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Review Article

Analyzing Challenges of Power and Electricity Crisis in Pakistan through SLR-PRISMA Approach: Solution and Policy Recommendations

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Abstract

Pakistan has been grappling with a severe electricity crisis for decades, characterized by frequent power outages, load shedding, and an ever-growing demand-supply gap. This review article aims to explore the root causes of the electricity crisis, evaluate existing policies, and propose sustainable solutions to address the issue. By analyzing renewable energy potential, improving energy efficiency, and reforming governance, Pakistan can overcome its energy challenges and ensure a reliable power supply for its growing population. This study has followed critical review analysis of the previous studies applying SLR approach through a PRISMA model (Preferred Reporting Items of Systematic Reviews and Meta-Analyses) for secondary data collection procedure. Critical content analysis was done through review of the existing studies. The study is qualitative, yet future researchers are required to go one step ahead by using primary data with advanced quantitative analysis or using a mixed method approach with a sample drawn from different provinces and regions of the country. This study is a significant step, and based on the data analysis, the study offers few ways forward to addressing the power scarcity crisis in the country along with some policy recommendations for the government functionaries.

Keywords: Challenges, Electricity Crisis, Causes of the Electricity Crisis, Comprehensive Analysis, Systematic Literature Review (SLR), PRISMA.

Introduction

Pakistan's electricity crisis is a multifaceted issue that has hindered economic growth, disrupted daily life, and exacerbated poverty. The country faces a significant demand-supply gap, with peak demand exceeding available generation capacity. According to the National Electric Power Regulatory Authority (NEPRA), Pakistan's electricity shortfall reached 6,000 MW in 2023, leading to up to 12 hours of load shedding in urban areas and even longer in rural regions (NEPRA, 2023). This article reviews the causes of the crisis and proposes actionable solutions.

The electricity crisis in Pakistan has been a persistent issue, impacting the nation's economy and the daily lives of its citizens. Over the years, the demand for electricity has soared due to population growth, industrial expansion, and urbanization. However, the supply has not kept pace, leading to widespread power outages and load shedding. This essay critically reviews the factors contributing to the electricity crisis in Pakistan and examines potential solutions to address these challenges. It starts with an overview of the current electricity landscape, highlighting the imbalance between supply and demand, and the reliance on outdated infrastructure. The essay also discusses the role of energy policies and governance in exacerbating the crisis. Furthermore, it explores alternative energy sources, including solar and wind, which hold significant potential for Pakistan but require appropriate investment and policy frameworks to be fully developed. Finally, the review underscores the importance of creating a strategic roadmap that aligns energy production with sustainable development goals, emphasizing the need for stakeholder engagement and public-private partnerships. Through this comprehensive analysis, the essay aims to provide insights into actionable strategies that can effectively mitigate the electricity crisis in Pakistan.

In recent years, Pakistan's electricity demand has outstripped supply, with shortfalls leading to significant socio-economic repercussions. According to the Pakistan Electric Power Company, the gap between electricity supply and demand often reaches thousands of megawatts during peak seasons. This situation is largely fueled by a growing population, urban migration, and industrial growth, which collectively increase energy needs. Compounding these issues are systemic problems such as inefficiency in the energy sector, inadequate infrastructure, and insufficient investment in energy generation. The existing power plants are often old and operate below their capacity, resulting in high technical losses and electricity theft. These operational inefficiencies are aggravated by a lack of governance and poor regulatory frameworks, which undermine the effectiveness of energy policies.

Addressing the electricity crisis necessitates a multifaceted approach. One vital aspect is the diversification of energy sources to reduce dependence on fossil fuels. Pakistan has immense potential for renewable energy, particularly solar and wind. Initiatives such as the Quaid-e-Azam Solar Park highlight the steps being taken toward harnessing these renewable resources. Moreover, enhancing transmission and distribution networks is critical to minimizing losses and improving reliability. Policymakers must also promote energy conservation measures among consumers, which can significantly reduce overall demand.

The electricity crisis in Pakistan poses substantial challenges that require urgent and innovative solutions. By diversifying energy sources, investing in infrastructure, and improving governance, Pakistan can create a more sustainable energy landscape. Emphasizing public and private sector collaboration is essential for mobilizing the resources needed for these initiatives. Only by implementing a strategic approach can Pakistan hope to overcome its electricity crisis and pave the way for economic growth and stability. The study has successfully met its objectives by offering solid recommendations as solution models to the government functionaries.

Literature Review

Perspectives on Power Sector in Pakistan

The power sector in Pakistan has played a critical role in the country's economic development and continues to face numerous challenges and opportunities. With a burgeoning population and increasing industrial demands, the need for reliable and sustainable energy sources has become paramount. This essay offers an overview of the current state of the power sector in Pakistan, focusing on energy generation, challenges, and prospects.

Pakistan primarily generates electricity through a combination of thermal, hydro, and renewable energy sources. As of recent reports, approximately 64 percent of the country's electricity is produced from thermal generation, primarily using natural gas and oil. Hydro power contributes around 26 percent, while the remaining 10 percent comes from renewable resources such as wind and solar (Pakistan Economic Survey, 2021). The potential for renewable energy in Pakistan is substantial, given its geographic advantage for solar and wind energy. However, the sector remains underdeveloped compared to its capabilities.

Despite its potential, Pakistan's power sector faces numerous challenges. One of the most pressing issues is the financial instability of power utilities, which often operate at a loss due to outdated infrastructure, inefficient billing systems, and high levels of electricity theft. The circular debt, which refers to the accumulation of outstanding payments among various stakeholders in the energy supply chain, has reached alarming levels, hindering investments and expansions in the sector (International Crisis Group, 2022). Additionally, frequent power outages have led to significant economic losses and have negatively impacted businesses and households alike.

Recent government initiatives aimed at reforming the power sector include investments in new energy projects, improvements in grid management, and policies to enhance energy efficiency. The government has also set ambitious renewable energy targets to increase the share of renewables in the energy mix, aiming to reach 30 percent by 2030 (Government of Pakistan, 2023). Moreover, international collaborations, such as partnerships with China for infrastructure development through the China-Pakistan Economic Corridor, are expected to unlock significant investment and technological advancements.

The power sector in Pakistan is at a crossroads, where the balance between outdated practices and the potential for modern, sustainable energy solutions must be struck. With the right policies and investments, the sector can overcome its challenges and become a catalyst for economic growth while ensuring energy security for the country. As Pakistan moves forward, the commitment to diversifying its energy sources and improving the efficiency of its power utilities will be crucial in shaping a sustainable energy future.

Electricity Crisis

The electricity crisis in Pakistan has become a significant issue, hampered economic growth and affect the quality of life for millions. This comprehensive review aims to identify the primary challenges of this crisis and explore potential solutions utilizing the PRISMA method-Predictive, Responsive, Innovative, Sustainable, and Manageable.

The predictive aspect focuses on understanding the demand and supply dynamics of electricity in Pakistan. Recent studies indicate a widening gap between electricity demand and supply due to rapid urbanization and population growth. The National Electric Power Regulatory Authority (NEPRA) reported that electricity demand surged to over 25,000 megawatts in peak times, while generation capacity lagged at 23,000 megawatts in 2022, leading to widespread load shedding (NEPRA, 2022). This highlights the urgency for accurate forecasting and planning to meet future demands.

The responsive component emphasizes the importance of immediate and effective policy adjustments. For instance, Pakistan's reliance on fossil fuels for energy generation needs reassessment. The government has taken steps towards diversifying its energy portfolio through initiatives like the China-Pakistan Economic Corridor (CPEC), aimed at enhancing renewable energy projects and reducing dependency on imported fuels (Zafar & Kim, 2021). However, challenges such as bureaucratic delays and financial constraints hinder progress, necessitating a more agile policy environment.

Innovation is vital in addressing the electricity crisis. The implementation of smart grid technologies can significantly optimize energy distribution and reduce losses. Research conducted by Khan *et al*. (2022) explored the potential of blockchain technology to enhance transparency in energy trading and distribution, which could empower consumers and improve efficiency. Collaboration between the government, academia, and the private sector is essential for fostering innovation that aligns with the nation's energy goals.

Sustainability involves transitioning from conventional power generation methods to renewable sources such as solar, wind, and hydroelectric power. Despite Pakistan's rich resources in these areas, the proportion of renewables in the energy mix remains low. The recent initiative to install solar panels in rural areas underscores the potential for renewable energy solutions that are not only environmentally viable but also economically beneficial (Ahmed, 2023).

Lastly, manageability pertains to effective resource management and infrastructure development. The aging grid infrastructure and high transmission losses contribute significantly to the crisis. Addressing these issues through targeted investments and upgrades is crucial for ensuring a reliable electricity supply.

Origin of the Electricity Crisis

The power sector in Pakistan is a critical component of the country's infrastructure, directly impacting its economic growth and social development. The challenges faced by this sector have implications that stretch beyond mere supply issues; they fundamentally affect the quality of life for millions of Pakistanis and the overall economic progress of the nation. This essay provides an overview of the electricity sector in Pakistan, addressing the needs, shortages, and their impact on social and economic life. One of the primary needs of Pakistan's power sector is investment in infrastructure. Despite a considerable increase in electricity generation facilities since the early 2000s, the country continues to suffer from a considerable electricity shortfall. According to the National Electric Power Regulatory Authority (NEPRA), Pakistan faced a shortfall of approximately 7,500 MW in 2022, leading to frequent load shedding and unscheduled outages (NEPRA, 2022). The neglect of maintenance and upgrades in existing power plants, coupled with a lack of new investments, exacerbates this issue. Furthermore, reliance on expensive fossil fuels for electricity generation makes the power sector unsustainable in the long run.

Such persistent shortages have dire social and economic implications. Households frequently face power outages that disrupt daily life, hamper education, and limit access to essential services. Studies have shown that electricity shortages contribute to decreased productivity in businesses, ultimately affecting the country's GDP growth (Zubair, 2021). Increased operational costs often lead to higher prices for goods and services, directly impacting the cost of living for average citizens. Moreover, the electricity crisis also impacts rural areas disproportionately. While urban centers may experience some level of service, many rural communities remain unconnected to the grid, which perpetuates poverty and hinders development (World Bank, 2020). Access to reliable electricity is crucial for improving educational outcomes and healthcare services, as these sectors rely heavily on uninterrupted power.

Addressing the challenges in Pakistan's power sector requires a multifaceted approach. Investment in renewable energy sources such as solar and wind would not only help alleviate shortages but also promote environmental sustainability. Additionally, policy reforms aimed at improving efficiency in electricity distribution and reducing transmission losses are essential for a more reliable and affordable power supply. The electricity sector in Pakistan is at a crossroads, with significant implications for the nation's social and economic life. The persistent shortages undermine quality of life and economic growth, particularly for underserved populations. Addressing these challenges through strategic investments and policy reforms is imperative to secure a sustainable energy future for Pakistan. Below is the are main causes of the electricity crisis in Pakistan:

1. ***Insufficient Generation Capacity***

Pakistan's power generation infrastructure is outdated and insufficient to meet the growing demand. The reliance on fossil fuels, particularly imported oil and gas, has made electricity generation expensive and unsustainable (Bhutto *et al*., 2020).

2. ***Circular Debt***

The circular debt in the power sector, which exceeds PKR 2.5 trillion, has crippled the ability of power companies to invest in infrastructure and maintain existing plants (World Bank, 2022).

3. *Transmission and Distribution Losses*

Pakistan's transmission and distribution (T&D) losses are among the highest in the world, averaging 18-20% due to technical inefficiencies and electricity theft (Asian Development Bank, 2021).

4. *Lack of Renewable Energy Integration*

Despite having immense potential for solar, wind, and hydropower, renewable energy accounts for less than 5% of Pakistan's energy mix (IRENA, 2023).

Circular Debt: Threat to Pakistan's Economy and Consumers

Circular debt has become a pressing issue in Pakistan, significantly affecting the country's economy and electricity consumers. Defined as the non-recovery of dues between various entities in the energy sector, circular debt leads to a chain of financial liabilities that ripple through the economy. This essay argues that circular debt has a detrimental impact on economic stability and electricity supply, manifesting in financial strain on energy companies and inconvenience for electricity users.

One of the primary consequences of circular debt is the financial strain it places on energy producers. As of recent reports, the circular debt in Pakistan has reached alarming levels, often exceeding trillion rupees (Ministry of Energy, 2021). This presents a dilemma whereby power companies face cash flow issues, leading them to struggle in meeting operational costs. Consequently, these firms may lack the necessary investment to upgrade the infrastructure or maintain efficient delivery service. The recurring cycle of debt limits their capacity to generate electricity reliably, which is crucial for economic development. Additionally, the repercussions for electricity users are evident. When power generation companies struggle financially, they often resort to load shedding—a practice that involves periodic interruptions in power supply to manage demand and minimize losses. This practice has widespread implications, particularly for small businesses and households. Load shedding disrupts productivity, leading to economic losses for businesses that rely on electricity for operations (Khan, 2022). Furthermore, households face inconvenience and reduced quality of life due to inconsistent power supply. This situation disproportionately affects the lower and middle-income population, thereby exacerbating economic inequality. Moreover, the government's attempts to resolve circular debt often result in temporary solutions, such as raising electricity tariffs. This approach only serves to burden consumers further, as increased prices do not necessarily translate into improved services. Instead, they reinforce a cycle of discontent among the populace, potentially resulting in reduced compliance with bill payments and greater financial instability in the energy sector (Shahid, 2023).

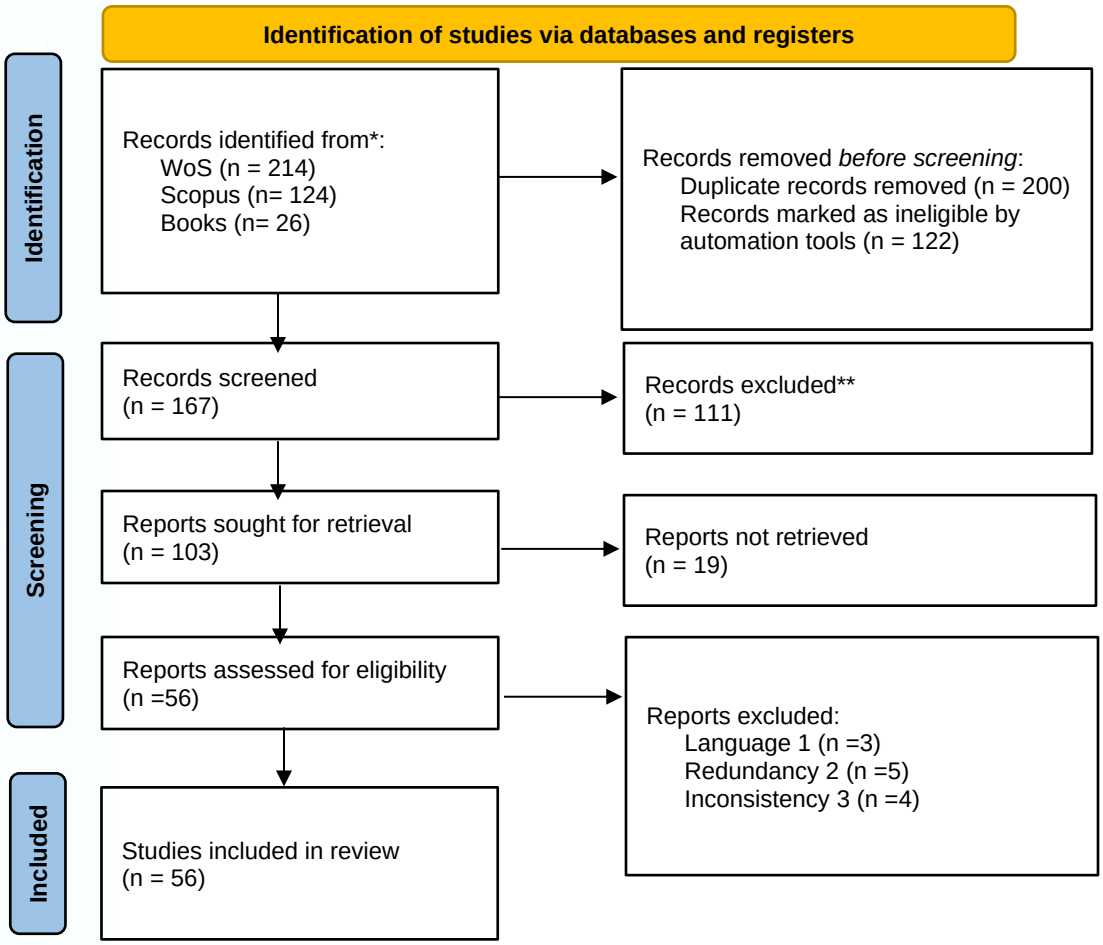
Circular debt poses a significant challenge to Pakistan's economic landscape and its electricity users. The financial strain on energy producers leads to unreliable services, creating a cycle of inconvenience for consumers and hindering economic growth. Addressing this issue demands comprehensive reforms that not only tackle the fiscal aspects of circular debt but also focus on enhancing service delivery and maintaining affordable electricity prices. Sustainable solutions are essential to breaking this cycle and fostering a more stable energy sector that benefits the economy and its users.

Method

A research methodology enlightens the type of research performed, justifies the methods that one chose to conduct a study by linking it back to the existing sources of research and literature, and describes the data collection and analysis procedures. This study has followed critical review analysis of the previous studies applying SLR approach through a PRISMA model (Preferred Reporting Items of Systematic Reviews and Meta-Analyses), depicted through a diagram 1 for secondary data collection procedure. The diagram 1 of PRISMA methodology was introduced in "2009, the QUOROM was updated to address several conceptual and practical advances in the science of systematic reviews and was renamed PRISMA, and it was then updated by the PRISMA 2020 which also includes new reporting guidance".

Diagram 1

PRISMA Diagram used for Identification of Studies via Databases and Registers



Proposed Solution

Proposed Solutions

The electricity crisis in Pakistan calls for a multifaceted approach incorporating predictive planning, responsive policies, innovative technologies, sustainable practices, and efficient management. Immediate actions, supported by comprehensive literature and research findings, are necessary to pave the way for a stable and prosperous energy future. The power sector in Pakistan is marked by significant challenges that impede its ability to provide reliable electricity to its growing population. Addressing these issues requires a multi-faceted approach that encompasses regulatory reforms, investment in infrastructure, improved energy mix, and enhanced efficiency measures. This essay outlines key steps to revitalize the power sector in Pakistan, drawing from recent developments and analytical data.

First, the regulatory framework governing the power sector needs substantial reform. The National Electric Power Regulatory Authority (NEPRA) must enforce accountability among power producers and distribution companies. Streamlining regulations can facilitate transparency in billing, reduce losses, and ultimately improve consumer trust

(World Bank, 2020). Furthermore, introducing competitive bidding for power purchases can lead to lower tariffs and enhance efficiency in generation.

Secondly, investment in infrastructure is crucial. Pakistan's electricity grid is outdated and can suffer from significant losses during transmission. According to the Asian Development Bank (2021), upgrading the grid and advancing smart grid technologies can improve operational efficiency and reduce transmission losses, which currently hover around 20 percent. Investment in renewable energy sources such as solar, wind, and hydropower is also essential. The government targets to increase the share of renewables in the energy mix to 30 percent by 2030, which not only aids sustainability but also diversifies the energy resources available (Government of Pakistan, 2021).

Thirdly, the focus on improving the energy mix is vital for reducing dependency on imported fuels. Pakistan primarily relies on fossil fuels, which exposes the country to global price fluctuations. A shift towards indigenous and renewable resources can help stabilize energy prices and enhance energy security. Recent projects in solar and wind energy are promising; for instance, the Quaid-e-Azam Solar Park is expected to generate considerable electricity from solar sources, contributing significantly to the national grid (Pakistan Renewable Energy Policy, 2022).

Lastly, maximizing efficiency in power utilization is crucial. Enhancing energy efficiency can involve consumer education regarding energy-saving practices and implementing energy-efficient technologies in industrial and residential sectors. Programs to promote LED lighting, efficient refrigeration, and industrial energy management systems can significantly reduce overall energy consumption.

Addressing the challenges in Pakistan's power sector requires comprehensive reforms that include regulatory adjustments, infrastructure investment, diversification of energy sources, and efficiency improvements. These steps are essential for ensuring a sustainable and reliable electricity supply in Pakistan, ultimately promoting economic growth and enhancing the quality of life for its citizens.

1. *Harnessing Renewable Energy*

Pakistan has significant potential for renewable energy, particularly solar and wind. The country receives an average of 8-9 hours of sunlight daily, making solar energy a viable option (Ali *et al*., 2021). The government should incentivize private investment in renewable energy projects and establish solar parks, such as the Quaid-e-Azam Solar Park in Bahawalpur.

2. *Improving Energy Efficiency*

Reducing T&D losses through smart grid technology and anti-theft measures can significantly improve energy efficiency. Public awareness campaigns can also promote energy conservation at the household and industrial levels (Khan *et al*., 2020).

3. *Reforming Governance and Policies*

The government must address circular debt by restructuring tariffs, reducing subsidies, and improving revenue collection. Strengthening regulatory bodies like NEPRA and ensuring transparency in the power sector are critical steps (World Bank, 2022).

4. *Investing in Hydropower*

Pakistan has the potential to generate over 60,000 MW of hydropower, but only a fraction of this potential has been utilized. Projects like the Diamer-Bhasha Dam and Dasu Hydropower Project should be prioritized to provide affordable and sustainable electricity (Water and Power Development Authority, 2023).

5. *Encouraging Public-Private Partnerships*

Public-private partnerships (PPPs) can attract foreign investment and expertise to the power sector. The success of the China-Pakistan Economic Corridor (CPEC) energy projects demonstrates the potential of such collaborations (Hussain, 2022).

Conclusion

Pakistan's electricity crisis is a complex challenge that requires a multi-pronged approach. By harnessing renewable energy, improving energy efficiency, reforming governance, and encouraging private investment, Pakistan can overcome its energy woes. The government must act decisively to implement these solutions and ensure a sustainable energy future for the country.

The power sector in Pakistan has become a focal point of discussion due to its critical influences on the nation's social and economic development. Despite significant potential in renewable energy and hydropower, Pakistan faces substantial electricity shortages that hinder growth and development.

The electricity crisis in Pakistan is characterized by frequent power outages and a significant shortfall in supply. According to the National Electric Power Regulatory Authority (NEPRA, 2021), the gap between electricity demand and supply is projected to reach around 7,000 megawatts (MW) by 2025. This shortage adversely affects industries, leading to reduced productivity and economic stagnation. For instance, manufacturers often face disruptions due to load shedding, compelling them to invest in alternative energy solutions, which increases operational costs (Siddiqui, 2021).

Socially, the electricity shortages exacerbate inequalities, particularly affecting less affluent communities. Access to reliable electricity is crucial for education services, health care facilities, and technology access. Schools in rural areas often lack consistent power, hindering students' learning experiences and outcomes. Moreover, healthcare facilities face challenges in providing adequate medical services, particularly in emergencies. A study by Raza *et al.* (2020) found that inadequate electricity negatively impacts tertiary hospitals' ability to deliver timely medical care.

To address these issues, it is crucial to adopt a multifaceted solution model focusing on renewable energy integration, improved energy management, and investment in infrastructure. This model should include incentives for private sector involvement in renewable energy projects, particularly solar and wind initiatives, which have shown promise in Pakistan (World Bank, 2021). Furthermore, enhancing the electricity grid's efficiency through the implementation of smart grid technologies can optimize energy distribution and reduce losses.

The electricity crisis in Pakistan poses significant social and economic challenges that warrant immediate attention. By investing in renewable energy, optimizing energy management, and enhancing infrastructure, Pakistan can mitigate shortages and foster sustainable development. This rigorous approach is essential for building a robust power sector capable of supporting the nation's ambitions.

Recommendations and Policy Implications

The electricity crisis in Pakistan has emerged as a significant hurdle to socio-economic development and the nation's overall progress. Frequent power outages and a growing energy demand create a challenging environment for industry, commerce, and daily life. This essay reviews the critical factors fueling the electricity crisis, discusses the implications of these challenges, and offers recommendations to help mitigate the situation.

A predominant issue contributing to the electricity crisis is the inefficiency of power generation and distribution systems. Many power plants operate below capacity due to outdated technology, mismanagement, and insufficient infrastructure. For instance, the energy sector struggles with widespread line losses, which can reach nearly 20 percent,

largely due to poor transmission and distribution systems. Moreover, reliance on thermal plants, which constitute over 60 percent of the power generation, creates burdens due to fluctuating fuel prices and environmental concerns. Another factor exacerbating the electricity crisis is the lack of investment in renewable energy. Pakistan, endowed with abundant renewable resources like solar and wind, has yet to utilize these effectively. The country has the potential to generate about 80,000 MW from renewable sources, yet this potential remains largely untapped. The government's policy focuses traditionally on non-renewable sources, which jeopardizes long-term energy security and sustainability.

To address these challenges, immediate and comprehensive policy measures are necessary. First, the government should prioritize investments in upgrading existing infrastructure. Enhanced grid management and advanced metering infrastructure can significantly reduce line losses and improve efficiency. A successful model is found in countries like India, which have successfully modernized their electricity grids, leading to decreased outages and enhanced service reliability. Furthermore, the diversification of energy sources is imperative, with a stronger emphasis on renewable energy investments. The government should incentivize private sector participation in renewable energy projects through favorable policies and subsidies. Reports indicate that countries utilizing renewable resources witness a marked decrease in carbon emissions and enhanced energy independence, which could greatly benefit Pakistan. Finally, public awareness campaigns should be implemented to encourage energy conservation habits among citizens. Education on energy efficiency can empower individuals to reduce consumption, enhancing the overall capacity to cope with energy shortages.

Tackling the electricity crisis in Pakistan requires urgent action rooted in effective policy reform and strategic investment. Modernizing infrastructure, diversifying energy sources, and promoting energy conservation are critical components of a comprehensive approach to ensure a stable energy future. This multifaceted strategy not only addresses the symptoms of the crisis but also aligns sustainable development goals critical to the nation's growth.

Controlling and Reducing the Circular Debt

Circular debt in Pakistan has emerged as a significant impediment to the country's economic stability and growth. It is the biggest headache for the government as political parties especially Jamaat e Islami is using it a weapon for agitation and pressuring the government for action against International Power producers (IPPs) responsible for circular debit and price hike for the consumer in Pakistan. It occurs mainly in the energy sector, where various stakeholders, including power producers, distribution companies, and consumers, are unable to settle their dues promptly. This essay argues that controlling and reducing circular debt requires a multi-faceted approach involving policy reforms, improved governance, and technological advancements.

Firstly, effective policy reforms are essential to address the structural issues that lead to circular debt. The government must focus on creating a transparent tariff structure that reflects the true cost of electricity production and distribution. According to the Pakistan Institute of Development Economics (2021), the current tariff does not cover the generation costs, leading to a perpetual cycle of losses. By implementing cost-reflective tariffs, the government would enhance the financial viability of power producers, reducing their dependency on governmental bailouts and minimizing the overall circular debt.

Secondly, improved governance is crucial. The energy sector in Pakistan is characterized by inefficiency and mismanagement, which exacerbates the issue of circular debt. The establishment of an independent regulatory authority that oversees the operations of various energy stakeholders can contribute to improved accountability. A report by the Energy Sector Management Assistance Program (2022) highlights how better governance can streamline processes, reduce inefficiencies, and help recover dues from consumers and businesses. With stronger governance, companies would have clearer paths to settle their outstanding debts, ultimately reducing circular debt levels.

Finally, technological advancements play a pivotal role in addressing circular debt. The adoption of smart meters and updated billing systems can improve revenue collection and minimize discrepancies. Smart meters allow real-time monitoring of electricity usage, thus ensuring accurate billing. As mentioned by Ahmad *et al*. (2023), implementing

smart technology has been shown to increase collection efficiency in multiple sectors. When consumers are accurately billed, there is a higher likelihood of timely payments, which helps stabilize the financial ecosystem.

Tackling circular debt in Pakistan necessitates a comprehensive strategy that incorporates policy reform, improved governance, and technological advancements. By implementing cost-reflective tariffs, enhancing the regulatory framework, and embracing modern technology, the government can significantly reduce circular debt. Such measures not only stabilize the energy sector but also contribute to the broader economic health of Pakistan, ensuring a sustainable and efficient energy supply for the future.

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Deceleration of Interest

The authors declare that there is no clash of interest.

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