

ANALYSIS OF CONVENTIONAL AND UN-CONVENTIONAL ENERGY PRACTICES IN THE SELECTED AREA OF DASOORI TANDO ALLAHYAR DISTRICT, SINDH, PAKISTAN

Samar Shamim Hussain¹, Fabiha Khalid², Madiha Midhat³

^{1, *2, 3}Department of Architecture and Environmental Design, Sir Syed University of Engineering and Technology, Karachi, Pakistan

²fkhaliid@ssuet.edu.pk

DOI: <https://doi.org/10.5281/zenodo.17586760>

Keywords

Climate Change, Conventional energy practice, Sustainable communities, clean energy sources

Article History

Received: 18 September 2025

Accepted: 27 October 2025

Published: 12 November 2025

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Corresponding Author:
Fabiha Khalid

Abstract

The unprecedented global challenges of climate crisis, mainly caused by the high levels of greenhouse gases in the atmosphere has a devastating impact on the world. The burning of fossil fuels for energy is a primary contributor to the problem, being responsible for approximately 75% of global carbon emissions. Countries like Pakistan severely faces the challenges of climate change despite of being a minor contributor of carbon emissions. The rural areas of Sindh are grappling with significant energy challenges, primarily due to limited access to reliable electricity from conventional sources. In case of selected union council Dasoori of Tando Allahyar district in the Hyderabad division, provenience of Sindh Pakistan has limited access to electricity and un-conventional energy sources. The study of region investigates the current situation of energy practices and consumption of the rural population.

The research methodology will be based on the quantitative and qualitative approach to collect the perception of the locals of communities through structured interviews and focus group questionnaires. The baseline survey has been carried out by primary data collection through the household, commercial and institutional survey.

Strategic recommendations emphasize the need for robust policy support, community-driven models, and financing to maximize the district's renewable energy adoption.

This study will also recommend a design proposal for solarization of a domestic unit. The research will help in improve the adoption of clean energy sources and play a perilous role in the development of sustainable rural communities.

INTRODUCTION

The environment and the economy are negatively impacted by conventional energy sources, such as coal, gasoline, and other fossil fuels. Pakistan's reliance on these resources has resulted in a catastrophic energy crisis. (Asghar et. al, 2022) Pakistan is facing multiple challenges for harnessing the indigenous energy resources and devise rational energy policies. Pakistan is facing severe electricity crisis and outages ranging from 8 to 12 hours

a day in urban areas and up to 18 hours in rural areas. (Mirjat et. al, 2017). The energy supply in Pakistan is highly dependent on thermal power generation which accounts for 60 percent of total energy. Any price surge in the foreign petroleum and natural gas market substantially affects power generation in Pakistan. (Tani et al, 2020). The GHG (greenhouse gas) emission from energy sector is 48.62 million ton consuming almost.

According to Intergovernmental Panel on climate change human activities in south Asia is 90% responsible for GHG emissions. (Renewable energy market update, Oct, 2022) update). Temperatures in South Asia are anticipated to rise by an average of 3.3 Centigrade by the end of the century, with Pakistan and India experiencing more significant rises than the average.

In Pakistan, the annual mean temperature has increased by about 0.5°C during the last half a century, the number of heat wave days per year has increased fivefold, and it has intensified the water and energy demand. Sindh is particularly affected with various manifestations of Climate Change such as increased variability of river flows and floods, heat waves and drought, these risks are affecting the health and economic well-being of the population and are resulting in social conflicts as well. In the face of natural hazards, it is essential to have development that is able to bear the impacts of these hazards and that is climate resilient development. Climate resilience is being woven into development approaches worldwide, which provide different development outcomes from business-as-usual scenarios. (Tani et al, 2020)

Several countries have initiated the creation of a more environmentally sustainable and less harmful energy infrastructure that could meet the rapidly growing energy demands (Ullah et. al. 2020). Integrating renewable energy sources into the energy mix would reduce the adverse effects on the environment and the healthcare expenses associated with economic growth while reducing debt and stabilizing energy prices in the long run (Dinc et. al, 2019). Hence, there has been a lot of emphasis on developing renewable energy globally. Wind and solar energy are the most sustainable options when considering ecosystem health, human well-being, and resource availability (Ahmed et. al).

Increasing agreement amongst

Countries like Pakistan severely faces the challenges of climate change despite of being a minor contributor of carbon emissions. A more vulnerable condition is observed in the second largest province of the country. The rural areas of Sindh are grappling with significant energy challenges, primarily due to

limited access to reliable electricity from conventional sources. This lack of dependable energy infrastructure has far-reaching implications, affecting socio-economic development and the overall quality of life for residents. In response to these pressing issues, this study aims to conduct a comprehensive assessment of the current nonrenewable and renewable energy supply, market dynamics, and consumption patterns in rural Sindh focusing on the union council Dasoori of Tando Allahyar district. (Tani et al, 2020)

1.1 SDGs Mapping

The research paper is associated with the United Nations Sustainable Development Goals (SDGs). This strategic configuration ensures that the study not only encounters the immediate energy needs of selected area of Dasoori Thando Allayar district but also subsidizes to wider global objectives, nurturing sustainable development on multiple heads.

The well-aligned Sustainable Development Goals (SDGs) includes SDG-13 Climate Action: the study directly links with making efforts towards a sustainable development by decreasing the reliance of fossil fuel and reducing carbon emissions, SDG-7 Affordable and Clean Energy will allow the underprivileged communities to improve on their livelihoods and development within their means and for SDG -11 Sustainable Cities and Communities: the selected community will be self-reliant and self-regulating on the production and utilization of solar energy as per their own conditions and will.

2. Objective of the Study

To investigate the current situation of conventional and un-conventional energy practices of the rural community of Dasoori, Thado Allayar district.

To identify and analyze the challenges faced by promoting and initiating the solar energy from the perspective of local of selected area.

Provide brief recommendations and design proposals related to solar energy adoption for the end users, policy makers, government and other stakeholders

Figure: 2 represents the Tando Allahyar is the district in the Hyderabad division, provenience of Sindh Pakistan. The four union councils are Dasoori, Missan, Shaikh Moosa and Jhando Mari. The area of Dasori was under the study.

Dasoori is the union council located in the Jhando Mari Taluka of Tando Allahyar district in Sindh, Pakistan.

Sanghar on Northern side, district Hyderabad and Matiari on the west and District Tando Muhammad Khan and Badin on Southern side.as shown in figure-1

4.1 Area of Dasori



Figure: 3 Map of Dasori

Figure:3 Dasori is located in the north of Tando Allahyar. It is one of the union councils of the mentioned district. The economic activities are majorly based on the agricultural crops. The villages also have an increasing alertness of accepting alternative energy solutions due to restricted access to conventional energy sources. The villages under Dasoori union council have road network and basic infrastructure facilities to

connect other villages and undeveloped facilities of, housing schools and other commercial activities for the daily life.

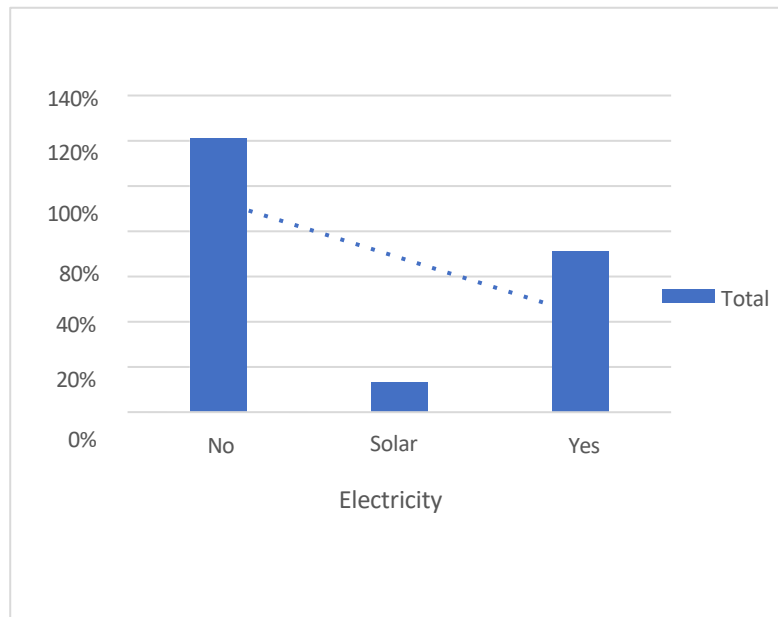
5. Results of Questionnaire Survey

The data collection is covered in three villages of union council dasoori ThandoAllahyar district such as Liaquat Thebo; Khuda Dino Mirjat; Mai Khan Thebo as shown in Table:1

S. No.	Villages	UC	Taluka	District
1	Liaquat Thebo	Dasoori	Jhando Mari	Tando Allahyar
2	Khuda Dino Mirjat	Dasoori	Jhando Mari	Tando Allahyar
3	Mai Khan Thebo	Dasoori	Jhando Mari	Tando Allahyar

Table: 1 this table is presents the selected villages of union council of Dasoori for the data collection related to the conventional and unconventional energy practices of rural communities. The random selected sample of population is 200. The results of baseline survey are mentioned in the graphical form.

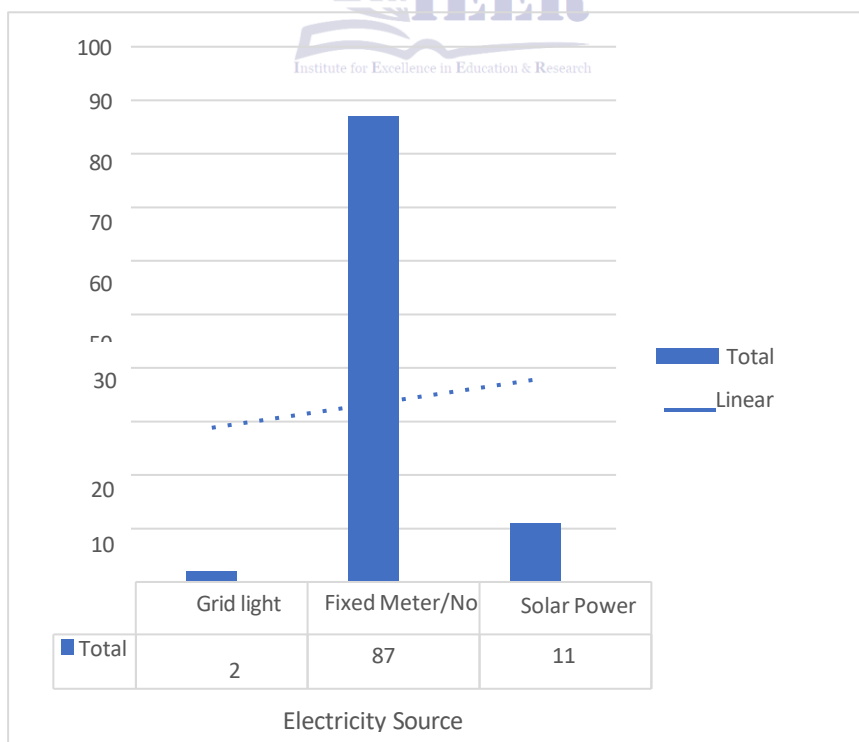
Graph: 1 Electricity Supply



Graph: 1 Majority of the population (120%) have “NO” access to electricity, and the other 80% of the population have availability to electricity. The solar category has the minor sample size (11%) that is indicating limited usage of solar energy.

Promoting solar energy practices in the villages should be a sustainable solution to increase electricity access.

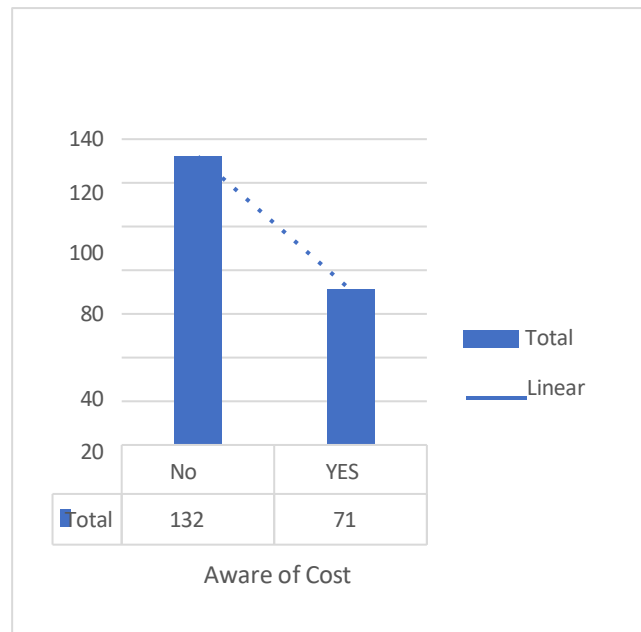
Graph: 2 Electricity Sources



Graph 2: The majority population sample size (87) has “No any” access to electricity, and fixed meter units against the conventional supply and the other sample size (11) has used solar power to generate electricity. However, the minor portion of the population (2) has used grid electricity.

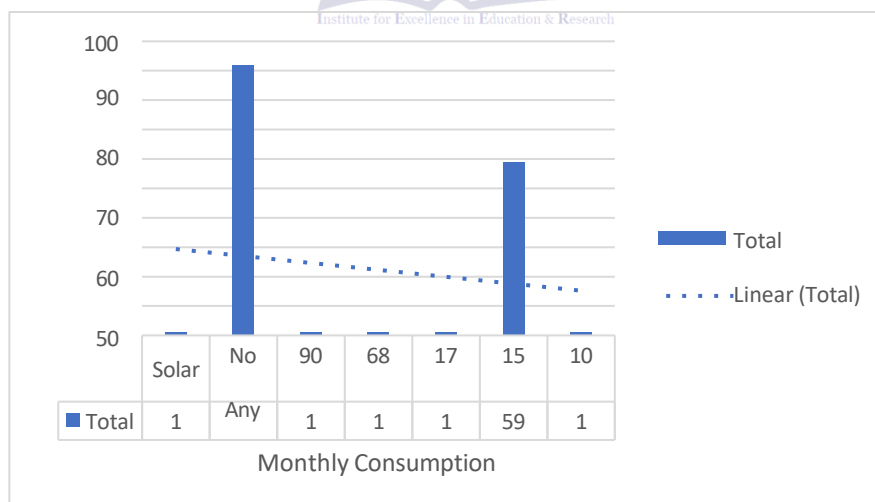
There is an urgent need to address this issue and provide off-grid electricity supply system through the different clean energy options like solar, and wind energy utilization.

Graph: 3 Aware of Cost



Graph 3: Most of the population (132) has no awareness of the cost of electricity in the villages, and the other sample size (71) is aware of the cost and monthly bills against the electricity consumption.

Graph: 4 Monthly Consumption and Bills



Graph: 4 the minor size of population has rely on the solar energy. The "NO" category has a significantly higher population sample (92), indicating a large portion of the population does not have monthly bills, and the other population sample is (59), representing the second largest portion of the population providing 500 fixed

monthly bills. The most of the areas of the selected villages has no access to conventional energy supply. Majority are depend on the meter light against fixed electricity bills and other minor sample of population is utilizing solar energy.

5. Discussions

In District TandoAllahyar Dasoori has limited access to Grid and it is limited to fixed billing amount which is varying between five hundred rupees for houses and 1000 thousand rupees for the commercial areas of Dasoori union council. District Tando Allayar have many remote settlements have limited access to grid electricity or face inconsistent and poor-quality power.

In most of the villages of Dasoori reliability of available grid is low as there are power outages of approximately 14 hrs.

5.1 Low Solar Energy Adoption

Solar energy usage remains very limited, with only 4% to 11% of households using solar panels across different locations in the selected villages of Dasoori. It shows the solar adoption (15%), but still, more than 50 % of its population lacks access to any energy source.

5.2 High Energy Insecurity and Challenges to adopting solar energy

A significant portion of the population in Dasoori has no access to any energy resource, highlighting severe energy poverty.

The main barriers to adopting solar energy are lack of information, high initial installation costs and over 90% of respondents in selected villages as major concerns regarding limited access to conventional energy practices.

The energy market in the mentioned villages of Thando Allayar district is underdeveloped, with low penetration of metered connections and fixed costs for limited electricity.

A majority of households earn Rs. 10,000–15,000/month, limiting their ability to invest in solar systems without subsidies or financing options. Despite of low income and limited resources the presence of solar panels indicate the motivation of people towards clean energy utilization.

Out of two hundreds households sample approximately twenty households are on solar panels. Demonstrates a strong willingness to transition to clean energy.

6. Conclusion

In conclusion, this research on the identification of the challenges related to energy practices, limited access to electricity and adoption of clean energy solutions from the end-user perspective in Dasoori Tando Allayar district After evaluating the conventional and unconventional energy practices of rural communities highlighting the issues of electricity, and this learning pursues to fill critical slits in the alternative energy sector. The insights gained will inform the development of more effective, user-centric renewable energy programs that address the specific needs of rural households, it also benefits to advancement the lively hoods of children and women in particular by adapting the recommendations for schools, clinics and healthcare facilities. Eventually supporting their evolution to sustainable energy solutions.

The research's results will bring vision for policy makers, energy providers, and end user communities confirming that future initiatives are well-aligned with the sustainable development goals and respond to climate change at the grassroots level. By educating rural communities with the knowledge and resources to contribute in the alternative energy adoption. The study's recommendations and solar energy proposal for residents will help to improve the electricity supply in rural communities of Dasoori, Tando Allayar district and play a crucial role in fostering a more sustainable and energy-secure future for rural Sindh.

7. Recommendations

1. Improve the reliability of energy supply and its sustainability.
2. Reduce the carbon emissions caused by exhausting non-renewable resources.
3. Development of local manufacturing and skilled human resources for renewable technologies.
4. Increase the electricity supply on affordable rates in all regions of Tando Allayar district.
5. Urgent need to plan off-grid solar energy system for the cluster of house units for the better supply of electricity.
6. Keeping an account of the

above-mentioned challenges, it directs towards a well informed and collective effort from the government, private sector, general public and international partners to foster an encouraging environment for renewable energy development in Pakistan.

7. In order to attract local and foreign investment a comprehensive and collective energy policy is required to meet the international trends. The policy must be based on local data analysis and relevant future speculations.

8. Introduce and regularize satellite grids or detached grids to promote local corporation and reduce the cost of mega transmission projects especially in rural areas.

9. By empowering rural communities with the knowledge and resources to participate in the clean energy transition, this research contributes to the overall development and well-being of the region.

10. **Distributed Solar Systems:** Encourage the installation of solar PV systems on rooftops of public sector buildings, schools, and hospitals in selected district. This initiative can help local population to familiarize with the technology and its benefits.

11. **Wind Energy Utilization:** Small-Scale wind turbines can be installed for domestic scale electricity generation. These turbines can facilitate localized energy generation, making them ideal for rural areas. These turbines typically range from 400W to 100kW.

12. **Solar Home Systems (SHS):** Facilitate the distribution and installation of solar home systems to low-income households.

13. **Biogas Energy:** Tando Allayar district has a very high number of rural populations engaged in lives talk or agricultural farming both on domestic and commercial scale

14. **Integrated Approach:** Combining resources can ensure energy reliability and sustainability Solar energy and Biogas can be integrated for clean electricity generation and cooking fuel. Wind and Solar can be combined for energy generation in areas with variable weather patterns and can facilitate multiple units of both domestic and commercial sector.

7.1 Solar Energy proposal for households

Solar energy arises as a sustainable and cost-effective solution for domestic users. Connecting the power of the sun not only reduces reliance on conventional energy demand but also reduces monthly electricity bills and decreases carbon footprints. This proposal outlines a inclusive approach to solar energy calculations, safeguarding locals of communities can efficiently optimize their energy consumption while making informed decisions about installation costs, investments, and long-term assistances.

Step 1: Total Daily Energy Consumption of Domestic User

Assuming an average usage of 6 hours per day:

1. 2(Pedestal Fans): $12.5W \times 6h = 75Wh$

2. 6(Lights): $12W \times 4h = 48Wh$

3. 2(Sockets): $18W \times 3h = 54Wh$

4. 1(Stitching Machine): $250W \times 4h = 1,000Wh$

Total estimated daily consumption: 1177 Wh (1.177 kWh)

Step 2: Total Solar Panel Capacity Needed for Domestic User

Daily energy requirement: 1.177 kWh

Peak sun hours: 5 hours/day

Step 3: Number of Solar Panels for Domestic User

Assuming use standard 150W solar panels:

Number of Panels= $235.4/150=1.569= 2$ plates

Recommended: Use 3 plates $\times 150W= 450W$ to meet your needs.

Use 2 solar plates $\times 250W=500W$ to meet and slightly exceed your needs.

Step 4: Recommended Battery Setup for domestic User Battery Sizing:

To store 1.177 kWh with a safety margin ($\times 1.5$ for autonomy)

$1.177 \times 1.5 = 1.7655$ kWh = 2KWh

Use number of 2 $\times 12V$ 100Ah Batteries.

Required Panel Capacity= $1.177/5=0.2354$ kW=235.4watts

Acknowledgements

We recognize the monetarist support of the Research Development Foundation (RDF) for the primary data collection related to energy

practices of locals of selected villages of Dasoori TandoAllahyar district, Sindh Pakistan and implementation of design proposal at the community level through the particular support of RDF. This effort was also stayed by the Kindernothilfe (KNH) and funding from BMZ, addresses critical energy access challenges in the rural districts of Tando Allahyar. We are grateful to the reviewers for their productive response and perceptive recommendations.

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