Energy Policy Evolution in Pakistan: Balancing Security, Efficiency, and Sustainability

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11 December 2024

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Abstract

This paper analyzes Pakistan's energy policies from 1990 to 2024, tracking their evolution from focusing on energy generation to an integrated approach emphasizing renewable energy and efficiency. Through a systematic literature review, the study evaluates policy effectiveness and identifies key implementation barriers. Early policies, such as the National Energy Conservation Policy (1992) and the Energy Policy (1994), prioritized generation capacity to meet energy security needs but paid limited attention to renewable sources or energy efficiency improvements. The policy landscape began to shift in the 2000s with the introduction of incentives for renewable energy and energy efficiency initiatives. Despite this progress, challenges related to short-term planning, inconsistent implementation, and an over-reliance on fossil fuels persist. Recent policies, such as the Alternative and Renewable Energy Policy (2019) and the National Energy Efficiency and Conservation Plan (2020-25), provide a comprehensive framework for promoting sustainable energy practices. However, persistent institutional, financial, and regulatory barriers limit their effectiveness. The paper recommends that Pakistan's energy strategy focus on long-term planning, strengthened fiscal incentives, and enhanced institutional support to align with global energy security and climate resilience standards. These recommendations aim to foster a sustainable energy future, advancing national energy security and environmental goals.

Keywords: Energy Policy, Energy Efficiency, Environment, fossil fuel.

1 Introduction

Over the past decades, global energy demand has continuously risen, placing tremendous pressure on energy security and exacerbating climate change (Zheng et al., 2024). Improving energy efficiency has been a cornerstone strategy to mitigate these effects, helping to alleviate the growing energy demand while reducing CO_2 emissions worldwide (Akram et al., 2020; Javid and Khan, 2020). The International Energy Agency (2018) estimates that strategic improvement in energy efficiency could account for over one-third of the total greenhouse gas (GHG) reductions needed to stabilize climate change. The International Aid Organization also recognizes that enhancing energy efficiency can lower household financial burdens and reduce greenhouse gas emissions (Canton, 2021).

Energy policies in developed countries like the United States, the United Kingdom, and Australia have been inconsistent in addressing climate change and energy security. This inconsistency is due to a lack of long-term planning, unclear objectives, and inadequate guidance for the most effective types of energy efficiency intervention (Bang, 2010; Gordon et al., 2017; Keay, 2016). Such policy gaps have significantly increased GHG emissions in developed and emerging economies (Le and Nguyen 2019). Today, energy efficiency is widely recognized as a cost-effective and viable approach to addressing energy security and CO2

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emissions (Danish et al., 2020), making it a critical research area for policymakers aiming to reduce CO2 emissions.

In Pakistan, the government has implemented various policies in the past and is now introducing new ones to optimize indigenous resources. In the 1990s, policies focused primarily on expanding power generation, often neglecting renewable energy and efficiency measures. As the energy crisis deepened, policy frameworks from the 2000s began shifting towards alternative energy sources with greater emphasis on environmental sustainability. Despite having sound policies, implementation was affected by bureaucratic inefficiencies, limited financial support, and inconsistent enforcement mechanisms. Only recently, with the introduction of the Alternative and Renewable Energy Policy (2019) and the National Energy Efficiency and Conservation Plan (2020-25), has there been a comprehensive approach to integrate renewable energy, energy efficiency, and environmental consideration. However, the share of renewable energy in the total energy mix remains low (See Figure 1). These recent policies aim to create a sustainable energy landscape by encouraging investment, reducing dependence on fossil fuels, and boosting renewable energy capacity. Nevertheless, longstanding policy implementation challenges continue to influence these initiatives' overall effectiveness.

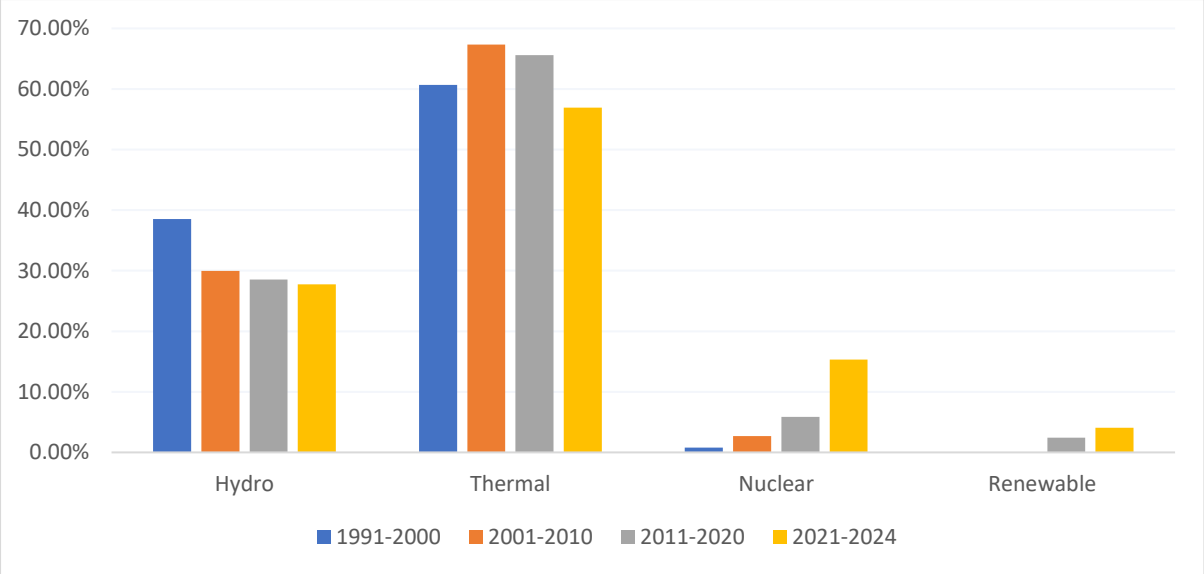

Figure 1:Pakistan's Primary Energy Supply by Source (Source: Pakistan Economy Dashboard)

Improving energy efficiency is essential for enhancing environmental sustainability and reducing Pakistan's energy demand. Numerous studies have shown that enhancing energy efficiency can significantly lower greenhouse gas emissions, supporting global efforts to mitigate climate change (Khan et al., 2023). Additionally, improving energy efficiency relieves pressure on the country's energy infrastructure, decreases reliance on fossil fuels, strengthens energy security, promotes sustainable development, and ensures a cleaner environment for future generations (Iram et al., 2020). This approach also conserves resources and lessens the financial burden of energy imports (Hussain et al., 2023).

Over recent decades, the government has introduced several policies addressing persistent energy security challenges. However, these policies have often been ineffective due to design flaws, implementation inconsistencies, and inefficient outcome measurement. This paper

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examines how government policies and regulatory frameworks have evolved to promote energy efficiency in Pakistan.

The analysis highlights Pakistan's historical energy challenges, mainly focusing on increasing generation capacity at the expense of energy efficiency and environmental sustainability. As the country transitioned towards renewable energy and more sustainable practices, it faced significant barriers, including economic constraints, institutional limitations, and inconsistent regulatory enforcement. The study assesses key policy indicators to determine whether specific targets have been achieved.

This research identifies uncertainties within policy frameworks and evaluates how shifting priorities, from energy generation to renewable energy and conservation, have shaped policy outcomes. Ultimately, it seeks to offer insights into the ongoing evolution of these policies, assessing their influence on energy efficiency initiatives and subsequent actions. This approach provides a comprehensive understanding of how energy policies have shaped Pakistan's current energy landscape and highlights actions needed to ensure sustainable energy security.

The remainder of the paper is organized as follows. Section 2 provides an extensive background on energy policy in Pakistan. Section 3 introduces the methodology and policy evaluation. Section 4 presents the Policy comparison and challenges. Section 5 presents the conclusion and policy recommendation.

1.1 Background of Energy Efficiency in Pakistan

For decades, the Pakistani government has overlooked energy efficiency and conservation as key strategies, focusing instead on increasing energy supply rather than reducing demand. According to the World Bank's Regulatory Indicators for Sustainable Energy Efficiency, Pakistan scores only 28 out of 100, underscoring significant gaps in policies, regulations, and financing mechanisms that place Pakistan behind its global peers.

To address its energy challenges, Pakistan has partnered with foreign organizations to build new power plants, upgrade transmission and distribution networks, and attract foreign capital to boost production capacity (Baloch et al., 2019). However, resolving the energy crisis required sustained efforts, long-term planning, and policy reform. Institutional energy efficiency and conservation efforts are unsatisfactory, and no federal authority is dedicated to implementing energy efficiency and conservation programs across all sectors (Mahar et al., 2018). Key barriers include high initial costs, inconsistent energy policies, lack of incentives, and low motivation (Wenlong et al., 2023).

In the 21st century, environmental scientists and policymakers have increasingly recognized energy efficiency and conservation as powerful tools for reducing emissions and combating climate change (Akram et al., 2022). For Pakistan, adopting these policies across all sectors is the most cost-effective path to achieve climate goals while minimizing economic costs. Despite the challenges, Pakistan's energy sectors possess a significant potential for energy efficiency, offering an economically viable solution for the government to address the ongoing energy crisis and climate change.

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2 Methodology

2.1 Systematic Review

To examine Pakistan's energy policies from 1990 to 2024, we focused on whether these policies prioritize energy efficiency and CO2 emission reduction. We conducted a systematic literature review to evaluate Pakistan's energy policies and their impact on reducing greenhouse gas emissions (Table 1). A systematic review gathers empirical evidence meeting pre-set eligibility criteria to answer a specific research question (Jpt 2008). Key advantages of this method include a clearly defined objective with pre-determined study criteria; an explicit, reproducible methodology; a comprehensive review process to identify all the eligibility criteria, an assessment of findings' validity (e.g., risk of bias) and a systematic presentation and synthesis of included studies (Jpt 2008).

2.2 Searching the Literature

To be included in the review, studies had to focus on energy efficiency and conservation concerning climate change. Studies were selected based on their relevance to Pakistan's energy policy landscape, especially those focusing on energy efficiency and conservation policies, sustainable environments, and climate change implications. Energy efficiency has been recognized globally as a cost-effective approach to reducing emissions and energy demand, contributing significantly to economic resilience and environmental goals (Canton, 2021). Several studies found that improving energy efficiency can mitigate the adverse impacts of Pakistan's reliance on fossil fuels, lower energy costs, and increase industrial competitiveness (Xiuhui and Raza, 2022; Raza and Lin, 2022). Environmental sustainability is critical given Pakistan's vulnerabilities to climate-related risks such as water scarcity and extreme weather, which amplify the need for policies that address long-term ecological stability and reliance (Ullah et al., 2024; Hassan et al., 2021). Focusing on climate change implications aligns with Pakistan's commitments under the Paris Agreement to reduce emissions and shift toward sustainable energy practices (Shahzad and Hamza, 2024; Ahmed et al., 2020). This selection criterion allows for a systematic analysis of whether energy policies integrate these essential parameters, providing insights into their effectiveness in reducing greenhouse gas emissions and supporting sustainable development in Pakistan.

The analysis of Pakistan's energy policies in sections 3 and 4 employs a systematic, multi-dimensional approach to evaluating policy evolution from 1990-2024. The methodology utilizes a phased framework derived from policy evolution models, specifically adapting Howlett and Cashore (2009) approach to analyze policy transformations. This framework systematically segments the policy landscape into four distinct phases, each characterized by unique policy priorities, technological contexts, and environmental considerations. The analysis proceeds through a comprehensive comparative methodology that examines multiple parameters: energy security, electricity generation, renewable energy integration, energy efficiency, environmental sustainability, fiscal incentives, and institutional feasibility. By employing a structured comparative analysis, as illustrated in Table 2, the research captures the nuanced shift in policy approaches across different time periods. This methodological approach examines how Pakistan's energy policy has evolved in response to domestic needs, technological advancements, and global sustainability trends. The phased framework provides a robust analytical lens, critically assessing policy successes, limitations, and strategic transition in the national energy management approach.

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2.3 Assessment of Validity

To systematically examine Pakistan's Energy policies from 1990 to 2024, this study selected research focused on energy efficiency and conservation, environmental sustainability, and climate impact. The systematic literature review (SLR) process, which gathers empirical evidence according to predefined criteria to answer a specific question (Grant and Booth, 2009), allowed us to assess the evolution of energy policies regarding sustainability objectives. Studies were included to determine whether (1) they addressed policy measures on energy efficiency and conservation, (2) they explored environmental impacts, or (3) they analyzed C02 emission trends linked to Pakistan's energy sector. Publications from the Web of Science and Scopus databases were selected using keywords such as "Energy Policies Pakistan," "Energy Efficiency and Energy Security," and "Environmental Impact".

We initially screened 110 articles, selecting only those published since 2000 in English and focusing on Pakistan's energy sector. Research papers were identified; 70 were generally relevant, 50 met the inclusion criteria, and 22 studies were further selected based on a quality assessment threshold, following guidelines from Wallace et al. (2006) to ensure methodological rigor and relevance to Pakistan's energy policy landscape. This multi-stage screening process ensured that selected studies aligned with the research's objectives and provided reliable insights.

The SLR Table 1 below summarizes each selected study's primary focus, methodology, and key findings, offering a structured overview of the literature on energy policies in Pakistan.

The literature review employed a structured methodological approach to categorize and analyze the selected studies systematically. The research utilized a thematic strategy that prioritized studies addressing key research criteria: (1) policy measures on energy efficiency and conservation, (2) environmental impact exploration, and (3) analysis of CO2 emission trends in Pakistan's energy sector. This approach allowed for a comprehensive examination of policy developments, capturing the critical dimensions of sustainability objectives and climate change mitigation strategies. By organizing the literature around these thematic pillars, the study ensures a nuanced understanding of how Pakistan's energy policies have addressed key sustainability challenges. The methodological framework enables a systematic assessment of policy evolution, highlighting the intersections between energy efficiency, environmental sustainability, and climate resilience in Pakistan's national energy management approach.

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Table 1: Systematic Literature Review

Year	Title	Methodology	Results
Nadeem (2014)	Barriers, drivers, and policy options for improving industrial energy efficiency in Pakistan	Mixed-Method Approach: Literature review, Stakeholder interviews, and policy document analysis	Identified three main barrier categories: economic (lack of capital, high initial costs), technical (lack of expertise), and organizational (management priorities). Recommended policy intervention, including financial incentives, capacity building, and mandatory energy audits.
Rauf et al. (2015)	An overview of energy status and development in Pakistan	Comprehensive document analysis and statistical review of energy sector data	The current energy mix heavily depends on fossil fuels (87%). Recommended increasing renewable energy share to 30% by 2030.
Raza et al. (2015)	Energy conservation policies, growth and trade performance: Evidence of feedback hypothesis in Pakistan	Autoregressive Distributed Lag (ARDL) approach with time series data analysis	Found bidirectional causality between energy consumption and economic growth. Energy conservation policies could reduce trade performance and slow economic growth.
Narejo et al. (2017)	An Energy Policy Analysis and Proposed Remedial Actions to Reduce Energy Crises in Pakistan	Policy analysis framework with document review and case study analysis	Identified regulatory compliance gaps in the energy sector. Found poor implementation of existing policies. Recommended strengthening regulations framework and monitoring mechanism.
Hali et al. (2017)	Impact of energy sources and the electricity crisis on economic growth: policy implications for Pakistan	Generalized Method of Moments (GMM) with panel data analysis	There is a strong positive correlation between electricity consumption and economic growth.
Mirjat et al. (2018)	Building energy efficiency policies and practices in Pakistan. A literature review	Systematic review with policy framework analysis	Found fragmented planning approach in the energy sector. Identified lack of coordination between stakeholders. Recommended integrated energy planning approach.

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Aized et al. (2018)	Energy security and renewable energy policy analysis of Pakistan	Long-range Energy Alternative Planning (LEAP) modeling	Projected energy demand-supply scenarios until 2050. Identified potential 40% contribution from renewables by 2050. Recommended policy reform for renewable energy integration.
Zafar et al. (2018)	An overview of the implemented renewable energy policy of Pakistan	Qualitative method	Strong political and financial commitments are needed to shift from thermal power to renewable energy.
Sajid and Javaid (2018)	A stochastic approach to energy policy and management: A case study of the Pakistan energy crisis	Stochastic modeling and uncertainty analysis	Quantified impact of energy theft on system reliability. Founded that 20-25% uncertainty in consumption data due to theft and proposed smart metering solution.
Malik et al. (2019)	Energy security in Pakistan: A quantitative approach to a sustainable energy policy	A quantitative approach	It recommends green solutions, like solar and smart metering, alongside conservation efforts, like insulation standards.
Hassan et al. (2019)	Energy policies and environmental security: A multi-criteria analysis of energy policies of Pakistan	multi-criteria decision analysis (MCDA	Energy policies are economic and technical, with social elements moderately addressed and environmental facets underrepresented.
Mahar et al. (2019)	Building energy efficiency policies and practices in Pakistan: A literature review	Systematic literature review	Political instability and policy discontinuity are major causes of inefficiency.
Hassan et al. (2021)	Energy and environmental security nexus in Pakistan	Mixed-method approach: Document analysis, expert interviews, and case studies.	Identified weak governance as the primary barrier. Found infrastructure gaps in energy distribution. Recommended comprehensive policy reforms.
Hassan et al. (2021)	Energy Sector of Pakistan–A Review	Systematic Literature Review	An issue in clean energy generation due to fluctuating international oil tariffs impacting consumers.
Aized et al. (2021)	Pakistan's energy situation, policy, and issues	Qualitative method	Poor infrastructure, outdated policies and implementation, short-term decisions, and theft were leading causes of power outages.

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Ali et al. (2021)	A comparison of energy policies of Pakistan and their impact on bioenergy development	Systematic literature review	Suggests that endogenous challenges in policymaking can be addressed through targeted measures.
Babar et al. (2022)	Energy policy of Pakistan: A consumer perspective	Large-scale consumer survey (n-1000) with statistical analysis	Founded that 78% of consumers were dissatisfied with energy policies. Major concerns: high costs and frequent outages. Key obstacles: corruption, political interference.
Qudrat-Ullah (2022)	A Review and Analysis of renewable energy policies and CO2 emissions in Pakistan	Dynamic model: MDESRAP	Suggests achieving emission targets sustainably, with a potential 23% annual electricity cost saving.
Raza and Lin (2022)	Energy efficiency and factor productivity in Pakistan: Policy perspectives	LMDI method	Reduction in energy use attributed to efficiency improvement in productive sectors.
Saira (2023)	Energy Policies of Pakistan; A Comparative Analysis (1994-2013)	Systematic Literature Review	Using Indigenous energy resources could alleviate the energy crisis.
Naz et al. (2024)	Pakistan Energy Outlook for the Next 25 Years	Autoregressive Moving Average with Exogenous Variable (ARMAX) modeling	Projected energy deficit elimination possible by 2030. A 7% annual increase in generation capacity is required. Recommended focus on indigenous resources.
Ahad et al. (2024)	Designing energy policy in the presence of underground economy: the case of Pakistan	Econometric analysis with time series data	A significant correlation between the underground economy and energy consumption was found, and an estimated 30-35% of energy consumption in the informal sector. Recommended policy reforms to address the informal sector.

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3 Energy Efficiency Policy Regimes from 1990-2024

According to the National Energy Efficiency and Conservation Authority (2020), improving energy efficiency in Pakistan offers a cost-effective opportunity to meet rising energy demand while reducing CO2 emissions. Rapid urbanization and industrial growth in the early 2000s led to a sharp rise in energy consumption and emissions. The Word Bank has emphasized that developed and developing nations must strengthen energy efficiency measures, underscoring its critical role in sustainable economic development and the importance of government initiatives in prioritizing energy efficiency.

However, promoting energy efficiency in Pakistan requires a comprehensive set of national policies and innovative institutional and fiscal mechanisms (Wu et al., 2021). Policies that encourage energy efficiency, alongside those supporting renewable energy technologies, can lay a strong foundation for meeting future energy needs and addressing climate change. According to NEECA, the barriers to the widespread adoption of energy-efficient technologies are economic and related to institutional, governance, and informational challenges. Well-designed regulations, policy measures, and enforcement mechanisms are crucial to overcome these obstacles. In this context, the evolution of energy policies in Pakistan is analyzed to assess the impact of the large-scale deployment of energy-efficient technologies.

3.1 Policy Evaluation

In Pakistan, energy policies primarily focus on energy generation to meet the demand (Raza et al., 2022). However, globally, the emphasis has shifted toward addressing climate change, accelerating the adoption of energy efficiency policies (Elkhatat and Al-Muhtaseb 2024). Economic policies drive energy efficiency measures to boost economic prosperity by reducing greenhouse gas emissions and energy consumption (Li et al., 2022; Zhao et al., 2022). Strengthening energy efficiency regulations conserves resources and offers potential economic benefits, such as lower energy bills and positive externalities related to environmental issues (Raza and Lin, 2022). Energy conservation is vital for combating climate change, promoting sustainable development, and ensuring energy security.

The evaluation of energy policies in Pakistan, particularly concerning energy efficiency, can be understood through four phases (Malik et al., 2020). The division of Pakistan's energy policy into four distinct phases reflects its evolving priorities, which are shaped by domestic needs and global trends. The first phase, rooted in the 1990s, was driven by concerns over fossil fuel scarcity and emphasized conservation, exemplified by the National Energy Conservation Policy (1992). Malik et al. (2020) underscores the foundational role of ENERCON in advancing energy-efficient technologies during this time.

In the 2000s, the second phase emerged, focusing on cost-effectiveness and increased reliance on indigenous resources. This shift is evident in policies like the Renewable Energy Policy (2006), which aimed to diversify energy sources and reduce dependence on imported fossil fuels (Irfan et al., 2019).

Post-2010 policies transitioned into the third phase, addressing chronic energy shortage and fostering renewable energy integration. Notable initiatives include the National Power Policy (2013) and the Alternative and Renewable Energy Policy (2019), which sought to enhance generation capacity while ensuring sustainability (Hassan et al., 2019*).*

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The fourth and current phase emphasizes energy efficiency and climate change mitigation. Policies such as the National Energy Efficiency and Conservation Plan (2020-25) align with international sustainability goals while delivering economic benefits through energy efficiency measures (Raza & Lin, 2022).

This phased framework aligns with Howlett and Cashore (2009) model of policy evolution, demonstrating how shifts in societal, economic, and environmental priorities have shaped Pakistan's energy policies over time. It provides a robust lens for evaluating the successes and challenges in the country's energy sector.

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3.1.1 Phase I: National Energy Conservation Policy (1990)

In the early 1990s, Pakistan faced significant challenges in its energy sector, marked by inefficiencies and a growing gap between energy demand and supply. To address these issues, the government launched a series of energy policies to alleviate the energy crisis and improve energy utilization across various sectors. A key initiative was establishing the Energy Conservation Centre (ENERCON) in 1986, which became operational in the early 1990s.

In 1992, the government introduced the National Energy Conservation Policy (NECP). This policy sought to reduce energy consumption by promoting energy-efficient technologies and practices, targeting critical sectors such as industry, transport, and agriculture. It included measures such as energy audits, retrofitting of equipment, and incentives for adopting energy-efficient appliances. These efforts resulted in energy saving and heightened awareness of energy efficiency in targeted sectors. For example, ENERCON's energy audit enabled industries to implement energy-saving measures, leading to cost savings and reduced energy usage.

Furthermore, the energy policies in 1994 and 1998 focused on expanding thermal energy production and encouraging private investors (IPPs) to participate in power projects. These policies provided tax and duty incentives to attract private investors (IPPs) to increase the generation capacity. IPPs were permitted to produce energy from any source and location, with minimal constraints from environmental regulations. The primary focus of these policies was on boosting energy production to address immediate energy shortage, with less emphasis on energy efficiency and conservation to reduce the demand and improve environmental quality.

However, several factors limited the success of these programs. Major issues were inconsistent policy implementation and enforcement, largely due to bureaucratic inefficiencies and poor inter-agency coordination. Additionally, the lack of financial incentives for businesses and households to adopt energy-efficient technologies slowed the uptake of these measures. Limited infrastructure and technical expertise also hindered large-scale energy efficiency efforts, with many industries and households lacking access to modern, energy-efficient technologies and trained professionals to guide implementation.

While these policies improved generation capacity, they contributed minimally to environmental benefits. The primary emphasis during the 1990s remained on addressing the immediate energy crisis, often overlooking the broader goals of economic efficiency and environmental sustainability.

3.1.2 Phase II: National Energy Conservation Policy

In 2002, the Pakistani government announced a new Energy Policy aimed at generating sufficient energy at minimal cost, primarily using indigenous resources, including renewable energy. This policy encouraged energy production by offering incentives such as flexible site and fuel selection for Independent Power Producers (IPPs). It sought to address a major shortcoming in previous policies by allowing IPPs to select any imported fossil fuel for energy production. However, this approach led to supply chain disruptions and price volatility, ultimately resulting in an energy crisis. Although the 2002 Policy supported thermal, large hydropower, and renewable energy projects, the flexibility in fuel choices for IPPs proved

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detrimental to its success. In response, the government introduced a policy focusing on renewable energy in 2006.

In 2006, ENERCON and the Ministry of Environment introduced the National Energy Conservation Policy 2006. This policy focused on promoting renewable energy and improving end-use efficiency across various energy consumption sectors. It introduced several measures and sector-specific initiatives aimed at energy conservation. Unlike previous policies, it emphasized developing alternative and renewable energy projects, including small hydropower plants, solar, wind, and biofuel sources. The policy also aimed to create an energy conservation market to raise awareness and improve energy efficiency among different consumer groups, ultimately enhancing environmental quality. Alongside this, the government released the Policy for Development of Renewable Energy for Power Generation (2006), which had three main goals: 1) To increase the development of renewable energy technologies, 2) To provide additional energy supply to meet growing demand, and 3) To offer financial incentives and facilities to attract investors to the renewable energy market.

While the National Energy Conservation Policy of 2006 marked a significant shift towards renewable energy and energy conservation, it had several limitations. One major issue was the limited regulatory support and authority to enforce energy efficiency measures, which weakened the policy's effectiveness. Additionally, it lacked comprehensive implementation and monitoring mechanisms, leading to inconsistent application across various sectors. The policy also failed to address economic and financial barriers to adopting energy-efficient technologies, such as high upfront costs and limited financing options. These shortcomings constrained the policy's impact on enhancing energy efficiency and reducing energy consumption in Pakistan.

3.1.3 Phase III: National Power Policy

After 2010, Pakistan's government grappled with a severe energy crisis driven by chronic underinvestment, inefficient power generation, circular debt, and policy failures. To address these challenges, the government introduced various energy policies to increase energy supply by enhancing generation capacity. In 2013, the government launched the National Power Policy to address the country's critical energy shortage. The policy aimed to develop an efficient, consumer-centric power generation, transmission, and distribution system to meet the urgent needs of the population while supporting sustainable economic growth. The main objectives of the National Power Policy of 2013 were to 1) Eliminate the supply-demand gap by increasing power generation capacity, 2) Reduce the cost of power generation to make electricity more affordable, 3) Improve the efficiency of the transmission and distribution system, and 4) Ensure environmental sustainability by adopting cleaner energy sources.

Despite these initiatives, the policy's implementation did not fully resolve the energy crisis, mainly due to persistent inefficiencies within the generation, transmission, and distribution system. Continuous policy failures have been attributed to factors such as political instability and the focus on short-term solutions (Irfan et al., 2019). In response, the government introduced the Power Generation Policy 2015 to encourage private investment in new power generation projects and the upgrade of existing power plants. This policy aimed to generate adequate power to meet the country's growing energy demand.

In 2018, the Policy for the Development of Renewable Energy for Power Generation expired, paving the way for the launch of successful Alternative and Renewable Energy (ARE) projects.

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The government sought to support these projects by providing financial incentives and removing regulatory barriers (Yar et al., 2022). In 2019, the Alternative and Renewable Energy Policy was introduced to promote renewable energy projects further and establish competitive pricing in Pakistan's energy market. The policy aimed to increase the share of renewable energy in the total energy mix to 20% by 2025 and 30% by 2030 (up from approximately 5% in 2020). Protect the environment by increasing green energy's role in Pakistan's energy portfolio and fostering affordable, competitive, and environment-friendly power markets through indigenous resources and advanced technology.

3.1.4 Phase IV: National Energy Efficiency and Conservation Policy

In response to the country's rising energy demand and environmental challenges, the Pakistani government introduced the National Energy Efficiency and Conservation (NEECA) plan (2020-25). This policy is particularly important given Pakistan's significant potential for energy efficiency improvements, with estimated savings of up to 25% across industrial, building, transport, power, and Agriculture sectors. The NEECA plan aims to lower energy consumption, reduce greenhouse gas emissions, and promote sustainable development by targeting energy saving in three stages, with the goal of reducing consumption by 3 million tons of oil equivalent (MTOE) by 2025. The first phase focuses on institutionalizing energy efficiency and conservation at the national and provincial levels, the second is operationalizing the plan through various initiatives and frameworks, and the third is implementing the full scope of the NEECA plan across sectors (NEECA 2020).

This plan was introduced to address the negative impacts of energy inefficiency, such as high cost, energy shortage, and environmental degradation. The government seeks to offer substantial economic benefits by improving energy efficiency, including reduced household energy bills and a decreased reliance on imported fuel. Additionally, the plan aligns with Pakistan's commitment to the climate agreement and sustainable development goals.

The NEECA plan also provides a range of incentives to attract investors' participation in energy efficiency projects. These incentives include tax exemptions, reduced tariffs, and financial support for energy-saving initiatives. By fostering a market-driven approach to energy conservation and efficiency, the government aims to attract both local and foreign investments in these sectors.

4 Policy Analysis and Comparison of Pakistan's Energy Policies (1990-2024)

4.1 Comprehensive Policy Evolution and Analysis

4.1.1 Early Energy Conservation Efforts (1991-2002)

Pakistan's Energy policies have evolved significantly from 1990 to 2024, initially prioritizing energy generation and security while delaying attention to energy efficiency and environmental sustainability. The National Energy Conservation Policy of 1992 marked Pakistan's first notable effort to promote energy efficiency, targeting key sectors such as industry, transport, and agriculture. Institutions like ENERCON were established to support this initiative. However, implementation faced significant hurdles, including bureaucratic inefficiencies and insufficient financial incentives.

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A critical limitation of this early approach was the lack of integration between energy efficiency and environmental objectives. This narrow focus left Pakistan trailing regional counterparts like India and China, which had begun incorporating sustainability principles into their energy framework (Elkhatat and Al-Muhtaseb, 2024). These shortcomings underscored the need for a more holistic, forward-thinking energy strategy.

4.1.2 Transition to Resource-Focused Policies (2002-2013)

Building on initial conservation efforts, the Energy policy of 2002 marked a strategic shift towards leveraging domestic resources to enhance energy security. However, the policy continued to prioritize thermal power generation, neglecting renewable energy sources and energy efficiency as pathway sustainability. In 2006, the Renewable Energy policy took a more progressive approach by incentivizing renewable energy projects and setting targets for CO2 reduction through small hydropower and biofuel initiatives (Akram et al., 2020).

While this policy was a step forward, fundamental implementation challenges persisted. Limited private investment in indigenous renewable sources kept the renewable energy contribution to the overall energy mix marginal, highlighting the difficulties of transitioning to a sustainable energy ecosystem.

4.1.3 Renewable Energy and Sustainability Emergence (2013-2019)

The National Power Policy of 2013 aimed to expand energy capacity while emphasizing renewable energy and energy efficiency. Fiscal incentives, including tax reductions, were introduced to promote cleaner energy technology. However, the policy lacked a robust framework for significant energy efficiency improvements and continued reliance on fossil fuels to reduce costs.

This approach starkly contrasted the more advanced strategies of regional competitors like India and China, which had integrated comprehensive energy efficiency measures into their policies (Edziah and Opoku, 2024; Yenneti et al., 2019). Pakistan's continued focus on short-term economic goals hindered its progress towards a sustainable energy model.

4.1.4 Comprehensive Energy Strategy (2019-2024)

Recent policy developments represent a significant milestone in Pakistan's energy policy evolution. The Alternative and Renewable Energy Policy of 2019 and the National Energy Efficiency and Conservation Plan for 2020-25 are the most environmentally focused and comprehensive (See Table 2). The ARE policy aims to increase the renewable energy share to 20% by 2025 and 30% by 2030, supported by a robust regulatory framework to support this goal (Ul-Haq et al., 2020).

Complementing this, the NEECA Plan emphasizes public and fiscal incentives, such as reduced tariffs and energy-saving subsidies. These policies align more closely with international standards, including those recommended by the International Energy Agency (IEA), prioritizing energy efficiency as a critical strategy for reducing carbon emissions and achieving sustainable development (Danish et al., 2020).

Despite ongoing economic constraints and political instability (Wenlong et al., 2023), these recent policies reflect a more mature and strategic approach to national energy management.

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They demonstrate a growing recognition of the complex interplay between energy security, economic development, and environmental sustainability.

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Table 2: Policy Comparison Framework

Parameter	Phase I		Phase II		Phase III			Phase IV
	National Energy Conservation Policy (1992)	Energy Policy (1994)	Power Policy (2002)	Renewable Energy Policy (2006)	National Power Policy (2013)	Power Generation Policy (2015)	Policy for Alternative & Renewable Energy (2019)	National Energy Efficiency and Conservation (2020-25)
Energy Security								
Electricity generation	✓	✓	✓	✓	✓	✓	✓	✓
Renewable Energy	×	×	×	✓	×	×	✓	✓
Energy Efficiency	✓	×	×	✓	×	×	✓	✓
Environmental								
Fossil fuel replaced	×	×	✓	✓	✓	×	✓	✓
CO2 Reduction	×	×	×	✓	✓	✓	✓	✓
Fiscal Incentives								
Grant	×	✓	×	×	×	✓	×	×
Tax Reduction	×	✓	×	✓	✓	✓	✓	×
Public Incentives								
Loan	×	✓	×	×	×	×	×	×
Reduction in bills	×	×	×	✓	✓	✓	✓	✓
Guarantee	×	✓	×	×	×	×	✓	×
Institution Feasibility								
Potential to implement	×	✓	×	✓	✓	✓	✓	✓
Investor interest	×	×	×	×	✓	×	✓	✓

✓: Indicate full policy coverage or primary focus on the specific parameter

×: Indicate absence or minimal focus on the particular parameter

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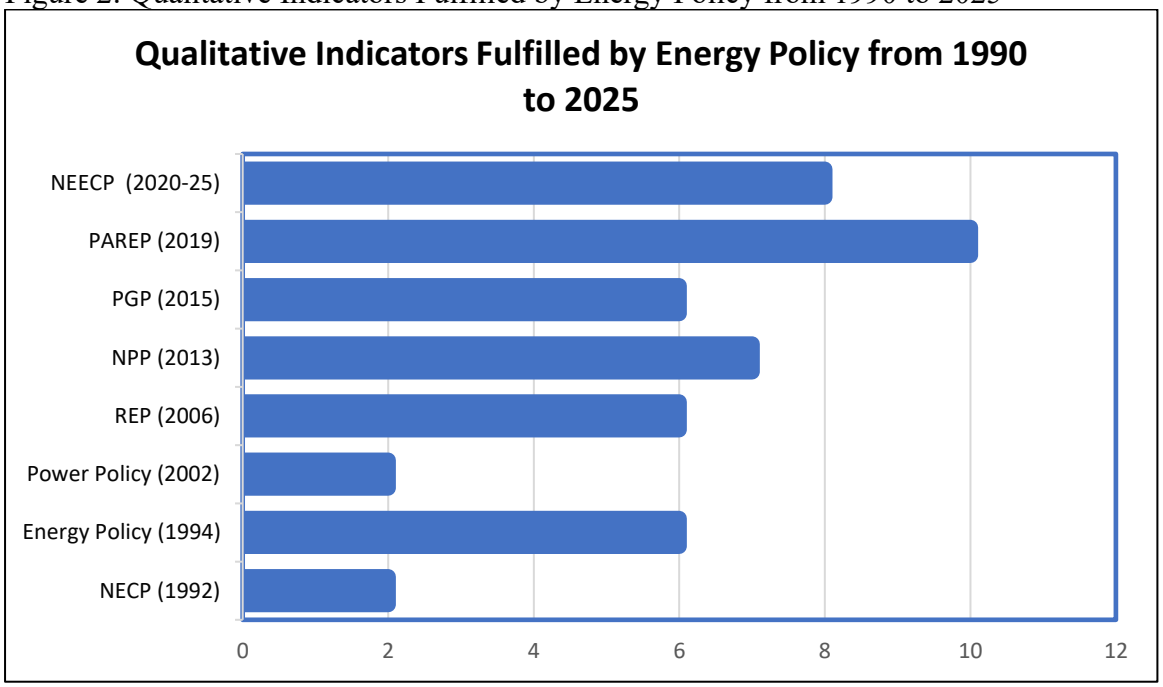
Table 2 illustrates the progressive development of Pakistan's energy policies from 1990 to 2024. The evolution can be observed across four key dimensions: energy security, environmental consideration, fiscal incentives, and institutional feasibility. Early policies (Phase I and II) primarily focused on electricity generation with minimal emphasis on renewable energy and environmental sustainability. Notably, the transition from Phase II to III marks a significant shift, with policies beginning to incorporate fossil fuel replacement and CO2 reduction strategies. The most recent policies (Phaser IV) demonstrate a holistic approach, simultaneously addressing renewable energy, energy efficiency, and environmental concerns.

4.2 Initial Phase and Incentives for Private Investors

In the Initial policy development phase, various incentives were introduced to attract private investors. These incentives included fuel for energy generation, purchasing power at a fair price, flexibility in site selection, protection against currency fluctuation, natural calamities, and duty-free imports (see Table 2). While these incentives successfully attracted investment, they primarily drew interest toward thermal energy rather than hydropower or renewable energy.

The flexibility in site selection, though intended to encourage investment, inadvertently contributed to inefficiencies. Energy transmission and distribution from these selected locations led to higher energy losses, undermining the potential benefits of the initial policy approach. This early strategy highlighted the importance of considering investment attraction and long-term infrastructure and efficiency implications of energy policy design.

Figure 2: Qualitative Indicators Fulfilled by Energy Policy from 1990 to 2025



4.2.1 Post-2000 Shift Towards Indigenous Resources

After 2000, policies began to encourage using indigenous resources such as coal and renewable energy to increase energy generation capacity. Consequently, the energy mix saw a significant rise in thermal energy (See Figure 1). However, the lack of restrictions on coal and oil usage

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hindered the growth of renewable energy sources. Private investors preferred faster returns from fossil fuel-based projects over longer-term hydropower initiatives.

The government's approach further complicated the energy landscape by guaranteeing fuel supply and fair energy pricing, effectively reducing competition among private investors. This arrangement led to inefficiencies, as investors had little incentive to improve operational efficiency or reduce per-unit energy costs. Moreover, the government was obligated to make substantial capacity payments to the IPPs, even when plants were not operational.

The combination of short-term return expectations, guaranteed pricing, and the lengthy development period required for hydropower projects ultimately led private investors to favor oil and gas power plants over more sustainable options. This strategic misalignment demonstrated the critical need for policy frameworks that incentivize long-term sustainable energy development.

4.2.2 Post-2010 Policy Shifts and Persistent Challenges

Policies introduced after 2010, particularly the National Power Policy (2013) and subsequent initiatives, demonstrated a stronger commitment to sustainability than the earlier framework. These policies aimed to improve energy efficiency, diversify the energy mix, and support environmental goals. Despite these intentions, they remained undermined by an over-reliance on fossil fuels, which limited progress towards a sustainable energy system.

The Nation Energy Efficiency and Conservation Plan (2020-25) emerged as a standout policy, integrating energy efficiency measures and renewable energy strategies. This plan offers a clearer pathway toward sustainable development. However, persistent challenges remained, primarily from political instability and the short-term nature of policy planning, which consistently hindered long-term progress.

This pattern aligns with global literature findings, emphasizing that sustained political commitment is a critical factor for the success of energy efficiency policies (Elkhatat and Al-Muhtaseb 2024; Javid and Khan 2020). The disconnect between policy intentions and implementation underscores the need for more robust, consistent, forward-looking energy strategies.

5 Conclusion

The evolution of Pakistan's energy policies over the past three decades reflects a gradual shift from focusing on expanding generation capacity to a more comprehensive approach incorporating renewable energy and energy efficiency. Early policies (Phase I and Phase II) prioritized energy security through increased production but largely neglected renewable integration and efficiency. The initial emphasis on expanding energy generation came at the expense of sustainable development, creating long-term environmental and economic challenges.

A notable turning point began with the Renewable Energy Policy (2006), which marked the beginning of a more sustainable approach. This trajectory was further strengthened by the Alternative and Renewable Energy Policy (2019), signaling a more intentional shift toward environmental consciousness. However, structural challenges have consistently undermined

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these efforts, including inadequate regulatory support, limited financial incentives, and efficient enforcement mechanisms.

The NEECA Plan (2020-25) represents the most significant stride toward achieving sustainable energy goals. By promoting energy conservation across multiple sectors, the plan demonstrates a more holistic understanding of energy policy. Wu et al. (2021) underscore the potential impact, suggesting that Pakistan could reduce its energy consumption by up to 25% through energy efficiency alone. This highlights the considerable untapped potential within the country's energy sector. Comparisons with countries like the United Kingdom and China demonstrate that combining fiscal incentives, stringent regulatory enforcement, and public awareness campaigns can significantly enhance energy efficiency and reduce emissions (Akram et al., 2022; Shahzad and Aruga, 2023; Shahzad and Aruga, 2024).

A persistent challenge in Pakistan's energy policy framework has been its lack of coherence and continuity, primarily driven by political instability. Successive governments have implemented policies without comprehensively assessing prior initiatives, resulting in short-term approaches and an inconsistent trajectory in renewable energy development (Shahzad and Aruga, 2023). Furthermore, the politicization of policy implementation and a tendency to subsidize fossil fuels have hindered sustainable energy efforts and encouraged inefficient practices. Global examples underscore the importance of sustained policy commitment and a robust institutional framework to achieve long-term energy security and environmental goals (Danish et al., 2020).

Several key steps are recommended to strengthen Pakistan's energy policy framework. First, prioritize long-term, integrated energy planning. Establishing coherent, long-term goals for energy efficiency and renewable integration would help Pakistan avoid the pitfalls of short-term policy shifts. As advised in global frameworks, institutionalizing policy evaluations would enable the government to identify gaps and realign efforts with sustainable development. Furthermore, regulatory and fiscal incentives would help to attract private investment in renewable energy. Strengthening the institutional framework would improve policy implementation delays and increase overall effectiveness. Finally, Public awareness campaigns about energy-efficient practices at household and industrial levels could help drive adoption and align Pakistan with international best practices. This could also reduce the country's reliance on imported fuels, supporting its climate commitments (Elkhatat and Al-Muhtaseb 2024).

Future research should examine the impact of the energy policy framework on sector-specific energy consumption and the role of behavioral interventions in enhancing public adoption of energy-efficient technologies. Additionally, studies assessing the economic feasibility of fiscal incentives in Pakistan's unique market context could provide valuable insights for more tailored policy solutions.

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