness, along with the capacity building of local stakeholders for fostering their knowledge and skills in utilizing modern energies, could significantly influence the environmental and economic dimensions of rural settlements in India. Furthermore, based on the results, enhancing the local stakeholders' confidence and trust supported their engagement for this type of energy, due to the role of solar energy technology in improving environmental quality, as well as its cost-effectiveness (Chandrasekar & Kandpal, 2007). In Southwest Asia, Iran has been accentuating the use of modern energies to reduce gender inequality through empowering environmental sustainability. Hence, empowering local stakeholders has been underscored for the new sources of energy to cope with the challenges of climate change. In addition, the findings of Afsharzade, Papzan, Ashjaee, Delangizan, Van Passel, & Azadi (2016) revealed that reaping the benefits of modern energies calls for creativity in politics and policy making. Further, the underdevelopment of using solar energy was related to the lack of attention to infrastructure upgradation, resource management, and economic benefits (Afsharzade et al, 2016).

In another study, Alam, Nor, Ahmad, & Hashim (2016) indicated that investing in this type of energy can have a remarkable effect on developing social welfare and environmental infrastructure in addition to alleviating poverty. Thus, policy changes were recommended for promoting the interventions of the private sector

for investment in green energy and widespread promotional campaigns by regarding the benefits of this type of energy (Alam et al, 2016).

In another study in African countries such as Zambia and South Africa, Mfune and Boon (2008) reported some barriers playing a major role in participating stakeholders such as disregarding appropriate policies to inform local stakeholders about the benefits of solar energy technology, high costs of using this type of energy, the underdevelopment of infrastructure, and lack of attention to advertising the benefits of renewable energy (Mfune & Boon, 2008). Also, Kenfack, Bossou, & Tchaptchet (2017) suggested that some internal factors such as little attention to raising public awareness, and an improper infrastructure for using solar energy technology and legal, financial and judicial issues related to the appropriation of solar energy as external factors, along with the weak presence of NGOs and public institutions have reduced the stakeholders' interest in exploiting modern energies in Central Africa and Cameroon (Kenfack, Bossou, & Tchaptchet, 2017)

Further, Aglina, Agbejule & Nyamuame (2016) emphasized a shift in policy towards participatory investment across different sectors in West Africa and Ghana. Accordingly, the need for strengthening the creation of capacity through NGOs was emphasized as a way of improving the use of solar energy (Aglina, Agbejule, & Nyamuame, 2016).

In East Africa, the findings of Katikiro (2016) in Tanzania have highlighted the need to raise the stakeholders' awareness to implement renewable energies and offer facilities to investors (Katikiro, 2016).

In another study, Musall and Kuik (2011) concluded that the stakeholders' ownership could play a role in encouraging investors to utilize new energies in European countries such as Germany (Musall & Kuik, 2011). Späth and Scolobig (2017) pinpointed the need for empowering stakeholders to turn to modern sources of energy in Western Europe, France, and Norway, especially at three levels of informing, consulting, and collaborating to make the transition possible. Thus, advising stakeholders on how to reap the benefits of solar energy and raising their information level were stressed along with strengthening the stakeholders' cooperation to exploit this source of energy (Späth & Scolobig, 2017).

In American countries, the participation and cooperation of all institutions and organizations with local stakeholders were highlighted in changing the procedures for benefiting from the new energies and entering into the market related to this type of technology (Banal-Estañol, Calzada & Jordana, 2017).

In Canada, Denis & Parker (2009) reported that giving authority for local decision-making is essential for encouraging stakeholders to raise their knowledge of solar energy technology. Further, the exchange of ideas and partnerships for putting the ideas into practice which can take place within the framework of rules through networks was emphasized (Denis & Parker, 2009). Finally, Bahadori, & Nwaoha (2013) showed that government policies are aimed at replacing all types of fossil fuels with renewable energy in Australia. Also, some incentives such as lending for the institutional investor, in addition to creating a close collaboration between research centers and technical centers to provide new energy services, were highlighted (Bahadori & Nwaoha, 2013).

By considering all the above-mentioned studies, it seems that the promotion of the indicators involved in the development of solar energy technology is effective in line with regional development, which can activate the optimal development cycle by promoting and improving environmental-ecological and social-economic indicators in rural settlements. Based on the new framework, solar energy offers potentials to residential centers, especially in rural areas away from urban centers and marginal areas and outskirts of cities, based on their socio-economic functions, infrastructure, and services to create a mutual interaction.

Thus, regarding Africa, the United States, Europe, Australia, East, and West Asia and Iran, the development of solar energy technology about rural settlements could increase agricultural and non-agricultural production, improve infrastructure and services, and subsequently promote natural, social, economic and physical environment indicators. Hence, solar energy technology can play a major role in the socio-economic development of human settlements, especially among rural areas. It is worth noting that despite the effect of using solar energy

technology on regional and local development, a small number of studies were conducted in Iran, especially at macro and regional levels. Therefore, the present study seeks to explore the indicator of using solar energy technology for sustainable rural development in the rural settlements of the desert region of Kerman province, Iran.

2.2. A theoretical model of the study

Based on the literature review, the theoretical approaches of the present study are based on the conceptual model. Based on this model, the main question is related to see whether the use of solar energy technology as an effective factor with all of its dimensions and indicators plays a significant role in promoting the indicators related to sustainable rural development, and whether they are mutually interrelated in this regard or not. Also, the present study discusses whether the facilitators related to the process of using solar energy such as education and awareness, knowledge and skill development, trust and capacity building, and investment of rural stakeholders can stimulate their participation in the decision-making process and investment in creating this technology, which can be seen as the potentials of exploiting solar energy technology for improving the indicators for sustainable rural development in Iran.

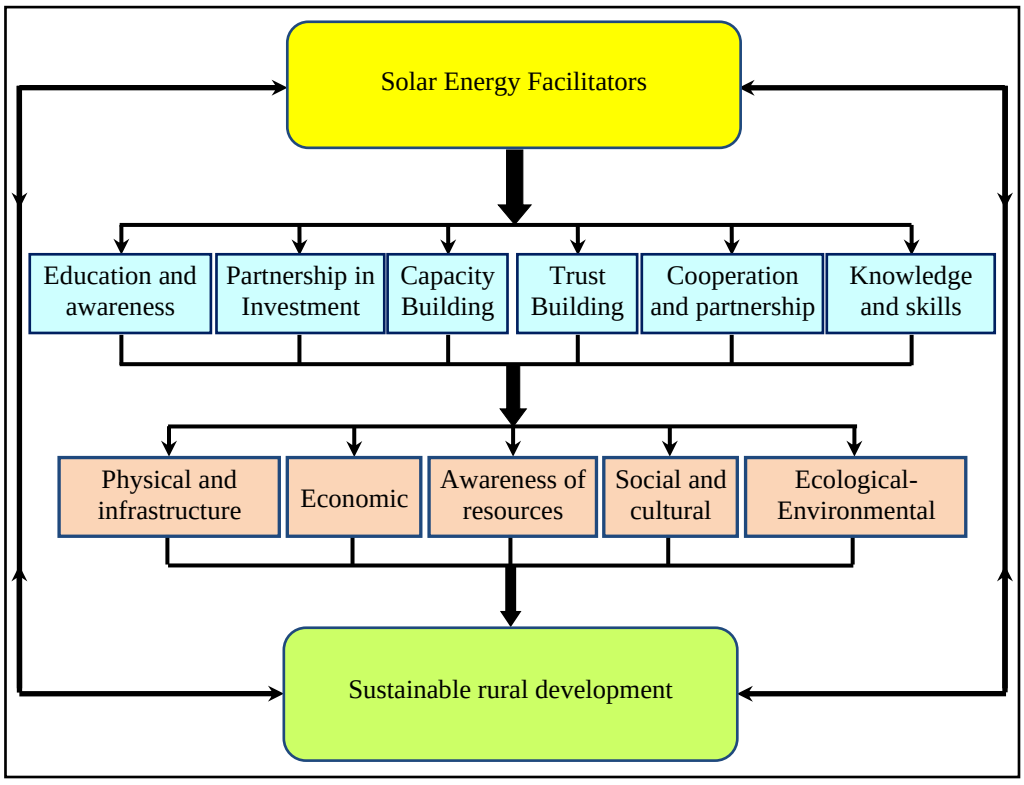

Figure 1. The conceptual model of the study based on the literature review and research background
(Source: Research findings, 2019)

3. Research Methodology

3.1. Geographical Scope of the Research

Kerman province is located between 21' 54 ° and 34' 59° east longitude and 29' 26° to 32° north latitude in the southeastern part of Iranian central plateau, with an area of 181785 km which covers more than 11% of the total area of Iran, which makes it one of the largest provinces in this country. Kerman, served as the south-east center of Iran, neighbors Yazd and Fars in the west, Hormozgan in the south and Sistan and Baluchestan Province in the east. Of the maximum and minimum height of the province lies in Hezar Heights in Bardsir (4473 m) Shahdad plain (117m), respectively. The average annual precipitation of the province was estimated at 188.5 mm during 2013-14, which ranged from 188.5 mL in the southwest (Baft Heights) to less than 65.5 mL (Shahdad plain) and Lut Desert in the eastern part of the province. The average air temperature in the same year ranged from less

than 13.2° in the center of the province (Hezar Heights) to more than 33.1° in Shahdad plain and Lut Desert. Based on the statistics in 2016, the population of the province was estimated 3164718, as the ninth populous province in Iran. Kerman is one of the most important and historical provinces of Iran, acting as the industrial, cultural, political, academic-scientific, religious center among the southeastern provinces in Iran.

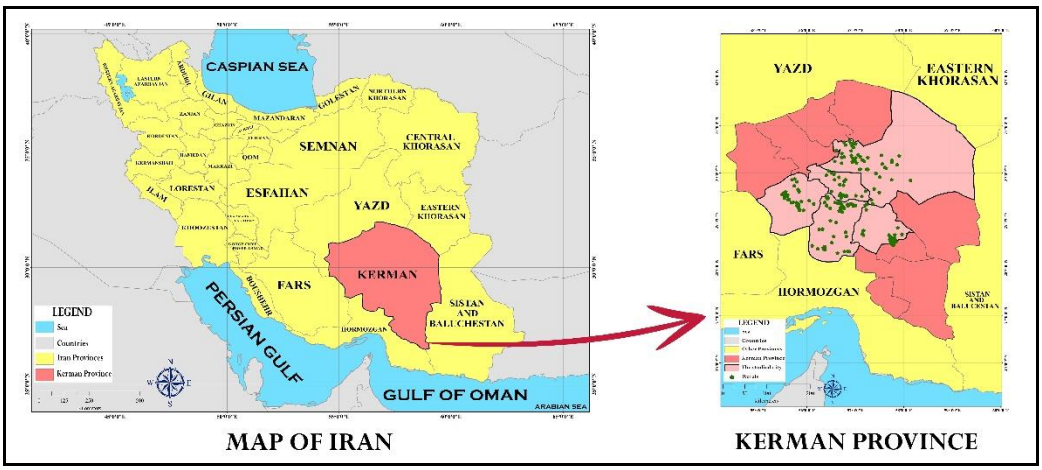

Figure 2. The geographical area of the study
(Source: Research findings, 2019)

3.2. Methodology

To explain the research objectives, a descriptive method was used for studying using solar energy technology facilitator for sustainable rural development. The population included 41 villages that used solar energy in Sirjan, Jiroft, Bardsir, Baft, Kerman, solar energy based on the data derived from the Statistical Center of Iran in 2016, among which, 31 were randomly selected as the sample. The sample included 11374 households as the rural population, who were selected based on a multi-stage sampling method. The sample size is 400 households based on the Cochran's formula. The selection of households among 31 villages was based on the percentage of household distribution in villages under study using a random sampling method including stratified sampling in the first stage and then simple random sampling (Kothari, 2009). Table 1 represents the parameters selected based on the literature review. Table 2 displays the factors influencing solar energy technology facilitators using for rural development including 6 scales and 34 subscales. Finally, Table 3 indicates the sustainable rural development in the area under study including 6 scales and 106 subscales.

Table 1. Indicators used in the previous studies about solar energy facilitators
(Source: Data analysis based on literature review, 2019)

Effective indicators in the process of solar -energy facilitators	**Researchers**
Education and awareness	Fang, 2011; Chandrasekar & Kandpal, 2007; Mfune & Boon, 2008; Kenfack, Bossou & Tchaptchet, 2017; Katikiro, 2016; Späth & Scolobig, 2017; UNECA, 2006
Knowledge and skills	Chandrasekar & Kandpal, 2007; UNECA, 2006
Cooperation and partnership	Fang, 2011; Chandrasekar & Kandpal, 2007 ; Alam et al., 2016; Kenfack, Bossou & Tchaptchet, 2017; Denis & Parker, 2009; UNECA, 2006; Banal-Estañol, Calzada & Jordana, 2017
Trust building	Chandrasekar & Kandpal, 2007; UNECA, 2006
Capacity building	Chandrasekar & Kandpal, 2007; Aglina, Agbejule & Nyamuame, 2016; Cebotari et al., 2017; UNECA, 2006
Partnership in investment	Alam et al., 2016; Aglina, Agbejule & Nyamuame, 2016; Cebotari et al., 2017; Bahadori & Nwaoha,2013; UNECA, 2006

Table 2. Scales and subscales facilitating the formation and development of solar energy technology facilitators
(Source: Data analysis based on literature review, 2019)

Indicator	Items
Knowledge and skills	Villager's knowledge and awareness of vi about using solar energy technology Residents' knowledge and ability in rural areas to deal with using solar energy technology problems Knowledge about the status of investment and allocation of credits for using solar energy technology Awareness of decisions related to the use of using solar energy technology The role of learning and training in the efficiency of using solar energy technology The effect of education on participation in making decisions on using solar energy technology The role of training in fostering creative thoughts by using solar energy technology
Education and awareness	The amount of training offered by organizations in charge of using solar energy technology The success rate of training courses organized by the organizations in charge of using solar energy technology The degree of access to solar energy education opportunities The scale of information-raising activities undertaken to promote educational programs related to solar energy The skills obtained from the training for encouraging people to use solar energy
Cooperation and partnership	Increasing rural population solidarity by using solar energy Establishing regular meetings with rural people to discuss the significance of using solar energy Using the facilities and local people's capabilities for promoting using solar energy Establishing a group of volunteers to monitor and evaluate the use of solar energy Collaborating between local authorities and people to support the use of using solar energy Emphasizing people's contribution to the use of using solar energy
Trust building	Raising people's awareness of the revenues derived from using solar energy Reinforcing people's confidence in using solar energy Paying attention to people's energy demands Fulfilling the promises made for people about using solar energy Inviting officials and relevant experts to attend public meetings on using solar energy Enhancing people's level of confidence about the effect of using solar energy Changing the attitude of public institutions about the villagers' low potentials
Capacity Building	Adopting educational and practical plan for using solar energy Raising public awareness about the use of solar energy Contributing to the decision-making process of solar energy Contributing to the provision of financial resources for the expansion of using solar energy Increasing the local people's motivation to utilize solar energy by considering banking facilities Enhancing the experts' willingness to share their knowledge of using solar energy with villagers Increasing the social interaction for the use of solar energy
Partnership in investment	Increasing the spirit of partnership in all stages of creating and using solar energy Raising the people's partnership in investing in solar energy Enhancing the people's participation in deciding on the use of solar energy

Table 3. Scales and subscales of sustainable rural development about the effects of using solar energy technology
(Source: Data analysis based on literature review, 2019)

Indicators	Items
Ecological-environmental dimensions	Monitoring the condition of pastures Improving the condition of vegetation and forests Preserving endangered plant species Improving the condition of crops and gardens Increasing biodiversity (plant and animal) Improving soil quality Supporting campaigns aimed at impeding desertification Preserving the reserves of surface water and underground water quality Enhancing the quality of surface and underground water Increasing the productivity of water derived from springs and Qantas Protecting agricultural lands Preventing soil erosion
Social and	Preparing the ground for maintaining the rural population

Indicators	Items
cultural dimensions	Improving the villagers' interaction and participation Fostering the social solidarity of the community Improving the demographic situation of rural areas Promoting people's living standard Increasing the residents' awareness Improving the growth of rural population Promoting the literacy level of male villagers Improving the literacy level of female villagers Increasing the rural residents' awareness about social problems Increasing rural residents' awareness of economic problems Promoting rural residents' skills in different fields Contributing to the diversity of skills among rural residents in different fields Emphasizing the rural residents' education to familiarize them with economic concepts Empowering rural residents to participate in social issues Increasing the power of bargaining and involvement in local decision-making Improving the training courses offered for solar energy Developing individual and group capacity among local residents Promoting individual and family skills Increasing social solidarity among villagers Developing people's trust in each other Supporting NGO activities Increasing the level of participation and cooperation among villagers Supporting the conservation of natural and historical heritages Raising the local people's awareness about the significance of resources in future Playing a role in managing and planning the village Improving the local people's involvement and contribution in making decisions Ensuring the adaptability of professional and training skills based on the needs of local community
Economic dimensions	Increasing the villagers' income level Supporting the investment of private sector Advocating the establishment of home-based workshops and stores Improving the villagers' skills and expertise Supporting the production and sale of handicrafts Promoting the status of the industry in rural areas Improving the export of agricultural products Supporting women's employment in rural industries Improving land and housing prices in rural areas Increasing the value of lands in rural areas Facilitating the process of changing land use Promoting men's employment in villages Increasing women's employment in villages Promoting the production of local handicrafts Creating new jobs Improving the villagers' purchasing power Expanding local markets Reducing the youths' unemployment in rural areas Increasing the total agricultural employment in rural areas Increasing the total non-agricultural employment in villages Increasing the workers' participation in agricultural activities among rural areas Increasing the workers' involvement in non-agricultural activities in villages Supporting the diversification of agricultural activities Supporting the diversification of non-agricultural activities in villages Increasing the yield per hectare of crops in the village Increasing the yield per hectare of garden products in the village Increasing the share of irrigated agricultural land among rural areas Increasing the share of lands allocated to dray farming among rural areas Expanding the area of agricultural lands

Indicators	Items
	Expanding the area of horticultural lands Promoting job diversification in villages Setting up and expanding small-scale credit funds (unofficial sources) in villages Developing and expanding official financing sources (banks) in villages Improving the level of savings among rural areas Improving the situation of peasant and small-scale beneficiaries in villages Increasing the share of villagers in the production of handicrafts and workshops Improving investment in agricultural activities among the villages Improving investment in non-agricultural activities among the villages Facilitating the access of rural residents to the market and commercial centers Promoting active enterprises in rural areas Supporting service industries
Physical and infrastructure dimensions	Improving water supply infrastructure Improving the conditions of roads and communication paths among rural areas Expanding landline networks Developing mobile communication networks Improving the condition of electricity networks and lighting in rural roads Expanding the infrastructure of gas supply networks Developing the infrastructure of the sewage networks Supporting and building up agricultural infrastructure Developing sports facilities and complexes Improving the infrastructure of rural industries Promoting fuel supply infrastructure Expanding the infrastructure of transportation network Promoting the health and medical conditions of rural areas Reinforcing the infrastructure for building construction
Education and resource awareness	Raising the local people's awareness about solar energy Improving the interaction between trainers and people concerning the solar energy Improving the quantity and quality of training related to solar energy Improving the residents' awareness of the benefits of solar energy Stressing the role of using solar energy in helping resource conservation Explaining the role of solar energy in the economic justification of resource conservation Developing and improving the quality of natural resources Increasing people's awareness about the significance of resources Increasing the level of awareness and sensitivity among the related authorities and managers about the significance of resources Enhancing the people's participation in protecting and preserving resources Fostering a sense of appreciation and gratitude towards nature in people Raising the local residents' awareness about the use of solar energy

Cronbach alpha coefficient is used to determine the reliability of qualitative subscales (Hafeznia, 2009). In the present study, Cronbach alpha of 0.815 was obtained for qualitative subscales. To assess the validity, the relevant individuals' comments and opinions in the Institute for Economic Research, Rural Planning and Agricultural Development of Jihad, the experts in New Energy Organization, New Energy Institute, and the Center for Natural Resources and Agricultural Researches in Kerman Province were collected for ensuring face validity.

Also, descriptive statistical methods were used to describe age groups. Kendall correlation coefficients were used to determine the relationship between the dependent and independent variables by considering the integrative nature of variables. Further, multivariate regression was used to determine the general relationship between dependent and independent variables, the potentials of using solar-energy facilitators in sustainable rural development.

4. Research Findings

A total of 400 respondents including 73% men and 27% female were selected for data analysis. Table 4 indicates the detailed specifications of the participants.

Table 4. Descriptive statistics for the participants (N = 400)
(Source: Research Findings, 2019)

Features		N	Percentage
Gender	Male	292	73
	Female	108	27
Education	Primary school	114	28.5
	Middle school	66	16.6
	High school diploma	62	15.6
	Associate degree	93	23
	Bachelor degree	53	13.3
	Master degree and higher	12	3
Job	Farmer	114	28.52
	Livestock farmer	93	23.33
	Service jobs	76	18.9
	Office jobs	56	14.1
	Retired persons	36	8.9
	Others	25	6.25

4.1. The effect of using solar energy technology on promoting sustainable development indices

As indicated in Tables 2 and 3, the effect of using solar energy technology on promoting sustainable rural development indicators was measured based on various scales and subscales. Hence, the dependent and independent variables were obtained based on the mean responses of the rural residents who used solar energy on a 5-point Likert scale.

Based on the literature review and the research background, the facilitators of using solar energy technology are influenced by six scales including education and awareness-raising, knowledge and skills, cooperation and participation, trust-building, capacity building, and investment partnerships. The use of solar energy technology can contribute to the promotion of sustainable rural development indicators if the process is implemented appropriately. Accordingly, the effect of the solar energy was evaluated based on the improvement of sustainable development indicators among rural settlements of Kerman province, Iran.

4.2. Relationship between people's education and awareness-raising of using solar energy technology and the promotion of sustainable development indices

Table 5 indicates the results of the role of education and awareness in using solar energy technology. Based on the results, no significant relationship is observed between these two factors and sustainable rural development ($p > 0.211$). There is no significant correlation between the subscales provided by the relevant organizations in charge of solar energy including the success rate of training courses implemented by the organizations in charge of solar energy, the degree of accessing to solar energy education opportunities, the role of information raising to provide educational programs for solar energy and skills obtained from the training related to participation in solar energy startups and improving sustainable rural development. In other words, the villagers in the present study struggle with many challenges in accessing education and training about solar energy. That is, organizations and institutions have failed to provide the necessary training and information in creating and expanding the structure of solar energy.

4.3. Relationship between the knowledge and skill of using solar energy technology and the promotion of sustainable development indices

Knowledge and skill for solar energy is a combination of seven subscales. The results of Kendall's tau-b test indicated a significant relationship between knowledge and skill and improving sustainable rural development (Table 5). Also, all subscales of knowledge and information, the impact of training on participation in decision making related to solar energy as well as the effect of training on nurturing innovative ideas about the use of solar energy were significantly related to the development of rural settlement in the significance level of 0.05 and 95% confidence level. However, the effect of

training on increasing solar energy efficiency was not confirmed. In other words, no significant relationship was found between the items related to the pervasiveness of education and sustainable development in the selected villages, due to the lack of sufficient training for empowering villagers. The villagers' knowledge and skills are obtained from the sources other than those authorities in charge of creating a solar energy framework.

4.4. Relationship between cooperation and the villagers' participation in using solar energy technology and the promotion of sustainable development

Table 5 displays the six subscales related to the cooperation and the villagers' participation. The results of Kendall's tau-b test indicated that the scale was significantly related to improving sustainable rural development (P=0.000). Besides, all 6 subscales of participation were significantly correlated with improving the indicators for sustainable rural development at the significance level of 0.05 and a 95% confidence level. However, local managers' cooperation with local people about solar energy failed to promote sustainable development.

4.5. Relationship between trust-building in using solar energy technology and the promotion of sustainable rural development

As indicated in Table 5, a significant relationship was observed between trust-building and improving sustainable rural development indicators (r = 0.417). However, no significant relation was reported between fulfilling the promises related to solar energy and inviting officials and experts to attend public meetings on solar energy.

4.6. Relationship between capacity building in using solar energy and the promotion of sustainable development

Table 5 represents a combination of seven subscales that influence sustainable development among rural settlements. Based on the results, capacity building was significantly related and to the dimensions of sustainable development of villages (r = 0.458). Also, all seven subscales of the capacity building were significantly correlated with improving sustainable rural development indicators at the significance level of 0.05 and 95% confidence level although, the experts' willingness of sharing their knowledge with villagers about solar energy was not confirmed.

4.7. Relationship between partnership for investment in using solar energy and the promotion of sustainable rural development

Based on the results of Kendall's tau-b test, the correlation coefficient of 0.514 suggests a significant and direct relationship was reported between all the related subscales and the promotion of rural settlement (r = 0.514). Reinforcing partnership in solar energy leads to an increase in the quantitative and qualitative use of solar energy and the promotion of sustainable development indicators for rural settlements.

Table 5. Relationship between using solar energy technology and sustainable rural development
(Source: Research findings, 2019)

Parameters affecting the using of solar energy	Variable	Mean	SD	Kendall's tau_b test		Correlation
				r	Sig	
Education and awareness-raising	Sustainable rural development	1.305	0.35620	0.214	0.304	-
Knowledge and skill		3.568	0.43437	0.435	0.000	+
Cooperation and partnership		4.625	0.54727	0.434	0.000	+
Trust building		4.418	0.44291	0.417	0.000	+
Partnership in investment		4.280	0.73900	0.514	0.000	+
Capacity building		4.641	0.56873	0.458	0.000	+

Finally, as indicated in Table 6, a significant relationship was observed between the potentials of using solar energy technology and promoting the indicators of sustainable rural development of rural settlements in Kerman province. Accordingly, appropriate use of solar energy technology potentials among the selected villages could improve the indicators related to the sustainable development of the settlements.

Table 6. Relationship between the potentials of using solar energy and the promotion of sustainable rural development

(Source: Research findings, 2019)

Parameters influencing the use of solar energy	Dependent variable	Mean	SD	Kendall's tau_b test		Correlation
				r	Sig	
Potentials of solar- energy technology	Promoting sustainable rural development indicators	3.76	0.823	0.581	0.000**	+

** Significance at 99% level

4.8. Final evaluation of the effect of using solar energy technology on the promotion of sustainable rural development

To determine the degree of correlation, multivariate regression was used to study the correlation among five variables including knowledge and skills, partnership, trust-building, investment partnership, and capacity building in the process of using solar energy technology and promoting sustainable rural development in the study area. The results indicated a positive correlation between the development of settlements using solar energy and five independent variables (r=0.512). Besides, based on the adjusted coefficient of determination, 62/1 % of the variation in the development of settlements by using solar energy technology could be explained by the linear combination of the five variables (Table 7).

Table 7. Regression results of five main variables and the promotion of sustainable rural development

(Source: Research findings, 2019)

Multiple Correlation Coefficient (r)	Coefficient of Determination R^2	Adjusted moderated coefficient	The standard error of measurement
0.512	0.654	0.621	0.009

Further, based on the F value at a 99% confidence level, the integration of independent variables could significantly explain and predict the variation in the dependent variables of the development of residential areas by using solar energy based on the rural residents' viewpoints.

Table 8. ANOVA for determining the effect of regression related to five main variables on improving sustainable rural development

(Source: Research findings, 2019)

Model		Sum	df	Mean squares	F	Sig.
1	Effect of regression	31.616	6	6.323	119.698	0.000
	Remainder	13.946	264	0.053		
	Total	45.563	269			

Finally, based on the standardized coefficient of the effect of independent variables on the dependent variable, the results obtained from a group of residents indicated that training failed to improve sustainable rural development. Also, based on the determination coefficient of variables on sustainable rural development, the capacity-building with a coefficient of 0.343 had the highest effect on improving sustainable rural development, followed by participation (0.310), partnership (0.257), confidence building (0.198) and knowledge and awareness (0.190).

Table 9. Coefficients of the effect of independent variables on dependent variables based on rural residents' viewpoints

(Source: Research findings, 2019)

Coefficients (a)						
Model		Non- standard coefficient		Standard coefficient	T	Sig.
		B	Std. Error	Beta		
1	Intercept	0.756	0.189		3.989	0.000
	Knowledge and skills	0.180	0.034	0.190	5.352	0.000
	Cooperation and partnership	0.233	0.030	0.310	7.712	0.000
	Confidence Building	0.184	0.035	0.198	5.068	0.000
	Partnership in investment	0.143	0.020	0.257	7.091	0.000
	Capacity building	0.248	0.026	0.343	9.393	0.000

Therefore, according to rural residents, the significance of education and awareness-raising in the process of establishing and expanding solar energy has not been considerably emphasized in the present study. The authorities in charge of implementing solar energy projects in the studied area have failed to provide the necessary education and training in this respect although the effect was positive in other dimensions which could contribute to the promotion of the indicators related to sustainable rural development.

5. Discussion and Conclusion

Using solar energy technology offers an effective means of addressing poverty and underdevelopment among villages. By increasing the people's level of knowledge by implementing innovative agricultural strategies and providing equal opportunities, they can play a role in improving socioeconomic services and raising the level of information to support food security. During recent years, the development of communication tools, an improvement in infrastructures, and the ease of access to these facilitators in all rural areas have greatly influenced the quality of life among villagers and the promotion of sustainable rural development dimensions.

Based on the results of the present study, a direct and positive linear correlation was observed between promoting the development of rural settlements and the use of solar energy. Therefore, the promotion of sustainable rural development indicators for using solar energy is measured through some indicators such as education, knowledge and skill, cooperation and partnership, trust-building, and capacity building in the conservation of natural resources. Concerning the impact coefficient of variables on the development of sustainable rural development indicators, the capacity building had the highest effect on sustainable rural development in the present situation, followed by cooperation and partnership, participation, trust-building, knowledge, and skills, respectively. However, based on the standardized coefficient of the effect of independent variables on dependent variables, the effect on rural development was only insignificant based on the educational dimension. Therefore, by considering the rural respondents' perspectives, only education and awareness-raising are suffering from insufficient attention of authorities in charge of developing solar energy in the current situation and more effective measures should be adopted to raise the villagers' level of knowledge.

The results of the present study were inconsistent with the findings reported in the United States, Europe, Africa, and even Asia including the study of Chandrasekar and Kandpal (2007) in India and Fang (2011) in China. Based on these studies, the extent and type of training are effective in raising the villagers' awareness and understanding of the optimum use of solar energy technology. Thus, in the study area, rural settlements have not been able to attract sufficient investment in various uses of solar- energy and improve the infrastructure required for further expansion of this technology despite the significance of participation and investment in investment. Currently, the use of solar energy in the studied area is mainly restricted to domestic applications; therefore, the positive benefits of using solar energy can be reaped through investment in its development and expansion to provide infrastructural and developmental services to people. Moreover, there

is a direct relationship between the promotion of sustainable development indicators of settlement and the role of solar- energy. In other words, from local respondents, there is a significant relationship between the process of developing and expanding solar energy and all items in ecological-environmental dimensions of the dependent variable of sustainable development. Indeed, the use of solar energy technology has improved the natural environment of the settlements in the studied area in terms of the quality of water, thanks to the proper utilization and mechanization of wells, and reinforcement of pastures and forests due to reduced exploration of these resources as sources of fuel.

Concerning socioeconomic indicators affecting sustainable rural development, despite the direct and positive linear relationships, due to limited investment in solar energy technology and limited access to credit and banking resources, there are still many challenges facing the expansion of solar energy technology use. Therefore, concerning social and economic indicators affecting the sustainable development of rural areas, a large portion of solar energy potentials are still untapped due to the above-mentioned factors, and a small share of villagers and their limited involvement in developing solar energy infrastructures. Further, disregarding the authorities in charge of promoting solar energy for technical and vocational training programs to encourage the optimal use of new energies, in general, and solar energy, in particular, has deteriorated the role of solar energy despite its effect on all aspects of sustainable rural development in the area under study.

Considering the literature on this issue which highlights the importance and potential of solar energy technology for promoting ecological, social, and cultural, economic and environmental indicators in rural areas, it is necessary to link the promotion of sustainable development indicators to planning method for embellishing and developing technology-related projects, improve the indicators related to sustainable rural development underlined by proper use of technology through adopting the appropriate social and economic policies of the government based on development planning.

Therefore, the proper recognition of the potentials related to the process of establishment and development of solar energy can help promote government-led policy-making and inspire sustainable rural development.

Also, the proper utilization of technology within the framework of empowerment and capacity building among local and rural stakeholders has rendered the previous "top-down" approach to the development of this type of technology for sustainable rural development which is ineffective at the local and regional level. However, it supports "bottom-up" initiatives as well as the process of establishing and developing, which is vital for improving rural and non-agricultural activities, fostering social activities, and enhancing the indicators related to the natural environment and rural infrastructure and services.

Finally, it is required for the local government in the study area to take initiatives in identifying local programs in this field and make planning for the proper development of solar energy technology to promote the facilitators used for establishing and developing solar energy to increase the sustainable development among rural settlements.

Acknowledgments: This article has not received any specific grant from any organizations and is the result of scientific research by the authors.

References

1. Afsharzade, N., Papzan, A., Ashjaee, M., Delangizan, S., Van Passel, S., & Azadi, H. (1395/2016). Renewable energy development in rural areas of Iran. *Renewable and Sustainable Energy Reviews, 65*, 743-755. [In Persian].
2. Aglina, M. K., Agbejule, A., & Nyamuame, G. Y. (2016). Policy framework on energy access and key development indicators: ECOWAS interventions and the case of Ghana. *Energy Policy, 97*, 332-342.
3. Akella, A. K., Saini, R. P., & Sharma, M. P. (2009). Social, economic and environmental impacts of renewable energy systems. *Renewable Energy, 34*, 390-396.
4. Alam, S. S., Nor, N. F. M., Ahmad, M., & Hashim, N. H. N. (2016). A survey on renewable energy development in Malaysia: current status, problems, and prospects. *Environmental and Climate Technologies, 17*, 5-17.

5. Alper, A., & Oguz, O. (2016). The role of renewable energy consumption in economic growth: Evidence from asymmetric causality. *Renewable and Sustainable Energy Reviews, 60*, 953-959.
6. Amundsen, S., & Martinsen, Ø. L. (2015). Linking empowering leadership to job satisfaction, work effort, and creativity: The role of self-leadership and psychological empowerment. *Journal of Leadership and Organizational Studies, 22*, 304-323.
7. Bahadori, A., & Nwaoha, C. (2013). A review of solar energy utilization in Australia. *Renewable and Sustainable Energy Reviews, 18*, 1-5.
8. Bakhshizadeh, H., Hosseinpour, M., & Pahlevanzadeh, F. (2011). Rural ICT interactive planning in Ardabil province: Sardabeh case study. *Procedia Computer Science, 3*, 254-259.
9. Banal-Estañol, A., Calzada, J., & Jordana, J. (2017). How to achieve full electrification: Lessons from Latin America. *Energy Policy, 108*, 55-69.
10. Bansal, S. P., & Kumar, J. (2011). Women empowerment and self-sustainability through tourism: A case study of self-employed women in handicraft sector in Kullu valley of Himachal Pradesh, *Himachal Pradesh University Journal*, 1-11.
11. Bridges. (2005). *E-readings assessment tools comparison.* Cape Town: Bridges.
12. Byrd, E. T., Bosley, H. E., & Dronberger, M. G. (2009). Comparisons of stakeholder perceptions of tourism impacts in rural eastern North Carolina. *Tourism Management, 30*, 693-703.
13. Cebotari, S., Cristea, M., Moldovan, C., & Zubascu, F. (2017). Renewable energy's impact on rural development in northwestern Romania. *Energy for Sustainable Development, 37*, 110-123.
14. Chandrasekar, B., & Kandpal, T. C. (2007). An opinion survey-based assessment of renewable energy technology development in India. *Renewable and Sustainable Energy Reviews, 11*(4), 688-701.
15. Cook, P. (2011). Infrastructure, rural electrification, and development. *Energy for Sustainable Development, 15*, 304-313.
16. Denis, G. S., & Parker, P. (2009). Community energy planning in Canada: The role of renewable energy. *Renewable and Sustainable Energy Reviews, 13*, 2088-2095.
17. Epley, D. R., & Menon, M. (2008). A method of assembling cross-sectional indicators into a community quality of life. *Social Indicators Research, 88*, 281-296.
18. Fang, Y. (2011). Economic welfare impacts from renewable energy consumption: The China experience. *Renewable and Sustainable Energy Reviews, 15*, 5120-5128.
19. Hafeznia, M.R. (2009). *Introduction to research methods in human sciences* (17th ed.). Samt Publication, Tehran.
20. Heshmatian, M., Shamsi, H., & Shamsi, S. (2012). *The economical use of renewable energy: A solution for sustainable solar energy development.* Paper presented at Second Conference on Environmental Planning and Management (EPM), Tehran, Iran. [In Persian with English abstract].
21. Katikiro, R. E. (2016). Prospects for the uptake of renewable energy technologies in rural Tanzania. *Energy Procedia, 93*, 229-233.
22. Kenfack, J., Bossou, O. V., & Tchaptchet, E. (2017). How can we promote renewable energy and energy efficiency in Central Africa? A Cameroon case study. *Renewable and Sustainable Energy Reviews, 75*, 1217-1224.
23. Kothari, C. R. (2009). *Research methodology: Methods and techniques*. New Delhi: New Age International Publishers.
24. Kruckenberg, L. J. (2015). Renewable energy partnerships in development cooperation: Towards a relational understanding of technical assistance. *Energy Policy, 77*, 11-20.
25. Mfune, O., & Boon, E. K. (2008). Promoting renewable energy technologies for rural development in Africa: experiences of Zambia, *Journal of Human Ecology*, 24, 175-189.
26. Mohebbigargarii, R.M., Coul, F., & Sistani, E.S. (2016). *The use of new and renewable energies is a practical approach to sustainable economic development and energy management*. Paper presented at Second Conference on Environmental Science, Engineering & Technologies, Tehran, Iran. [In Persian].
27. Mondal, A. H., & Klein, D. (2011). Impacts of solar home systems on social development in rural Bangladesh. *Energy for Sustainable Development, 15*, 17-20.
28. Musall, F. D., & Kuik, O. (2011). Local acceptance of renewable energy: A case study from southeast Germany. *Energy Policy, 39*, 3252-3260.

29. Mutula, S. M., & Van Brakel, P. (2006). An evaluation of e-readiness assessment tools concerning information access: Towards an integrated information-rich tool. *International Journal of Information Management, 26,* 212-223.
30. Najam, A., & Cleveland, C. J. (2005). Energy and sustainable development at global environmental summits: an evolving agenda. *Environment, Development, and Sustainability*, *5*, 117-138.
31. Pasten, C., & Santamarina, J. C. (2012). Energy and quality of life. *Energy Policy, 49,* 468-476.
32. Pfeiffer, B., & Mulder, P. (2013). Explaining the diffusion of renewable energy technology in developing countries. *Energy Economics, 40,* 285-296.
33. Rossberger, R. J., & Krause, D. E. (2015). Participative and team-oriented leadership styles, countries' education level, and national innovation: the mediating role of economic factors and national cultural practices. *Cross-Cultural Research, 49*(1), 20-56.
34. Sartipipour, M. (2012). The role and application of renewable energies in rural development. *Geography, 9,* 125-148. [In Persian].
35. Sharma, P. N., & Kirkman, B. L. (2015). Leveraging leaders: A literature review and future lines of inquiry for empowering leadership research. *Group and Organization Management, 40,* 193-237.
36. Späth, L., & Scolobig, A. (2017). Stakeholder empowerment through participatory planning practices: The case of electricity transmission lines in France and Norway. *Energy Research & Social Science, 23,* 189-198.
37. Streimikiene, D. (2015). Environmental indicators for the assessment of the quality of life. *Intellectual Economics, 9,* 67-79.
38. Süsser, D., Döring, M., & Ratter, B. M. (2017). Harvesting energy: Place and local entrepreneurship in the community-based renewable energy transition. *Energy Policy, 101,* 332-341.
39. United Nations Economic Commission for Africa (UNECA). (2006): *African Regional Implementation Review for the 14th Session of the Commission on Sustainable Development (CSD-14).* Available at: https://sustainabledevelopment.un.org/content/documents/ecaRIM_bp.pdf.
40. Zhao, Z. Y., Zuo, J., Feng, T. T., & Zillante, G. (2011). International cooperation on renewable energy development in China–a critical analysis. *Renewable Energy, 36,* 1105-1110.
41. Zizumbo-Villarreal, R., & Roja-Caldelas, R. I. (2011). Assessment of a sustainable rural development model: best practices in Comala, Colima, and Mexico. *WIT Transactions on Ecology and the Environment, 150,* 609-621.

Journal of Research and Rural Planning
Volume 9, No. 3, Summer 2020, Serial No. 30, Pp. 105-123
eISSN: 2383-2495 **ISSN: 2322-2514**
http://jrrp.um.ac.ir

ظرفیت‌های اجتماعی برای تسهیل استقرار فناوری انرژی خورشیدی و اثرات آن بر توسعه پایدار روستایی (مورد مطالعه: منطقه بیابانی استان کرمان، ایران)

ناصر شفیعی ثابت*[1]- نگین سادات میرواحدی[2]- سعیده هراتی‌فرد[3]

۱- استادیار جغرافیا و برنامه‌ریزی روستایی، دانشگاه شهید بهشتی، تهران، ایران
۲- دانشجوی دکترای جغرافیا و برنامه‌ریزی روستایی، دانشگاه شهید بهشتی، تهران، ایران
۳- دانش‌آموخته دکترای جغرافیا و برنامه‌ریزی روستایی، دانشگاه شهید بهشتی، تهران، ایران

تاریخ دریافت: ۲ اردیبهشت ۱۳۹۹ ***تاریخ پذیرش: ۲ تیر ۱۳۹۹***

چکیده مبسوط

۱. مقدمه

فناوری انرژی خورشیدی از پتانسیل فراوانی برای ایجاد ثروت و سرمایه، مقابله با فقر و توسعه نیافتگی روستاها به ویژه در روستاهایی که فاصله بیشتری از کانون‌های شهری و مراکز تأمین سوخت‌های فسیلی دارند، برخوردار است. روستاهای مورد مطالعه با توجه به شرایط اقلیمی حاکم برآن و فراوانی تعداد روزهای آفتابی قابلیت زیادی در به کاربردن انرژی خورشیدی دارند اما چالش‌هایی در زمینه آموزش و آگاهی بخشی، دانش و اطلاعات، ظرفیت‌سازی و توانمندسازی و مشارکت روستاییان در رابطه با انرژی خورشیدی وجود دارد. این مسائل پایداری و توسعه اجتماعی ـ اقتصادی سکونتگاه‌های روستایی را با مشکل مواجه کرده است. پرداختن به موضوع مساله در ارتباط با فناوری انرژی خورشیدی به عنوان محرک فعالیت‌های اقتصادی و مبنای تحول و توسعه روستایی می‌تواند تاثیر مستقیمی بر بهبود مسکن و محیط زیست، فعالیت‌های کشاورزی، دامداری، باغداری و ارتقاء سطح رفاه روستاییان در کاهش هزینه‌های ملی و صرفه جویی و ذخیره منابع انرژی فسیلی داشته باشند و از اهمیت زیادی برخوردار است.

۲. مبانی نظری تحقیق

نگرش توسعه پایدار که از نشست‌ها و مباحث بین المللی درباره محیط و توسعه از دهه ۱۹۷۰ میلادی تا کنون حاصل شده، هنوز مورد اقبال مجامع و کارشناسان قرار دارد. کارشناسانی که هوادار ادغام مسائل زیست محیطی و اکولوژیک در روندهای توسعه فعالیت تولیدی در عرصه شهری و روستایی هستند و بحث فنآوری انرژی‌های تجدیدپذیر برای آن‌ها از اهمیت ویژه‌ای برخورداراست. این رویکرد نتیجتا به پارادایمی انجامید که در عرصه‌های مختلف شهری و روستایی و همچنین مدیریت منابع طبیعی کارایی دارد و پارادایم‌های گوناگونی را به نحوی یکپارچه پیشنهاد می‌کند. بالابردن سطح دانش و اطلاعات روستاییان و توانمندی آن‌ها در به‌کارگیری این فناوری در فعالیت‌های اجتماعی ـ اقتصادی می‌تواند مددرسان توسعه روستایی باشد و توجه به امر توانمندسازی و ظرفیت‌مندی ساکنان محلی در پذیرش فناوری انرژی خورشیدی در ارتباط با مقوله‌های مربوط به فعالیت‌های کشاورزی و غیرکشاورزی آن‌ها است. توانمندسازی روستاییان به مثابه یک ابزار کارآمد نقش مهم و انکارناپذیری در پذیرش فناوری انرژی خورشیدی در سکونتگاه‌های روستایی دارد. در عصر حاضر نیز به دلیل نیاز جدی روستاییان به دانستن و آگاهی برای پیشبرد اهداف زندگی اجتماعی و اقتصادی بر اهمیت آن بیش از پیش افزوده شده است و عملا در بالا بردن سطح آگاهی، دانش، اطلاعات جوامع در پذیرش این تکنولوژی نقش مهمی دارد و علاوه بر ارتقاء سطح رضایت‌مندی و پذیرش روستاییان در به‌کارگیری فناوری انرژی خورشیدی مددرسان توسعه پایدار روستایی نیز می‌شود.

*. نویسندهٔ مسئول:
دکتر ناصر شفیعی ثابت
آدرس: گروه جغرافیای انسانی و آمایش، دانشکده علوم زمین، دانشگاه شهید بهشتی، تهران، ایران.
پست الکترونیکی: Email: n_shafiei@sbu.ac.ir

۳. روش تحقیق

تحقیق حاضر با استفاده از روش توصیفی ـ تحلیلی است. جامعه آماری تعداد ۴۱روستا در شهرستان‌های سیرجان، جیرفت، بردسیر، بافت، کرمان و غیره هستند. تعداد خانوار این ۳۱ روستای نمونه برابر با ۱۱۳۷۴ خانوار بوده که حجم جامعه آماری خانوار روستایی را تشکیل می‌دهد. با توجه به موضوع و جامعه آماری، روش نمونه‌گیری چند مرحله‌ای است. حجم نمونه محاسبه شده برای ساکنین محلی بر اساس فرمول کوکران تعداد ۴۰۰ خانوار نمونه است. انتخاب خانوارها در ۳۱ سکونتگاه روستایی نمونه با در نظر گرفتن درصد توزیع آن‌ها به نسبت خانوار روستاها با استفاده از نمونه گیری ترکیبی تصادفی شامل نمونه گیری نسبی یا طبقه‌ای در مرحله اول و سپس تصادفی ساده بوده است. برای تعیین ارتباط بین مؤلفه های اثرگذار و اثرپذیر تحقیق با توجه به ترتیبی بودن متغیرها از ضرایب همبستگی کندال تائوبی استفاده شد. تعیین ارتباط کل متغیرهای پتانسیل استفاده از فناوری انرژی خورشیدی در توسعه روستایی، از رگرسیون چند متغیره استفاده شد.

۴. یافته‌های تحقیق

روستاییان منطقه مورد مطالعه چالش‌هایی برای دسترسی به آموزش و آگاهی بخشی در زمینه انرژی خورشیدی دارند. شاخص دانش و مهارت در زمینه فناوری انرژی خورشیدی حاصل متغیر ترکیبی ۷ گویه است که رابطه معناداری بین این مولفه با بهبود شاخص‌های توسعه پایدار روستایی وجود دارد. با استفاده مناسب از قابلیت‌ها و پتانسیل‌های فناوری انرژی خورشیدی در روستاهای مورد مطالعه، شاخص‌های توسعه پایدار و پایداری این سکونتگاه‌ها نیز ارتقاء یافته است. نتایج به‌دست آمده رگرسیون، نشان داد میان توسعه سکونتگاه‌هایی که از فناوری انرژی خورشیدی استفاده می‌کنند، با عوامل پنجگانه اثرگذار به میزان ۰/۵۱۲همبستگی وجود دارد. بر اساس ضریب استاندار شده تاثیر متغیرهای مستقل بر متغیر وابسته، نتایج در گروه ساکنان محلی نشان داد که تاثیر آماری در بعد آموزش بر میزان ارتقاء شاخص‌های توسعه پایدار روستایی معنادار نبوده است. از نظر ضریب تاثیر متغیرها بر میزان توسعه پایدار روستایی، متغیر ظرفیت‌سازی در شرایط موجود با ضریب تاثیر ۰/۳۴۳ بیشترین میزان اثر را برارتقاء شاخص‌های توسعه پایدار روستایی دارد. پس از آن متغیرهای مشارکت با ضریب ۰/۳۱۰، بعد شراکت با ضریب تاثیر۰/۲۵۷، بعد اعتمادسازی با ضریب تاثیر ۰/۱۹۸، دانش و اطلاعات با ضریب تاثیر ۰/۱۹۰ بر ارتقاء شاخص‌های توسعه پایدار روستایی اثرگذارند.

۵. بحث و نتیجه گیری

نتایج پژوهش نشان می‌دهد که میان ارتقاء شاخص های توسعه سکونتگاه‌های استفاده کننده از فناوری انرژی خورشیدی همبستگی خطی مستقیم و مثبت وجود دارد. ارتقاء شاخص‌های توسعه پایدار روستایی از به‌کارگیری انرژی خورشیدی از طریق مجموع شاخص‌های بعد آموزشی، بعد دانش و مهارت، بعد همکاری و مشارکت، بعد اعتماد سازی، بعد شراکت و بعد ظرفیت سازی در حفاظت از منابع طبیعی سنجیده شده است. متغیر ویژگی‌های ظرفیت سازی در شرایط موجود بیشترین میزان تأثیر برشاخص‌های توسعه پایدار روستایی داشته است. پس از آن به ترتیب متغیرهای همکاری و مشارکت، متغیرهای شراکت، اعتماد سازی، دانش و مهارت بر میزان توسعه روستایی اثرگذارند. ضریب استاندار شده تاثیر متغیرهای مستقل بر متغیر وابسته نشان می‌دهد که تاثیر آماری تنها در بعد آموزش بر میزان توسعه روستایی معنادار نبوده است. رابطه مستقیمی بین ارتقاء شاخص‌های توسعه پایدار سکونتگاه‌ها با نقش فناوری انرژی خورشیدی وجود دارد. استفاده از فنآوری انرژی خورشیدی باعث بهبود وضعیت محیط طبیعی سکونتگاه های منطقه مورد مطالعه از نظر کیفیت آب به دلیل بهره‌برداری مناسب و برقدار کردن چاه‌ها، پوشش مرتعی و جنگلی به دلیل کاهش استفاده از این منابع برای سوخت شد. در ارتباط با شاخص‌های اجتماعی و اقتصادی اثرگذار بر توسعه پایدار روستایی، به رغم وجود رابطه خطی مستقیم و مثبت، به دلیل سرمایه‌گذاری محدود در ارتباط با انرژی خورشیدی و دسترسی محدود به اعتبار و منابع بانکی هنوز مشکلات فراوان در زمینه گسترش استفاده از انرژی خورشیدی در فعالیت‌های عمرانی و زیربنایی روستاها وجود دارد.

کلیدواژه‌ها: انرژی خورشیدی، توسعه پایدار روستایی، منطقه بیابانی کرمان، ایران.

تشکر و قدردانی

پژوهش حاضر حامی مالی نداشته و حاصل فعالیت علمی نویسندگان است.

Use your device to scan and read the article online

How to cite this article:

Shafieisabet, N., Mirvahedi, N. & Haratifard, S. (2020). Social capacities to facilitate the establishment of solar energy technology and its effects on sustainable rural development (Case study: Kerman desert region, Iran). *Journal of Research & Rural Planning*, 9(3), 105-123.

http://dx.doi.org/10.22067/jrrp.v9i4.86523