

ANALYZING ENERGY POLICIES AND POWER SECTOR DYNAMICS

Dr. Fouzia SOHAIL & Dr. Uzma TABASSUM

Key Outcomes

- Thermal power sources (including coal and gas) account for a significant portion (approximately **60 per cent**) of the installed capacity, contributing to high emissions and vulnerability to fuel price fluctuations.
- The average Energy Power Price (EPP) for certain fuels like RFO and imported coal is significantly higher, contributing to a high cost of electricity for consumers.
- Capacity Power Prices (CPP) for private IPPs, particularly for RLNG and imported coal, are extremely high (e.g., up to **706.86 Rs/kwh** for RLNG), significantly impacting electricity costs.
- Despite significant potential, renewable energy sources (solar, wind) contribute a relatively small percentage (**around 5 per cent**) to the overall electricity generation mix.
- While private IPPs account for **60 per cent** of the installed capacity, their actual generation contribution is significantly lower (around **41.61 per cent**), indicating operational inefficiencies.
- Significant variations in EPP and CPP exist between regions, with the North and South regions facing distinct challenges in terms of energy costs.

Background

The high cost of electricity in Pakistan has become a severe challenge, affecting domestic, industrial, and agricultural sectors. The extraordinary price hikes have strained ordinary citizens and hampered economic growth, with GDP posting a mere 0.29 per cent increase in FY 2022-23. Key drivers include rising fuel costs, rupee devaluation, capacity payments, circular debt, high transmission losses, theft, and governance issues. Rupee devaluation, a significant factor, has increased the cost of foreign debt servicing, imported energy resources, and power infrastructure, directly raising electricity tariffs. From FY 2021-22 to FY 2022-23, the rupee depreciated from 204.85 to 287.50 per USD, intensifying financial strain on power companies and consumers alike.

The under-utilization of "Take or Pay" generation capacity is a major driver of high electricity costs. These agreements require utilities to pay for contracted capacity, even if unused, burdening consumers with costs for idle power. The fixed capacity payment and take-or-pay agreements ensure that IPPs receive a guaranteed payment regardless of actual power generation. These contractual obligations have effectively tied the hands of policymakers, forcing them to prioritize the interests of IPPs over those of consumers and the environment, and perpetuating a cycle of expensive power purchases that is crippling the economy.

In FY 2022-23, the utilization of de-rated thermal capacity was only 34.68 per cent, leading to inefficiencies and economic losses. Payments for unused capacity, including Rs. 46.59 billion in Part Load Adjustment Charges, further increased per-unit costs. Coupled with rupee devaluation, these inefficiencies have strained the sector's financial liquidity, delayed payments to suppliers, and discouraged investment, jeopardizing modernization and expansion efforts. Addressing these systemic issues is essential to stabilizing electricity costs and ensuring sustainable growth.

This misalignment of incentives and the resulting inefficiencies necessitate a thorough examination of Pakistan's energy landscape to identify systemic flaws and potential areas for reform. By dissecting the power sector's structure—its reliance on varied energy types, regional disparities in costs, and ownership dynamics—it becomes possible to uncover the root causes of inefficiencies and propose targeted solutions. A nuanced understanding of these elements is crucial to realigning the power sector's operations with consumer interests, ensuring affordability, and fostering a transition toward a more sustainable and equitable energy system.

Hence, this policy brief is structured into two sections: the first provides a comprehensive review of Pakistan's energy policies, and the second presents an in-depth scrutiny of the latest available facts and figures on the power sector, focusing on plant types, regional distribution, and ownership structures

Review of Pakistan's Energy Policies

Pakistan has potential to satisfy its energy demands since the country has the availability of indigenous energy resources but if these resources are investigated and exploited sensibly with effective policy planning and execution. In 1994, the government enacted market-oriented reforms that resulted in a complete overhaul of Pakistan's power sector.

Pakistan's government has developed a policy in 1994 to attract foreign investment and promote domestic capital markets. Pakistan extended an invitation to independent power producers (IPPs) to participate in electricity projects by offering incentives as part of its strategy.

The Private Power and Infrastructure Board (PPIB), established in the same year, was responsible for carrying out the policy. It acts as an intermediary between IPPs and the government to negotiate, implement, and oversee agreements with IPPs. The IPP policy was first created to fill a 1,500 MW generating capacity gap. For the first time, the government offered attractive incentives to draw significant private investment to the electricity industry. The policy utilized the "cost-plus" technique to decide tariff, providing investors with an enticing rate of 6.5 cents/KWh. IPPs could pick their principal fuel and could utilize any technology, with the exception of major hydro projects on the Indus.

The 1994 policy also offered several fiscal incentive and financing arrangements to attract new investments. Investors were exempted from corporate income tax and allowed to import machinery and equipment without paying custom duties, sales tax and other surcharges. Moreover, foreign investors were allowed to establish projects without local partners. The government provided assurances over payments obligations and convertibility. The government further offered protection against modifications to specific taxes and charges. The policy main feature was the Bulk Power Tariff (BPT) which was determined assuming 60 per cent capacity factor. The BPT was consist of two part: capacity payment, which government liable to pay monthly regardless of receiving electricity and it covered fixed cost, maintenance cost, debt servicing, insurance expenses and return on equity. While the actual energy sold to WAPDA/KESC was the basis for the energy payment, the second component of BPT. The policy was effective in attracting both domestic and foreign investment mainly due to its assurance of a specified return on investment. However, considerable investment was limited to thermal projects predominantly based on imports. As a result, the subsequent power strategy of 1995 was expressly designed to promote the use of hydropower resources for generating power, although it proved less effective.

In 1998, policy underwent significant changes. This policy encouraged the use of indigenous coal and hydropower resources for generating electricity. Bidders were supposed to use international competitive bidding based on electricity tariffs under the 1998 regulation. The minimal levelized tariff would serve as the basis for selection. Before the bidding, thorough feasibility assessments would be prepared for site specific coal and hydel projects. For thermal projects, the implementation was done under the Build-Own-Operate model, and for hydro projects, under the Build-Own-Operate Transfer (BOOT) model. There were some tax incentives in this policy, although fewer than in 1994. The government eliminated the tariff exemption for importing plants and machinery in the electricity policy of 1998. Investors were permitted to import machinery and plants as long as they paid import license fees, sales tax, import tariffs, and other surcharges. The government maintained payments and other assurance under this policy as well. Nevertheless, the 1998 power policy was unsuccessful in attracting private investment. The investors were dissatisfied with revised fiscal benefits and demanded reduction in their tariff rates.

In 2002 the government introduced new power policy with an intention to encourage and ensure the use of indigenous resources. The features under this policy are fairly comparable with the previous policy. However, there were some amendments to the 2002 policy. The investors might benefit from extra tax perks. As per this policy the power companies could import machinery and equipment at concessionary rates (5 per cent customs duty). Investors were no longer free to choose the location. Furthermore, for the projects of over 50 MW, the federal government was responsible, while smaller projects of fewer than 50 MW were the responsibility of the provinces. Following the 2002 energy strategy, the government was able to attract some new investments. However, these power plants were still fuel and gas-based. The government was not exceptionally successful in reducing costs.

Given that, earlier policies had mostly resulted in thermal investments, the Government of Pakistan announced the "Policy for Development of Renewable Energy for Power Generation" in 2006 to

encourage the effective use of renewable energy resources and safeguard environment. The 2006 energy strategy emphasized power projects that use biofuel, solar, wind, and small hydropower technologies. To encourage investment, the machinery used for these projects was exempt from duties and taxes. Government announced specific incentives for renewable energy-based IPPs that provide all produced power (excluding auxiliary usage) to the grid. The objective was to protect IPPs that rely on fluctuating renewable resources, such as wind and water, from variables beyond their control while rewarding them for surpassing realistic performance targets. Consequently, 24 wind IPPs with a combined capacity of 1234 MW and 7 solar IPPs with a capacity of 430 MW were established.

In 2015, Pakistan shifted its focus away from biofuel, solar, wind and small hydro energy sources in favor of large scale hydropower and thermal projects for private investment as well as public-private partnerships to reduce the imbalances in energy supply and demand. The 2015 energy policy built upon the 2002 energy policy framework which emphasized thermal and hydroelectric power resources. In 2015 government further advanced these priorities by encouraging large scale power projects. The ultimate objective of the 2015 Power Generation Policy was to maximize generation capacity while minimizing costs, utilizing local resources, protecting the environment, and including all relevant parties. In light of the fact that run-of-river and raw hydropower sites are relatively inexpensive, sustainable, and native resources, the strategy prioritizes their full utilization. Moreover, the strategy also calls for encouraging the development of highly efficient, ecologically responsible, indigenous, and imported fuel-based power plants.

In 2019, Pakistan's government started developing alternative and renewable energy (ARE). The initiative was a continuation of the government's 2006 renewable energy (RE) policy, which intended to promote the use of RE technologies, improve the national energy mix, and assure universal, affordable access to power across the country. In contrast to 2006 RE policy, the 2019 ARE policy had an expanded scope encompassing all major alternative and renewable source and competitive procurement. It further focused on distributed generation system and off-grid solutions. The Government of Pakistan placed considerable emphasis on adding new capacity and replacing retiring plants with AREPs. By 2025 and 2030, respectively, at least 20 and 30 per cent of renewable energy must be produced on-grid, including mini/micro grids. AREPs would be utilized not just to increase generation capacity, but also to replace expensive fossil fuel-based power generation. This was a substantial departure from previous approaches, stemming from the decline in AREP deployment costs and the absence of capacity payments in AREP tariff. The tariff would be in Pak Rupees comprise solely on purchase price. The majority of incentives from RE Policy 2006 were carried over into 2019 policy to maintain investor confidence. Key incentives include exemption of corporate tax and import duties, allowed to have a foreign currency account and 100 per cent foreign equity, safeguard against changes in law and expropriation etc.

Lastly, the national power policy (2021) was put forward in response to the inadequacies of earlier policies that did not adequately address the issues facing the power sector. The 2021 power policy aligns with the Sustainable Development Goals (SDGs) and prioritizes a balanced approach to attaining energy security, affordability, and sustainability throughout the power sector. Efficiency, transparency, competitiveness, financial viability, indigenization, and environmental responsibility are among the policy's guiding principles. It specifies precise objectives for electricity generation, transmission, distribution, and operations, with a focus on integrated and sustainable growth. The policy paper lacks detailed implementation strategies and practical instructions. However, it is claimed that in order to accomplish broader objectives, the government proposes specific efforts for a certain power sector subsector or segment through periodic National Electricity Plans.

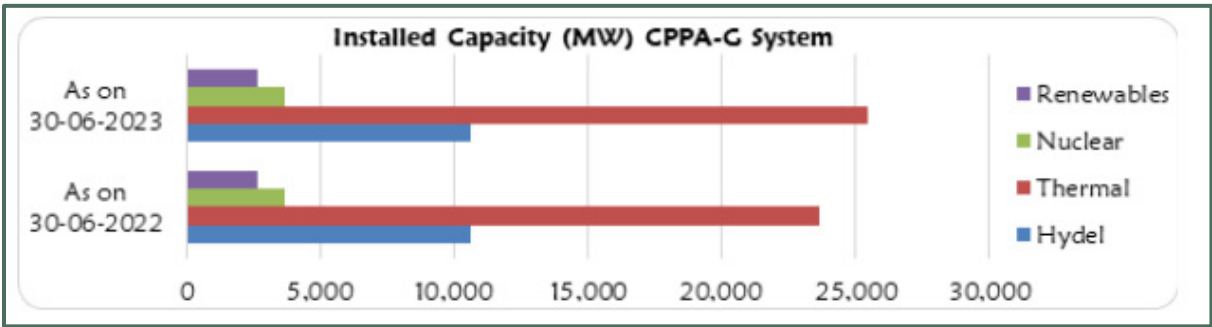
Findings and Analysis

The power generation mix in Pakistan is characterized by a diverse range of sources, including hydropower, thermal, nuclear and RE plants such as wind, solar, and bagasse/biomass facilities. In addition to the power generation plants operated by the public sector, IPPs play a crucial role in augmenting the country’s overall power generation capacity.

- Installed Capacity

According to NEPRA (2024) Pakistan’s total installed capacity in 2023 stood at 45,885 MW. Recent statistics reveals that about 60 percent of installed capacity are owned by private investors, while 40 percent are owned by government. Most of the private IPPs are thermal (85 percent) and renewable (15 percent) like Bagasse, solar and wind. However, most of the government owned IPPs are hydel and nuclear power plants.

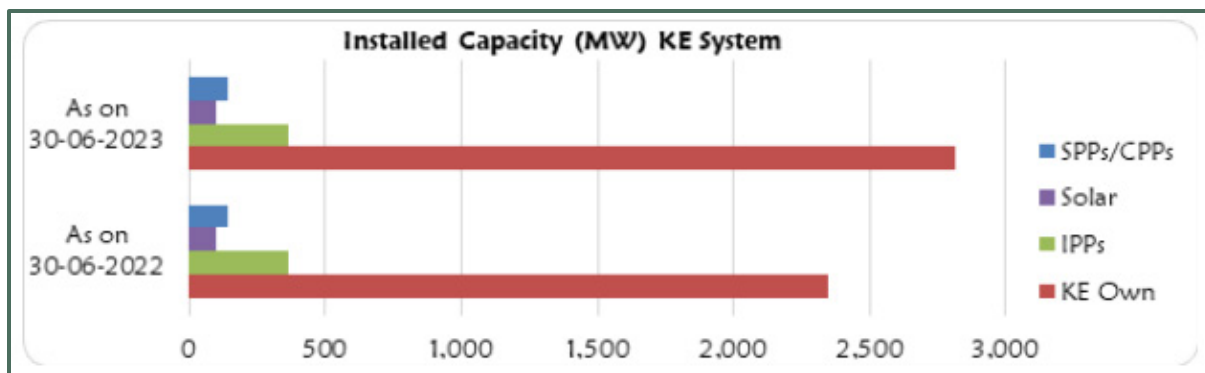
The detailed breakdown of this capacity according to energy sources and systems is provided in the Table 1:



Source: State of Industry Report, NEPRA 2023.

FIGURE 1
Installed Capacity for the FYs 2022 and 2023
(CPPA-G System)

Figure 1 illustrates that the installed capacity within the CPPA-G system is currently at 42,362 MW. This capacity is distributed among various energy sources, with thermal generation (comprising GENCOs, IPPs, and SPPs) accounting 60 percent, hydroelectric contributing 25 percent, wind power providing 4 percent, solar energy contributing 1.3 percent, biomass (bagasse) generating 0.6 percent, and nuclear power adding 8.5 percent. Further, KE’s own thermal generation capacity is 2,816 MW (Figure 2).



Source: State of Industry Report, NEPRA 2023.

FIGURE 2

Installed capacity for the FYs 2022 and 2023 (KE-System)

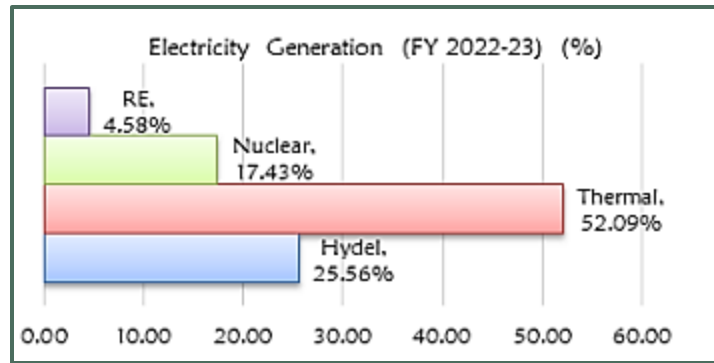
Moreover, Figure 1 demonstrate an increase in the installed capacity of thermal generation power plants from 2022 to 2023, while the installed capacity of power plants using other sources remained unchanged. This indicates the implementation of new, costly contractual agreements with thermal power plants.

Hence, it is evident from the data that thermal power plants contribute significantly to the installed capacity. However, when it comes to actual generation, the picture is different. Among others, factors like demand, weather conditions and fuel availability influence the performance.

- Electricity Generation

In the FY 2022-23, the total electricity generation amounted to 138,028.86 GWh which is notably less than the previous year (154,056.18 GWh). In addition to local generation, the country also imported 478.62 GWh of electricity from Iran during FY 2022-23. Despite, negative growth rate in electricity consumption was recorded, which can be attributed to several factors, most important of which is lack of confidence in the national power supply system as more consumers are diverting towards distributed generation through roof-top solar plants. However, the primary issue seems to be the high cost of electricity coupled with unreliability of DISCOs supply.

Figure 3 shows that Hydel, thermal, Nuclear and renewable energy generate 25.56 percent, 52.09 percent, 17.43 percent and 4.58 percent electricity respectively. The most notable point is that in the FY 2022-23, power generation from public sector power plants, across the country, amounted to 80,596.73 GWh, representing 58.39 per cent of the overall energy production as compared to the 40 percent of total installed capacity. On the other hand, private sector power plants, including KE, contributed a total generation of 57,432.13 GWh, making up approximately 41.61 per cent of the total power generated, while the installed capacity of private sector was 60 percent. This reverse contribution clearly shows the inefficiency of private IPPs.



Source: State of Industry Report, NEPRA 2023.

FIGURE 3
Electricity Generation

- Energy & Capacity Power Price

Table 1 shows Energy Power Price (EPP) and Capacity Power Price (CPP) in rupees per kilowatt-hour (Rs/kWh) by power source type and ownership. This table highlights key trends in energy pricing across various energy sources and ownership types, underscoring distinct differences in pricing structures for Government-owned IPPs and Private IPPs.

Table 1 shows that private IPPs generally have significantly higher Capacity Power Prices (CPP), especially for RLNG and imported coal, where CPPs reach extreme values (e.g., up to 706.86 Rs/kwh for RLNG). This shows the high fixed costs of private operators that ultimately transfers on to consumers.

Over all, prices vary widely by energy source. For instance, RFO (Residual Fuel Oil) has high EPP and variable CPP in private IPPs. Similarly, RLNG (Re-gasified Liquefied Natural Gas) and imported coal power plants have the highest average CPPs among private IPPs, pointing to reliance on more costly, import-dependent energy sources. Whereas, Thar Coal and Natural Gas power plants offer relatively stable pricing, with lower EPP and CPP, making them more affordable energy options.

TABLE 1

Energy Power Price & Capacity Power Price by Type and ownership

TYPE		Government Owned IPPs		Private IPPs	
		EPP (Rs/kwh)	CPP (Rs/kwh)	EPP (Rs/kwh)	CPP (Rs/kwh)
RFO	Average	...	...	44.01	24.10
	Max.	...	...	60.70	56.58
	Min.	...	...	36.03	10.13
RLNG	Average	23.58	8.58	32.29	155.39
	Max.	26.55	15.72	38.19	706.86
	Min.	21.80	3.84	28.09	9.22
N. gas	Average	14.00	0	15.79	8.62
	Max.	14.00	0	24.27	22.95
	Min.	14.00	0	10.12	2.13
Imported-coal	Average	...	...	26.79	131.59
	Max.	...	...	49.90	299.99
	Min.	...	...	14.90	33.16
Thar-coal	Average	...	...	13.87	16.98
	Max.	...	...	15.23	17.58
	Min.	...	...	12.48	16.20
Solar	Average	0	42.00	0	23.11
	Max.	0	42.00	0	49.51
	Min.	0	42.00	0	1.89
Wind	Average	...	...	0	46.20
	Max.	...	...	0	88.22
	Min.	...	...	0	11.45
Bagasse	Average	...	...	7.35	8.63
	Max.	...	...	8.50	11.25
	Min.	...	...	7.28	6.50
Hydel	Average	1.63	26.45	...	...
	Max.	6.87	57.78	...	...
	Min.	0.04	6.23	...	...
Nuclear	Average	1.84	18.57	...	...
	Max.	1.84	18.57	...	...
	Min.	1.84	18.57	...	...

Source: Authors' estimation using NEPRA data.

TABLE 2

Energy Power Price & Capacity Power Price by Type and Region

Type		North Region		South Region	
		EPP (Rs/kwh)	CPP (Rs/kwh)	EPP (Rs/kwh)	CPP (Rs/kwh)
RFO	Average	44.01	24.10	...	...
	Max.	60.70	56.58	...	...
	Min.	36.03	10.13	...	...
RLNG	Average	27.94	81.99	...	...
	Max.	38.19	706.86	...	...
	Min.	21.80	3.84	...	...
N. gas	Average	19.19	22.95	14.92	4.79
	Max.	19.19	22.95	24.27	12.37
	Min.	19.19	22.95	10.12	2.13
Imported-coal	Average	19.75	56.52	29.14	156.62
	Max.	19.75	56.52	49.93	299.99
	Min.	19.75	56.52	14.90	33.16
Thar coal	Average	...	...	13.87	16.98
	Max.	...	...	15.23	17.58
	Min.	...	...	12.48	16.20
Solar	Average	0.00	34.65	0.00	2.48
	Max.		49.51	0.00	2.60
	Min.		1.89	0.00	2.28
Wind	Average	...	...	0.00	46.20
	Max.	...	...	0.00	88.22
	Min.	...	...	0.00	11.45
Bagasse	Average	7.32	9.25	7.49	4.29
	Max.	8.50	11.25	7.49	4.29
	Min.	4.98	6.50	7.49	4.29
Hydel	Average	1.63	26.45	...	...
	Max.	6.87	57.78	...	...
	Min.	0.04	6.23	...	...
Nuclear	Average	...	...	1.84	18.57
	Max.	...	...	1.84	18.57
	Min.	...	...	1.84	18.57

Source: Authors' estimation using NEPRA data.

Table 2 provides a detailed analysis of the energy purchase price (EPP) and capacity purchase price (CPP) for various energy types across the North and South regions. This table underscores the importance of regional strategies and targeted policy interventions to optimize energy costs and enhance efficiency.

North region exhibits higher EPP and CPP variability for RFO and RLNG power plants compared to other fuels. This reflects dependency on volatile international market conditions and thus suggesting inefficiencies. The extreme variability in CPP for RLNG and RFO suggests a need for renegotiating contracts and improving efficiency in procurement.

In South, power plants operating with imported coal, show extreme variability in CPP, with values ranging from 33.16 Rs/kwh to 299.99 Rs/kwh. Similarly, EPP for imported coal is higher in the South (29.14 Rs/kWh average) than in the North. Hence, imported coal is costlier and more volatile, especially in the South region, thus recommending less dependency on external sources. In contrast, Thar coal CPP is relatively stable (16.98 Rs/kWh). Thus it is recommended to use it in hybrid systems combined with renewables like solar to reduce dependency on imported fuels. It is also recommended to expand wind energy projects along the Sindh coast and in Baluchistan, where wind speeds are high and consistent. Similarly, investing in large-scale solar farms in arid areas, such as Thar and other regions of Sindh, to utilize abundant sunlight is suggested.

As far as existing renewable energy power plants are concerned, solar CPP in the North averages 34.65 Rs/kWh, which is significantly higher than in the South (2.48 Rs/kWh). Rationalize CPP through better procurement practices, use of locally manufactured panels, and standardized installation guidelines would help in optimizing capacity purchasing price. However, the average CPP for bagasse is relatively low across both regions.

Conclusion and Policy Recommendations

Energy is a cornerstone of infrastructure critical to Pakistan's development, yet the sector faces persistent challenges despite the availability of indigenous energy resources. Historical energy policies have focused on attracting investments, primarily in thermal power, but these approaches have led to high electricity costs, operational inefficiencies, and underutilization of renewable resources. The rupee's devaluation, coupled with rigid capacity payment structures and reliance on imported fuels, has further compounded economic and environmental pressures. The above analysis underscores the importance of targeted strategies to optimize costs, enhance reliability, and ensure a sustainable energy mix that aligns with regional capabilities and needs. Bridging these gaps will require a combination of policy reform, technological investment, and strategic planning tailored to the unique characteristics of each region. Addressing the underlying issues and restoring confidence in the power supply system are inevitably needed for revitalizing electricity consumption and, consequently, stimulating economic growth. A multifaceted approach involving renegotiation of agreements, improvements in infrastructure, enhancing system efficiency, better governance across all sectors of the power system, regulatory measures, and strategies to adapt to evolving societal dynamics need to be adopted. Building trust in the power infrastructure is pivotal for encouraging increased consumption and bolstering economic growth. The key policy recommendations are summarized below:

- To achieve Pakistan's established target of attaining a 30 per cent share of renewable energy in the energy mix by 2030, it is imperative to prioritize policy reforms and focused implementation. This requires enhancing support for wind, solar, and small hydropower projects while addressing existing structural and operational barriers. Accelerating the transition from thermal to renewable energy is essential to reducing emissions, enhancing energy security, and fostering sustainable economic growth.

- Conduct a comprehensive review of existing IPP agreements and implement performance-based incentives to ensure cost-efficiency and accountability. Moreover, restructure take-or-pay contracts to reduce financial burdens caused by underutilized capacity.
- Develop region-specific energy policies addressing unique challenges such as varying energy prices, resource availability, and consumption patterns in the North and South.
- Leverage geographic advantages to prioritize resource-specific projects, such as wind energy in coastal areas and hydropower in northern regions.

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