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Exploring the Electricity Crisis in Gilgit-Baltistan: A Case Study of Skardu's Energy Challenges, Impacts, and Sustainable Solutions

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Abstract
The electricity crisis in Skardu, a critical hub in Gilgit-Baltistan, reflects broader infrastructural challenges in the region. Gilgit-Baltistan's isolation from Pakistan's national grid is a significant contributor, leaving the region dependent on inadequate local hydropower plants and limited thermal power generation. These systems are unable to meet growing demands, particularly with the increasing urbanization and surge in tourism. Skardu, the largest city in Gilgit-Baltistan, Pakistan, is grappling with a severe electricity crisis characterized by prolonged power outages, some lasting up to 22 hours. This situation has been exacerbated by a surge in mountain tourism, which has significantly increased the demand for electricity in the region. The city's energy infrastructure is currently unable to meet this heightened demand. Gilgit Baltistan is not connected to Pakistan's national grid and relies on local hydro power plants for electricity. The existing facilities are insufficient, leading to frequent and prolonged load shedding.
Keywords .Skardu .Electricity Crisis, Load Sheading, Gilgit Baltistan

Introduction

Skardu, the largest city in Gilgit-Baltistan, Pakistan, is grappling with a severe electricity crisis characterized by prolonged power outages, some lasting up to 22 hours. This situation has been exacerbated by a surge in mountain tourism, which has significantly increased the demand for electricity in the region. The city's energy infrastructure is currently unable to meet this heightened demand. Gilgit Baltistan is not connected to Pakistan's national grid and relies on local hydro power plants for electricity. The existing facilities are insufficient, leading to frequent and prolonged load shedding. The impact of this energy shortage is profound, affecting both residents and local businesses. Households are compelled to find alternative means for daily activities, often resorting to traditional methods that are less efficient and more labor-intensive. For instance, some residents use their refrigerators as storage cupboards due to the lack of consistent power.

Local businesses, particularly those dependent on electricity, have suffered significant setbacks. Tailors and handicraft makers, for example, have had to replace electric sewing machines with manual ones, leading to a substantial decrease in productivity. The tourism industry, a major economic driver in Skardu, is also adversely affected, as hotels and other facilities struggle to provide adequate services without reliable power.

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The situation has led to public unrest, with residents organizing protests to demand immediate action from authorities. The lack of electricity not only disrupts daily life but also hampers educational activities, as seen in the case of the Skardu Municipal Library, which has faced operational challenges due to power outages and lack of heating.

Addressing Skardu's electricity crisis requires a multifaceted approach, including investment in energy infrastructure, exploration of alternative energy sources, and efficient management of the existing power supply to meet the growing demands of both residents and the burgeoning tourism industry. The electricity crisis in Skardu, a critical hub in Gilgit-Baltistan, reflects broader infrastructural challenges in the region. Gilgit-Baltistan's isolation from Pakistan's national grid is a significant contributor, leaving the region dependent on inadequate local hydropower plants and limited thermal power generation. These systems are unable to meet growing demands, particularly with the increasing urbanization and surge in tourism.

Research Gap

After reviewing the literature published on domains of energy crisis in Gilgit Baltistan, various arguments in this scholarship mostly touch on perspectives by discussing the dimension of causes. This writing has ignored elaborating on socioeconomic and socio-developmental angles.

The concept of the Skardu as case study t has remained untouched by the prospects of the academic writing sphere. By keeping it isolated from the sphere of debate and covering the prospects of the local literature in Gilgit Baltistan, the present study will cover these angles that still need to be clarified from previous literature on the scope of these aspects.

Methodology

The present study will be exploratory, employing qualitative investigation methods. Both primary and secondary data sources will be utilized. Secondary data drawn from published literature, such as books, articles, newspapers, and reports, will provide a comprehensive background. The primary data will be collected through targeted interviews with key

Stakeholders in the local market economy, including shopkeepers, hotel owners, trade unions, trader business people, , and business quarters segments of thought. This way, the whole methodology will proceed. The application of a neoliberal approach to address energy crisis impact on local market economies can create opportunities for economic growth, inclusivity, and collaboration. By promoting free market access, supporting entrepreneurship, leveraging technology, and fostering social cohesion, local economies can work toward overcoming the challenges posed by sectarian divisions. Policymakers and community leaders should prioritize strategies that integrate diverse groups into the economic landscape, ensuring that all community members have the opportunity to thrive

Causes of the Electricity Crisis

1. **Inadequate Energy Infrastructure**:

The region’s energy infrastructure was not designed to support its growing population or the influx of tourists. Existing hydropower stations are outdated and operate at low capacities. Seasonal variations in water availability, which affect hydropower generation, exacerbate the problem.

2. **Tourism Boom**:

Skardu has become a hotspot for both domestic and international tourists. The

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high seasonality of tourism creates peak electricity demands during the summer months, overwhelming the fragile system.

3. **Climate Change**:
The region is experiencing changes in weather patterns, which impact water flow in rivers and streams used for hydropower generation. Reduced water flow during winters causes additional strain.

4. **Poor Governance and Investment**:
Limited government investment in energy projects and delays in ongoing initiatives have prolonged the crisis. The lack of a clear strategy for integrating renewable energy sources like solar or wind is also evident.

5. **Geographical and Logistical Constraints**:
The mountainous terrain makes the construction of infrastructure and grid connections expensive and technically challenging.

Impact of the Crisis

1. **Economic Downturn**:
Small businesses, which form the backbone of the local economy, face operational hurdles due to frequent power outages. Tailors, handicraft artisans, and shopkeepers struggle to maintain productivity. Tourism-related businesses, like hotels and restaurants, suffer from dissatisfied customers who expect modern amenities.

2. **Public Unrest**:
Protests in Skardu have become common, as residents demand reliable electricity. Frustration with prolonged load-shedding and lack of government action fuels civil unrest.

3. **Impact on Education**:
Educational institutions face challenges in maintaining operations, especially during winter months when power is critical for heating and lighting.

4. **Health Sector Challenges**:
Hospitals and clinics in the region struggle to provide uninterrupted care due to power shortages, relying on expensive diesel generators as backups.

5. **Environmental Impact**:
The reliance on diesel generators for power during outages contributes to air pollution and carbon emissions, undermining the region's ecological balance.

Proposed Solutions

1. **Integration with the National Grid**
A long-term solution involves connecting Gilgit-Baltistan to Pakistan's national grid. This requires significant investment but would provide stability.

2. **Renewable Energy Development**:
Solar Power: With high levels of sunlight in the region, solar energy could be a reliable alternative. Small-scale solar projects can be quickly implemented to alleviate the crisis.
Wind Power: Certain valleys experience strong winds, making wind energy feasible option.
Micro-Hydropower Projects: Developing small, community-driven hydropower projects

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can cater to localized needs.

Energy Efficiency Measures:

Promoting energy conservation practices among residents and businesses could reduce the strain on the system. Incentivizing the use of energy-efficient appliances is another step.

3. **Government Policy and Investment**:
   The government needs to prioritize energy projects in Gilgit-Baltistan, ensuring timely completion and proper maintenance of infrastructure. Public-private partnerships could accelerate development.
4. **Improved Tourism Management**:
   Introducing policies to manage the seasonal influx of tourists can prevent sudden spikes in energy demand.
5. **Community Engagement**:
   Engaging local communities in energy projects can enhance acceptance and ensure equitable distribution of resources.

The Case of Skardu: A Call to Action

Skardu serves as a focal point for highlighting the electricity challenges in Gilgit-Baltistan. Its growing prominence as a tourism hub underscores the urgency of addressing these issues. While immediate relief can be sought through measures like diesel-powered generators or temporary solar panels, sustainable solutions require a comprehensive strategy.

Collaboration between federal and local governments, international organizations, and the private sector can transform Skardu's energy landscape. Long-term investments in infrastructure, coupled with a focus on renewable energy, hold the key to mitigating the crisis and setting a precedent for other regions in Gilgit-Baltistan.

Public Opinion on the Electricity Crisis in Skardu

The people of Skardu have diverse and strong opinions about the electricity crisis, reflecting their lived experiences, frustrations, and hopes. Public sentiment often revolves around dissatisfaction with governance, the impact on daily life, and the urgency of sustainable solutions. Below is a deeper exploration of the public's views:

Neglect of Remote Areas:

Many residents feel abandoned by the federal and regional governments. They believe that Skardu's energy issues are overlooked in favor of urban centers like Islamabad and Karachi.

Corruption Allegations:

The public often accuses authorities of mismanaging funds allocated for energy projects. This perceived corruption fuels distrust and cynicism about government initiatives.

Lack of Communication:

Citizens express frustration over the absence of transparent communication regarding load-shedding schedules, project timelines, and solutions in progress.

Economic Strain and Lifestyle Challenges

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Families struggle with high electricity costs and unreliable service. Many are forced to rely on firewood or expensive generators, further straining household budgets. Shop owners and small-scale industries voice concerns about reduced productivity. For instance, tailors, welders, and carpenters often lose valuable work hours due to unexpected outages. Skardu's thriving tourism sector, a lifeline for the local economy, is negatively affected. Tourists complain about the lack of basic amenities, including uninterrupted electricity, which tarnishes the region's image.

Support for Solar and Hydropower:

Residents advocate for renewable solutions like solar panels and community-driven hydroelectric projects. They see these options as sustainable and suitable for Skardu's unique environment. Public awareness about the environmental impact of increased wood consumption is growing. Locals emphasize the need for energy solutions that reduce dependency on Forests.

Resilience and Grassroots Advocacy

- **Civil Society Activism**:
  Community groups and local leaders are stepping up to voice the people's concerns. Through petitions, protests, and media campaigns, they demand immediate action from the authorities.
- **Youth Engagement**:
  The younger generation is vocal on social media platforms, using hash tags and digital campaigns to highlight the crisis and push for solutions.

Positive Outlook toward Collaborative Efforts

- **Partnerships with NGOs**:
  Public opinion is generally favorable toward non-governmental organizations that have initiated small-scale renewable energy projects in the region.
- **Hope for International Support**:
  Residents express optimism about international collaborations that bring modern technology and funding for energy infrastructure to Skardu.

Community Voices (Quotes and Anecdotes)

"We are tired of hearing promises from politicians. We need action, not words!" – Local shopkeeper.

"Skardu has so much water and sunlight. Why can't we use it to solve our problems?" – University student.

"Tourists love this place, but they leave complaining about basic facilities. This hurts our reputation and income." – Guesthouse owner.

The people of Skardu demand accountability and sustainable energy solutions. While there is frustration and skepticism about government efforts, there is also a strong belief in the potential of renewable energy and community-led initiatives. This sentiment reflects the resilience and resourcefulness of Skardu's residents, who are eager to play an active role in shaping their energy future.

By employing these strategies, Skardu can transition from its current energy crisis to a sustainable and reliable electricity system that supports both residents and economic growth.

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The major crisis in Skardu with respect to load-shedding is deeply rooted in the inadequacy of its electricity infrastructure and its inability to meet the growing demand for power.

Skardu relies heavily on small, outdated hydropower stations which cannot meet the city's growing energy demands. Seasonal changes, such as reduced water flow in winters, further hinder hydropower generation.

Unlike other parts of Pakistan, Gilgit-Baltistan, including Skardu, is not connected to the national electricity grid. This isolation leaves the region dependent on limited local energy resources, which are insufficient to meet both residential and commercial needs.

Skardu has become a prominent tourist destination, attracting thousands of visitors during peak seasons. This surge in population significantly increases the demand for electricity in hotels, restaurants, and transportation services, overwhelming the already strained power supply.

The prolonged power outages, often lasting 16–22 hours a day, severely disrupt local businesses, particularly those reliant on electricity, such as tailors, workshops, and grocery stores. This creates economic hardship for many families. This is leading for breakdown of many masses associated with the business and leading to problem concerns for the survival.

Power shortages in schools and hospitals lead to operational challenges. Students are unable to study effectively in poorly lit classrooms, and healthcare facilities struggle to operate equipment without a reliable power source. This phase is leading having series concerns for student of local area to having disturbances for educational activities .Due to which may serious challenges also having problem for health sector .Having the unavailability of light many operation regarding health care remain functional .

During the cold months, the lack of electricity compounds difficulties for residents. Heating and lighting are essential during this time, and prolonged load-shedding forces people to rely on alternative energy sources like firewood and kerosene lamps, which are both costly and environmentally unsustainability . That is making concerns for the environment and also for the local masses to having alternative mechanism to be operated.

Conclusion

The load-shedding crisis in Skardu is not merely an inconvenience but a multifaceted challenge affecting daily life, economic activities, education, and healthcare. Addressing this issue requires urgent attention, investments in renewable energy, and integration with broader energy solutions to ensure a sustainable and reliable power supply.

The electricity crisis in Skardu reflects the broader challenges faced by remote regions in ensuring sustainable and reliable energy access. The persistent issue of prolonged load-shedding has significant implications for the socio-economic well-being of the region, impacting households, businesses, healthcare facilities, and educational institutions. Skardu’s geographical isolation, compounded by the absence of connection to the national power grid, amplifies its reliance on inadequate and outdated local energy sources, primarily small-scale hydropower plants.

The crisis is exacerbated during peak tourist seasons, where the demand for electricity surpasses the region's supply capacity. Tourism, while an economic boon, has unintentionally highlighted the inefficiencies of the local energy infrastructure. Hotels, restaurants, and other services dependent on power are unable to meet the expectations of visitors, potentially threatening the sustainability of this vital industry. Similarly, local businesses and industries that rely on electricity for operations experience frequent disruptions, leading to economic losses

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and reduced productivity.

Households face daily struggles, particularly during harsh winters when the need for heating and lighting becomes critical. The lack of power forces residents to turn to traditional and often unsustainable alternatives such as firewood or kerosene, further straining environmental resources. Educational institutions are unable to provide conducive learning environments, while healthcare facilities face difficulties in delivering essential services due to unreliable power.

Efforts to mitigate the crisis must focus on both immediate and long-term solutions. In the short term, the installation of backup generators and the promotion of energy conservation practices can provide some relief. However, sustainable development requires investments in renewable energy sources such as solar, wind, and micro-hydropower. The potential for solar power in Skardu is particularly promising, given its high exposure to sunlight. Similarly, wind energy in specific valleys and the modernization of existing hydropower facilities can significantly enhance electricity production.

Connecting Gilgit-Baltistan to Pakistan's national grid is a long-term goal that would address the region's energy deficit. While this solution requires substantial investment and faces logistical challenges due to Skardu's rugged terrain, it is essential for ensuring energy security. Public private partnerships can play a crucial role in mobilizing resources and expertise for infrastructure development. Policy reforms are equally important. The government must prioritize energy planning for Gilgit Baltistan, tailoring solutions to its unique geographical and socio-economic context. Engaging local communities in decision-making processes and empowering them to manage small-scale renewable projects can also ensure equitable distribution and community ownership of resources.

In conclusion, the electricity crisis in Skardu is a complex issue that requires a multifaceted and collaborative approach. By leveraging renewable energy, modernizing infrastructure, and implementing effective policy measures, the region can overcome its energy challenges. Addressing this crisis is not only critical for improving the quality of life for residents but also for ensuring the sustainable development of Skardu as a hub for tourism and economic activity. Through coordinated efforts and strategic investments, Skardu can transition from an energy deprived region to a model for sustainable energy solutions in mountainous and remote areas

Strategies to Mitigate the Electricity Crisis in Skardu

To address the ongoing electricity challenges in Skardu, a multifaceted and sustainable approach is essential. The following strategies can help alleviate the crisis and pave the way for a more reliable energy system.

1. Integration of Renewable Energy Sources

- **Solar Energy**: Skardu's geographical location offers significant potential for solar power. Installing solar panels for households, businesses, and public institutions can provide a sustainable solution to meet energy needs, particularly during the summer.
- **Micro-Hydropower Plants**: Building small-scale, localized hydropower stations can supplement electricity for villages and remote areas. These projects are cost-effective and environmentally friendly.
- **Wind Power**: Feasibility studies for wind energy in Skardu's valleys can identify sites for wind

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turbines, providing a steady energy supply.

2. Strengthening Existing Energy Infrastructure

· **Upgrading Hydropower Plants**: Enhancing the efficiency of existing hydropower plants through modernization and maintenance can significantly improve electricity output. · **Efficient Energy Transmission**: Investing in robust transmission lines and substations to reduce energy losses during distribution.

3. Connecting to the National Grid

While challenging due to the region's topography, integrating Skardu with Pakistan's national grid would ensure a consistent power supply. This requires prioritization in national energy planning and significant government investment.

4. Policy Reform and Institutional Support

· **Strategic Planning**: Developing a comprehensive energy strategy specifically for Gilgit Baltistan, focusing on long-term sustainability and local needs.

· **Public-Private Partnerships (PPPs)**: Encouraging private sector investment in energy projects through incentives such as tax exemptions and subsidies.

· **Regulatory Frameworks**: Enforcing regulations that promote energy efficiency and penalize wasteful practices.

5. Tourism Management

· **Seasonal Load Management**: Establishing policies to manage peak-season energy demands driven by tourism, such as restricting energy-intensive activities during high demand periods.

· **Eco-Friendly Tourism**: Promoting the use of solar-powered lighting and heating in hotels and tourist facilities.

6. Community Involvement and Awareness

· **Education Campaigns**: Raising awareness about energy conservation and the benefits of renewable energy among residents.

· **Community-Led Projects**: Empowering local communities to participate in small-scale energy projects, such as micro-hydropower or solar installations.

7. Emergency Measures for Immediate Relief

· **Backup Generators**: Installing diesel or gas-powered generators at key locations, such as hospitals and schools, to ensure uninterrupted services during power outages. · **Energy Storage Systems**: Utilizing battery storage technology to store surplus energy generated during off-peak hours for use during high-demand periods.

8. Leveraging International Support

Funding from Development Agencies: Seeking financial assistance and technical expertise from international organizations specializing in renewable energy and infrastructure development.

· **Knowledge Sharing**: Collaborating with countries or regions that have successfully implemented off-grid and renewable energy solutions in mountainous areas.

9. Innovative Energy Solutions

· **Smart Grids**: Implementing smart grid technology to optimize energy distribution, monitor usage, and reduce wastage.

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· **Energy Efficiency Programs**: Introducing energy-efficient appliances and retrofitting public buildings with energy-saving technology.

10. Research and Development

· **Feasibility Studies**: Conducting research on local energy resources, including untapped renewable sources, to identify long-term solutions.

· **Technological Innovation**: Partnering with universities and research institutions to develop cost-effective and scalable energy solutions.

Implementation Roadmap

1. **Short-Term (1-2 Years)**: Focus on emergency measures, energy conservation awareness, and installing solar panels in critical areas.
2. **Medium-Term (3-5 Years)**: Upgrade existing infrastructure, initiate community-led projects, and develop renewable energy facilities.
3. **Long-Term (5+ Years)**: Achieve grid integration, establish a robust policy framework, and ensure sustainable energy independence.

References

Government Reports and Documents

1. **Gilgit-Baltistan Annual Development Reports**:
   - o Published by the Government of Pakistan, these reports outline energy projects and developmental challenges in the region.
   - o Available through Government of Pakistan's official website.

National Electric Power Regulatory Authority (NEPRA) Reports: o Detailed assessments of energy distribution, challenges, and strategies for improving electricity supply in remote regions.

- o NEPRA Official Website.

Academic Research Papers and Studies

1. **"Hydropower Development in Northern Pakistan: Challenges and Opportunities"** o Focuses on the potential of hydropower in mountainous regions.
   - o Available on ResearchGate.

"Energy Crisis and Its Impact on Socio-Economic Development in Pakistan" o A broader look at energy issues in Pakistan, with specific mentions of Gilgit Baltistan.

- o Searchable via academic databases like JSTOR or Springer.

News Outlets

1. **Dawn News**:
   - o Articles on electricity shortages and protests in Skardu.
   - o Dawn News.
2. **The News International**:
   - o Coverage of how tourism exacerbates the energy crisis in Skardu.
   - o The News.

NGO and International Agency Reports

1. **United Nations Development Programme (UNDP) Pakistan**:
   - o Reports on renewable energy projects and infrastructure development in Gilgit Baltistan.
   - o UNDP Pakistan.

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2. **World Bank Reports on Energy in Pakistan**:
   - o Insights into funding and energy reform initiatives in northern regions. o World Bank Official Sit

Local and Regional Sources

1. **Gilgit-Baltistan Tribune**:
   - o Regional news platform covering socio-economic issues, including electricity shortages.
   - o Search for articles specific to Skardu's challenges.
2. **Pamphlets and Reports by Local NGOs**:
   - o Organizations like Aga Khan Rural Support Programme (AKRSP) often publish community-driven solutions and case studies.
   - o AKRSP Official Website.

Online Platforms and Forums

1. **Pakistani Mountain Forum**:
   - o Discussions on issues faced by communities in Gilgit-Baltistan.
   - o Accessible via regional online forums and Facebook groups.
2. **Climate and Development Knowledge Network (CDKN)**:
   - o Reports on how climate change impacts hydropower potential in Skardu. o CDKN Website.